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PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER Nº: 1821

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SECTION 12

ENVIRONMENTAL IMPACT STUDY

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REVISION 1

REVISION

SECTION CONTENTS

12. Environmental Impact Studies

12.1. Étude d'impact sur l'environnement
12.2. Mise en contexte du projet
12.3. Description du projet
12.4. Description du milieu
12.5. Consultation de la population
12.6. Méthode d'analyse des impacts environnementaux
12.7. Identification et évaluation des impacts et des mesures d'atténuation
12.8. Risques technologiques
12.9. Programme de surveillance et de suivi
12.10. Développement durable
12.11. Références et sources d'information consultées

NOTE

The Environmental Impact Study has been carried out by SNC Lavalin on behalf of NAIC between the months of December 2015 and July 2016. Tenova and Techint have intensely cooperated with SNC to provide all the required information to complete a thorough report as required by the environmental authorities of the Government of Quebec.

In July 2016 the study has been submitted to the Ministère du Développement Durable de l'Environnement et des Changements Climatiques (MDDELCC) of the Government of Quebec under the Dossier # 3211-14-037.

This Environmental Impact Study by SNC Lavalin and the attachments to the Environmental Impact Study are part of the Feasibility Study and are presented as an independent volume to this FS.

Pig Iron Facility Project - Saguenay

Final Report (English Version)

Environmental Impact Study submitted to the Ministry of Sustainable Development, Environment and the Fight against Climate Change (MDDELCC)

File: 3211-14-037

North Atlantic Iron Corporation

Environment & Geoscience

July | 2016

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Table of Contents

1 Impact Assessment Objectives and Background 1

1.1 Consultant 1
1.2 Methodological Considerations 2
1.3 Report Structure 2

2 Context 1

2.1 Project Promoter 1
2.1.1 Grand River Ironsands 1
2.1.2 Petmin 1
2.2 Project Background 2
2.3 Project Objectives 2
2.4 Project Justification 2
2.4.1 Types of Merchant Pig Iron 3
2.4.2 Advantages of Nodular Pig Iron 4
2.4.3 Advantages and Disadvantages of Scrap Iron 5
2.4.4 Direct Reduced Iron (DRI) 5
2.5 Pig Iron Market 6
2.5.1 Global Context 6
2.5.2 Increase in Electric-Arc-Furnace-Produced Steel 8
2.5.3 Reduction in Merchant Pig Iron Production Capacity 9
2.5.4 Targeted Market 9
2.6 Choosing Quebec 9
2.6.1 Geographical Position of the Market 9
2.7 Site Selection 11
2.7.1 The Saguenay Site 11
2.7.2 Regulatory Context 12
2.8 Project Overview 12
2.9 Technology Selection 14
2.9.1 Pig Iron Production Technologies 14
2.9.2 Reducing Agent 23
2.9.3 Cooling Methods 24
2.9.4 Sanitary Wastewater Treatment Methods 25

2.9.5 Process Wastewater Treatment Methods 25
2.9.6 Atmospheric Emission Control 28
2.9.7 CO_2 Management 29

3 Project Description 1

3.1 General Facility Construction 1
3.2 Production Capacity 3
3.3 Process Description 4
3.3.1 Iron Pellets Receiving and Handling 4
3.3.2 Direct Reduced Iron 6
3.3.3 Smelting in the Electric Arc Furnace and Pig Iron Casting 11
3.4 Auxiliary Services 12
3.4.1 Steam Production 12
3.4.2 Compressed Air Production 12
3.4.3 Nitrogen Production 12
3.4.4 Electric Substation 12
3.5 Material Storage and Handling 13
3.5.1 Raw Material 13
3.5.2 Chemical Products for Water Treatment 17
3.5.3 Natural Gas and Combustibles 17
3.5.4 Final Product – Pig Iron 17
3.6 Water Uses and Treatment 18
3.6.1 Demineralization Unit 19
3.6.2 Quenching Cooling Tower Water 21
3.6.3 EAF Cooling Tower, DRI Conveyor and Pig Caster Cooling 21
3.6.4 Industrial Wastewater Treatment 22
3.6.5 Sanitary Wastewater Treatment 26
3.6.6 Run-off Water Management 28
3.7 Solid and Hazardous Waste 30
3.7.1 Slag 30
3.7.2 Screening Fines 31
3.7.3 Sludge: Wastewater Treatment and Baghouse 31
3.7.4 Scrubbing Solution 31
3.7.5 Centrifugation Sludge 31

3.7.6 Refractory Bricks 31
3.7.7 Activated Carbon and Catalysts 32
3.7.8 Waste Oil and Solvents 32
3.7.9 Domestic Waste 32
3.7.10 Empty Containers 32
3.8 Atmospheric Emissions 32
3.8.1 Emission Standards 36
3.9 Noise Emissions 37
3.10 Supporting Infrastructure 38
3.10.1 Natural Gas Supply 38
3.10.2 Electricity Supply 38
3.10.3 Water Supply 38
3.10.4 Railway 38
3.10.5 Port and Conveyor Facilities 38
3.11 Facility Pre-Start-up 39
3.12 Plant Closure 39
3.13 Construction Activities 40
3.13.1 Construction Schedule 40
3.13.2 Site Preparation 41
3.13.3 Temporary Facilities 42
3.13.4 Construction of Buildings and Equipment Installation 43
3.13.5 Construction of the Storage Dome 43
3.14 Emissions and Discharges During Construction 44
3.14.1 Dust 44
3.14.2 Stormwater and Wastewater 44
3.14.3 Solid Waste 44
3.14.4 Noise 45

4 Description of the Environment 1

4.1 Study Area 1
4.1.1 Delineation of the Study Areas 1
4.1.2 Project Area 1
4.1.3 Local Study Area 1
4.1.4 Extended Study Area 1

4.2		Physical Environment	2
	4.2.1	Climate	2
	4.2.2	Air Quality	6
	4.2.3	Physiography	9
	4.2.4	Hydrography and Surface Water Quality	9
	4.2.5	Geology and Soil Quality	11
	4.2.6	Hydrogeology and Groundwater	14
4.3		Biological Environment	15
	4.3.1	Vegetation	15
	4.3.2	Wildlife	19
	4.3.3	Threatened, Vulnerable or Endangered Species	22
	4.3.4	Protected Areas, Conservation Areas and Sensitive Areas	28
4.4		Human Environment	28
	4.4.1	Administrative Framework	28
	4.4.2	Socioeconomic Profile	29
	4.4.3	Land Use	41
	4.4.4	Infrastructure and Public Services	46
	4.4.5	Historical and Archaeological Heritage	54
4.5		Noise Environment	55
	4.5.1	Initial Condition	55
	4.5.2	Noise Limits	56
4.6		Visual Environment	58
	4.6.1	Regional Landscape	58
	4.6.2	Landscape of the Local Study Area	59
	4.6.3	Identification of Landscape Units	59
5		Public Consultation	1
5.1		Consultation Approach	1
5.2		Preliminary Consultations	1
	5.2.1	Consulted Stakeholders	1
	5.2.2	Objectives	1
	5.2.3	Methodology	2
	5.2.4	Participation Level	2
	5.2.5	Principal Problems and Concerns	3

5.2.6 Stakeholders' Recommendations 5
5.3 Consultation on the ESIA results 6

6 Environmental Impact Assessment Methodology 1

6.1 Identification of Environmental Impacts 1
6.2 Assessment of Environmental and Social Impacts 3
6.2.1 Intensity of the Impact 5
6.2.2 Extent of the Impact 6
6.2.3 Duration of the Impact 7
6.2.4 Significance of the Impact 7
6.3 Cumulative Environmental and Social Impacts 8

7 Identification and Assessment of Impacts and Mitigation Measures 1

7.1 Impacts on the Biophysical Environment during the Construction Period 1
7.1.1 Air Quality 1
7.1.2 Surface Water Quality 2
7.1.3 Soil and Groundwater Quality 5
7.1.4 Impacts on Vegetation 5
7.1.5 Impacts on Wildlife 6
7.2 Impacts on the Biophysical Environment during the Operation Period 8
7.2.1 Air Quality 8
7.2.2 Surface Water Quality 10
7.2.3 Soil and Groundwater Quality 11
7.2.4 Hydrology of the Receiving Watershed 13
7.2.5 Vegetation 15
7.2.6 Terrestrial Wildlife 15
7.2.7 Aquatic Wildlife 15
7.3 Impacts on the Human Environment 22
7.3.1 Land Use Planning 22
7.3.2 Public Infrastructure 23
7.3.3 Human Health and Odors 25
7.3.4 Greenhouse Gas 26
7.3.5 Soundscape 27
7.3.6 Visual Environment 34

7.3.7 Quality of Life 39
7.3.8 Archeological Heritage 39
7.3.9 Economic Spin-offs 40
7.4 Impacts of the Plant's Closure 44
7.5 Impact Summary 45
7.6 Cumulative Environmental Impacts 50
7.6.1 Projects Considered 50
7.6.2 Cumulative Impacts Results Analysis 51

8 Technological Risks 1

8.1 Introduction 1
8.2 Identification of the Sensitive Components of the Project's Environment 2
8.2.1 Population 2
8.2.2 Industrial Facilities 3
8.2.3 Road and Rail Freight 3
8.2.4 Pipeline 3
8.2.5 Environmental Features 3
8.3 Identification of External Risks 3
8.3.1 Earthquakes 4
8.3.2 Floods 4
8.3.3 Landslides 5
8.3.4 Exceptional Weather Conditions 5
8.3.5 Aerial Transport 6
8.3.6 Industrial Activities 6
8.4 Hazard Identification 6
8.4.1 Description of Hazardous Materials 6
8.4.2 Transportation of Hazardous Materials 10
8.4.3 Accidentology 11
8.5 Assessment of the Consequences of the Alternative and Standardized Scenarios 12
8.5.1 Methodology 12
8.5.2 Worst-Case Scenarios 17
8.5.3 Alternative Scenarios 19
8.5.4 Scenarios Not Assessed Quantitatively 22
8.5.5 Summary of Potential Consequences 23

8.6 Protection and Prevention Measures 23
8.6.1 Identification of Applicable Laws and Regulations 24
8.6.2 Protection and Prevention Equipment 25
8.7 Risk Management Plan 27

9 Environmental Monitoring and Follow-up Program 2

9.1 Emissions Monitoring Program During Construction 2
9.2 Emissions Monitoring Program – Operation Phase 3
9.2.1 Atmospheric Emissions 3
9.2.2 Consumption and Discharge of Water 6
9.2.3 Solid and Semi-Solid Hazardous Waste 7
9.3 Environmental Monitoring – Operation Phase 9
9.3.1 Ambient Air Quality 9
9.3.2 Noise 9
9.3.3 Groundwater 9
9.4 Reporting and Delivery of Results 10

10 Sustainable Development 1

10.1 NAIC Values and Core Principles 1
10.2 Proposed Sustainable Development Actions 2

11 References Cited and Consulted 1

Acronyms xiv

Chemical Formulas xx

Units and Symbols xxi

List of Tables

Table 2.1	Project Promoter Contact Information	1
Table 2.2	Proportions of Chemical Components in Merchant Pig Iron (MPI)	4
Table 2.3	Main Grey and Ductile Iron Casting Producer Countries in 2013	8
Table 2.4	Advantages of Constructing a Nodular Pig Iron Facility in Quebec	10
Table 2.5	Traditional vs. DR Ironmaking	15
Table 2.6	Gas-based vs. Coal-based DR Ironmaking	20
Table 2.7	Comparison of Gas-based DR/EAF Plants	21
Table 3.1	Raw Materials and Products	14
Table 3.2	Flowrates of Streams to Treat and Reuse	24
Table 3.3	Expected Quality of Water Upstream and Downstream of the Final Treatment	26
Table 3.4	Sanitary Wastewater Characteristics	28
Table 3.5	Estimated Annual Air Emissions from the Cast Iron Manufacturing Plant (tons per year)	35
Table 3.6	Emission Standards	36
Table 3.7	Construction phases	41
Table 3.8	Equipment Used for Construction	46
Table 4.1	Study Areas Considered Based on the Receiving Environment's Component	2
Table 4.2	Climate Normals in Bagotville (from 1981 to 2010)	4
Table 4.3	Stations Selected for Air Quality Description Purposes (2012 to 2014)	6
Table 4.4	Ambient Air Quality Standards	7
Table 4.5	Measurements of O_3 from 2012 to 2014 at the Chicoutimi Station	8
Table 4.6	PM_T (µg/m³) Measurements at the La Baie Station from 2012 to 2014	8
Table 4.7	$PM_{2.5}$ (µg/m³) Measurements at the Chicoutimi Station from 2012 to 2014	9
Table 4.8	Watersheds Present in the Study Area	10
Table 4.9	Study Area Vegetation Profile	16
Table 4.10	Distribution of Wetland Types Present in the Study Area	18
Table 4.11	Wetlands Charactérized[1] in the Study Area	19
Table 4.12	Special Status Plant Species in or Near the Study Area	23
Table 4.13	Special Status Species Possibly Present in or Nearby the Local Study Area[1]	25
Table 4.14	Population Data for the Regional Study Area	31
Table 4.15	Distribution of the Population of the Regional Study Area by Age	32
Table 4.16	Educational Attainment (Population Aged 15 and Over)	34
Table 4.17	Comparative Employment Data by Sector	37
Table 4.18	Main Employers in the City of Saguenay	38
Table 4.19	Employment and Unemployment Rate in 2011	38
Table 4.20	Individual and Household Income (CAD)	39
Table 4.21	Land Allocation in the Study Area	41
Table 4.22	Land Use in the Study Area	44

Table 4.23	Type, Origin and Destination of the Main Goods Handled at the Grande-Anse Terminal	48
Table 4.24	Results of Initial Noise Level Measurements in Sensitive Areas	56
Table 4.25.	Summary of Noise Limits for the Project's Stationary Sources	57
Table 4.26	Summary of Noise Limits for the Construction of the Project	58
Table 5.1	Issues and Concerns Raised during the Preliminary Consultations	4
Table 5.2	Stakeholders Recommendations – Preliminary Consultations	5
Table 6.1	Grid for Determining the Environmental Value	6
Table 6.2	Grid for Determining the Intensity of an Impact	6
Table 6.3	Grid for Determining the Impact Significance	8
Table 7.1	Summary of the Results of the Atmospheric Dispersion Study for Scenarios 1 and 2	10
Table 7.2	Specific Low-Water Flows at the Stations Considered	14
Table 7.3	Flows Estimated for Watercourse 06f80000 at its Estuary with the Saguenay River	15
Table 7.4	Quality of the Effluent based on MDDELCC Criteria	16
Table 7.5	Assessed Toxicity of the Compounds used for the Conditioning of the Water	17
Table 7.6	Noise Levels and Equipment Use Percentage	29
Table 7.7	Projected Noise Levels – Plant Construction	29
Table 7.8	Intensity of the Noise Level Anticipated during the Construction of the Plant	30
Table 7.9	Plant Equipment Sound Power Level	31
Table 7.10	Projected Noise Levels Generated during the Operation of the Plant	33
Table 7.11	Intensity of the Noise Level Anticipated during the Operation of the Plant	33
Table 7.12	Economic Impact of the $257 Million Capital Expenditures (in thousands of dollars, 2016)	42
Table 7.13	Economic Impacts of $141.3 Operating Expenditure (in thousands of dollars -2016)	43
Table 7.14	Summary of the Residual Impacts of NAIC's Pig Iron Plant Project– Construction Phase	46
Table 7.15	Summary of the Residual Impacts of NAIC's Pig Iron Plant Project– Operation Phase	48
Table 7.16	Annual Emissions due to Materials Handling Activities by the APS	53
Table 7.17	Summary of the Results of the Atmospheric Dispersion Study on the Cumulative Impacts of the Plant's Operation and APS Handling Activities	54
Table 8.1	Main Sensitive Elements within the Study Area	2
Table 8.2	Climate Data from the National Building Code	6
Table 8.3	Identification of the Main Hazardous Materials	7
Table 8.4	Properties of the Main Hazardous Materials	7
Table 8.5	Thresholds Used to Evaluate Impact Zones Related to Fatality Risk	14
Table 8.6	Thresholds Used to Assess Potential Effects on Health	15
Table 8.7	DMDS Toxicity Thresholds Defined by MEEDDM	16
Table 8.8	Carbon Monoxide Toxicity Thresholds Defined by AEGL and ERPG Values	16
Table 8.9	Thresholds Used for Domino Effects and Material Damage	17
Table 8.10	Maximum Impact Distances under the Worst-Case Scenario Involving Natural Gas	18
Table 8.11	Maximum Effects Radius for the Diesel-Related Standardized Scenario	18
Table 8.12	Maximum Effects Radius for the Standardized Scenario Associated with the DMDS	19
Table 8.13	Maximum Effects Radius for a Natural Gas Leak Followed by a Jet Fire	20

Table 8.14	Maximum Effects Radius for a Major Natural Gas Leak Followed by an Explosion	20
Table 8.15	Maximum Effects Radius for a Major DMDS Leak	21
Table 8.16	Maximum Effects Radius for a Major Process Gas Leak (CO Toxicity)	21
Table 8.17	Maximum Effects Radius for a Major Process Gas Leak (Mixture Flammability)	22
Table 9.1	Measurement and Sampling of the Final Effluent (No. 3)	7

List of Figures

Figure 2.1	Market Potential for Pig Iron 2014 - 2025	7
Figure 2.2	Site Location	13
Figure 3.1	Plant General Layout	2
Figure 3.2	Pig Iron Simplified Process Flow Diagram	5
Figure 3.3	Simplified Diagram: CO2 Removal	9
Figure 3.4	Water Uses	20
Figure 3.5	Simplified Diagram: Industrial Wastewater Treatment	23
Figure 3.6	Simplified Diagram: Sanitary Wastewater and Run-off Water Treatment	27
Figure 3.7	Labour Requirements during Plant Construction	40
Figure 4.1	Wind Rose at the Bagotville Weather Station (2010 to 2014)	3
Figure 4.2	Schematic View of a Section of the Saguenay Graben	13
Figure 4.3	Territories of Saguenay-Lac-Saint-Jean and their Population	30
Figure 4.4	Post-secondary Education Subjects Studied by the Population of the Study Area	35
Figure 4.5	Economic Development Index for the Saguenay-Lac-St-Jean Region	36
Figure 4.6	Number of Ships Docked on the Saguenay River between 1990 and 2015	49
Figure 4.7	Intersection of Rang Saint-Mathieu and Rue des Cormiers	60
Figure 4.8	*Chemin* St-Joseph	60
Figure 4.9	Quai des Croisières, La Baie	61
Figure 4.10	View towards the Grande-Anse Marine Terminal from the Saguenay's North Shore	62
Figure 4.11	Vacant land where the future pig iron plant will be constructed	62
Figure 4.12	Railway link to the Grande-Anse Intermodal Marine Industrial Park	63
Figure 4.13	Forest area forming the buffer zone between the site, Rue Saint-Martin and the Saguenay River	63
Figure 4.14	View towards the Saguenay from Chemin St-Martin	64
Figure 4.15	Chemin Saint-Martin	64
Figure 4.16	Saguenay river seen from Saint-Fulgence	65
Figure 4.17	View of the flats, St-Fulgence	65
Figure 4.18	Terrasse of the Auberge de la Tourelle	66
Figure 4.19	Beach located south of Cap Jaseax	66
Figure 4.20	View of Chemin Saint-Martin from the Auberge de la Tourelle	67
Figure 6.1	Environmental Impact Assessment Process	4

Figure 7.1	Visual Simulation	38
Figure 8.1	Technological Risks – General Methodology	1

List of Maps

Map 1	Study Area Limit and Monitoring Stations	68
Map 2	Biophysical Environment	69
Map 3	Hydrographic Network	70
Map 4	Landuse Designation and Planning	71
Map 5	Description of the Human Environment	72
Map 6	Landscape Components Description	73

List of Appendices

Appendix A - Water Chemical Conditioning Program

A1 - Chemical Products
A2 - Safety Data Sheets

Appendix B - Slag

B1 - Methodology for the Production of Slag with the same Characteristics (French only)s
B2 - Decision Flow Chart for Repurposing (extract from the guide) (French only)
B3 - Slag Analytical Results Overview (French only)
B4 - Detailed Results and Certificates of Analyses (French only)

Appendix C - Potable Water Quality (French Only)

Appendix D - Atmospheric Emissions

D1 - Atmospheric Emission Calculations
D2 - Atmospheric Dispersion Study (English version beginning only at section 2.7)

Appendix E - Surface Water

E1 - Description of watercourses (French only)
E2 - Surface Water Quality – Analysis results (French only)
E3 - Surface Water Quality - Certificates of analyses (French only)

Appendix F - Soil and Groundwater

F1 - Soil Quality (French only)
F2 - Groundwater Quality (French only)
F3 - Calculation of DRASTIC Vulnerability Index (French only)

Appendix G - Biological Species (French only)

Appendix H - Noise

H1 - Noise Measurements (French only)
H2 - Administrative Codification of Regulation VS-R-2007-51 relative to Noise in the City of Saguenay (French only)
H3 - Handling of Noise Complaints and Requirements of Companies that Generate it (MDDELCC) (French only)
H4 - Guidelines on Noise Levels from the Industrial Construction Site (MDDELCC) (French only)
H5 - Noise Impact Intensity (French only)
H6 - Map H1 Predicted Noise Levels during Facility Operation

Appendix I - Visual Impact

I1 – Location of Photos and Visibility Analyses
I2 – Photographic Report
I3 – Visual Impact Variable Analysis

Appendix J - Consultations

J1 – Stakeholders Met (preliminary consultations)
J2 – Description of Targeted Stakeholders
J3 – Communication Tools Used during Preliminary Consultations

Appendix K - Technological Risks

K1 – Safety Data Sheets
K2 – Consequence Assessment Assumptions
K3 – Preliminary Emergency Response Plan

Acronyms

AADT	Average Annual Daily Traffic
AARQ	Amphibian and Reptile Atlas of Quebec (*Atlas des amphibiens et des reptiles du Québec*)
AEGL	Acute Exposure Guideline Levels
AEPHIS	Association of the Enterprises of the Industrial Park of the Haut-Saguenay Inc. (*Association des Entreprises du Parc Industriel du Haut-Saguenay inc.*)
AIHA	American Industrial Hygienist Association
APS	Saguenay Port Authority (*Administration portuaire de Saguenay*)
ATU	Acute Toxicity Unit
AVS	Attestation of Vocational Specialization
BAPE	Bureau des audiences publiques sur l'environnement
BATEA	Best available technologies economically achievable
BDTQ	Quebec Topographic Database
BF	Blast Furnace
BNQ	*Bureau de la normalisation du Québec*
BOD_5	Biological Oxygen Demand, 5 days
BOF	Basic Oxygen Furnace
BPT	Best Practicable Control Technology
BQMA	Aquatic Environment Quality Database (*Banque de données sur la qualité du milieu aquatique*)
C_{10}-C_{50}	Petroleum Hydrocarbon Chains 10-50 Carbons in Length
CA	Certificate of Authorization
CAAQS	Canadian Ambient Air Quality Standards
CAR	Clean Air Regulation
CCISF	Chamber of commerce and industry in Saguenay-Le Fjord (*Chambre de commerce et d'industrie Saguenay – Le Fjord*)
CCPS	Center for Chemical Process Safety
CDPNQ	Quebec Natural Heritage Data Center
CEC	Chicoutimi Environment Committee (*Comité de l'environnement de Chicoutimi*)

CEGEP	General and Vocational Education Colleges
CEMP	Construction Environmental Management Plan
CFRS	Roberval and Saguenay Railway Company
CFU	Colony-Forming Units
CIUSSS	Integrated University Health and Social Services Center
CLD	Local Development Center (*Centre Local de Développement*)
CLSC	Health and Social Services Center
CN	Canadian National (Railway)
CNRC	National Research Council of Canada (*Conseil national de recherche du Canada*)
COP21	21st Conference of Parties
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSEPAC	Comité sur la situation des espèces en péril au Canada
CPTAQ	Commission for the Protection of Agricultural Land in Quebec
CQRDA	Quebec Aluminum Research and Development Center
CRAIM	Council for the Reduction of Major Industrial Accidents
CREDD	Regional environmental and sustainable development council of Saguneay-Lac-Saint-Jean (*Conseil regional de l'environnement et du développement durable du Saguenay-Lac-Saint-Jean*)
CRRNT	Commission régionale sur les ressources naturelles et le territoire du Saguenay-Lac-Saint-Jean
CSA	Canadian Standards Association
CSE	Canadian Securities Exchange
CSSSC	Chicoutimi Health and Social Services Center
CTA	Aluminum Technology Center
CTU	Chronic Toxicity Unit
CURAL	University Research Center on Aluminum
DEE	Direction générale de l'évaluation environnementale
DIPPR	Design Institute for Physical Property
DMDS	Dimethyl Disulfide
DR	Direct Reduction

DRI	Direct Reduced Iron
DUC	Ducks Unlimited Canada
EAF	Electric Arc Furnace
EDO	Environmental Discharge Objective
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EPOQ	Studies of Bird Populations in Quebec
ERPG	Emergency Response Planning Guidelines
ESAI	Environmental and Social Impact Assessment
ESP	Electrostatic Precipitator
FSM	Forks Specialty Metals
FQCQ	Fédération québécoise des clubs quad
FTE	Full-time Equivalents
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GIEBV	Integrated Management of Water per Watershed (*Gestion intégrée de l'eau par bassin versant*)
GR3MB	Research Group on Renewable Resources in the Boreal Forest
GRI	Grand River Ironsands
HBI	Hot Briquetting Iron
HHV	High Heating Value
HRC	Hot Rolled Coil
ISQ	Statistical Institute of Quebec
JSE	Johannesbourg Stock Exchange
LEMV	Act Respecting Threatened or Vulnerable Species
LFL	Lower Flammable Limit
LNG	Liquefied Natural Gas
LS	Liquid Steel

MAPAQ	Ministry of Agriculture and Fish of Quebec (*Ministère de l'Agriculture et des Pêches du Québec*)
MAPR	Multi-sector Air Pollutants Regulations of Canada
MCC	Ministry of Culture and Communication (*Ministère de la Culture et des Communications*)
MDDEFP	Ministry of Sustainable Development, Environment, Wildlife and Parks (*Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs,* former name of the *MDDELCC*)
MDDELCC	Ministry of Sustainable Development, Environment, and the Fight against Climate Change (*Ministère du Développement durable, de l'Environnement, de la Lutte contre les Changements Climatiques*)
(a)MDEA	(Activated) Methyl diethanolamine
MEDD	Ministry of Ecology and Sustainable Development
MEEDDM	Ministry of Ecology, Energy, Sustainable Development and the Sea
MEIE	Ministry of Economy, Innovation and Exports
MERN	Ministry of Energy and Natural Resources
MFFP	Ministry of Wildlife, Forests and Parks
MMER	Metal Mining Effluent Regulations
MRNF	Ministry of Natural Resources and Wildlife
MTM	Modified Transverse Mercator
MTQ	Ministry of Transport of Quebec
NAFTA	North American Free Trade Agreement
NAD83	North American Datum of 1983
NAIC	North Atlantic Iron Corporation
NBC	National Building Code of Canada
NFC	National Fire Code of Canada
NFPA	National Fire Protection Association
NQISL	Internal Short Line Railroad of Northern Quebec
OBV	Watershed Organization (*organisme de bassin versant*)
OSHA	Occupational Safety and Health Administration
PAE	Comprehensive Development Plan
PAHs	Polycyclic Aromatic Hydrocarbons

PCB	Polychloride biphenyl
PCDD-F	Polychlorinated dibenzodioxins/furans
Petmin	Petmin Limited
PHAST	Process Hazards Analysis Software Tools
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter, diameter ≤ 2.5 microns
PM_T	Total Particulate Matter
PVC	Polyvinyl chloride
Q2	2nd Quarter
QCT	Quenching Cooling Tower
RAA	Clean Air Regulation
RCM	Regional County Municipality (*Municipalité régionale de comté*, MRC)
RMMP	Residual Material (Waste) Management Plant
RMRCECA	Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere
RQO	Regroupement Quebec Oiseaux
RPRT	Land Protection and Rehabilitation Regulation (*Règlement sur la protection et la réhabilitation des terrains*)
SAA	Secrétariat aux affaires autochtones
SAE	Service to companies (*Service aux entreprises*)
SARA	Species at Risk Act
SCR	Selective Catalytic Reduction
SEI	Irreversible Effects Threshold (*seuil des effets irréversibles*)
SELS	Lethal Significant Effects Threshold (*seuil des effets létaux significatifs*)
SER	Reversible Effects Threshold (*seuil des effets réversibles*)
SIEF	Ecoforest Information System (*système d'information écoforestière*)
SIGEOM	Geomining Information System of Quebec (*Système d'information géominière du Québec*)
SLDTV	Species Likely to be Designated Threatened or Vulnerable
SME	Small and Medium-sized Enterprises

SMS	Surface Mineral Substances
SOS-POP	Endangered Species Monitoring
SPA	Saguenay Port Authority
SPEL	First Lethal Effects Threshold (*seuil des premiers effets létaux*)
TERMPOL	Technical Review Process of Marine Terminal Systems in Transhipment Sites
TOC	Total Organic Compounds
TSS	Total Suspended Solids
UGAF	Fur-Bearing Animal Management Unit
UQAM	University of Quebec in Chicoutimi
UTM	Universal Transverse Mercator
UV	Ultra-violet
VOC	Volatile Organic Compound
VSD	Vocational Studies Diploma
WSA	Waterfowl Staging Area
WHMIS	Canadian Workplace Hazardous Materials Information System
ZEC	Controlled operating zone (*Zone d'exploitation contrôlée*)
ZR	Zero Reformer

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Chemical Formulas

Al_2O_3	Aluminum Oxide, Alumina
$CaCO_3$	Calcium Carbonate
CaO	Calcium Oxide
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Fe	Iron
Fe_2O_3	Iron(III) Oxide
Fe_3C	Iron Carbide
$FeCl_3$	Ferric Chloride
H_2	Hydrogen
H_2O	Water
H_2S	Hydrogen Sulfide
MgO	Magnesium Oxide
N_2	Nitrogen
Na^+	Sodium Ion
NaCl	Salt, Sodium Chloride
NO_3	Nitrates
NOx	Mono-nitrogen Oxides
SiO_2	Silicon Oxide
SO_2	Sulfur Dioxide

Units and Symbols

dBA	A-weighted decibels
g/kmV	grams per kilometer traveled
ha	hectares
kg/h	kilogram per hour
km	kilometer
kV	kilovolt
m^3	cubic meters
m^3/d	cubic meters per day
m^3/h	cubic meters per hour
mg/l	milligram per liter
M t/y	Million tons per year
MVA	Mega Volt Amp
MW	megawatts
Nm^3/h	Normal cubic meters per hour
Ppb	parts per billion
ppmvs	parts per million by volume
t/h	tons per hour
$\mu g/m^3$	micrograms per meter cubed

Chapter 1

Impact Assessment Objectives and Background

Table of Contents

1 Impact Assessment Objectives and Background 1

1.1 Consultant 1

1.2 Methodological Considerations 2

1.3 Report Structure 2

1 Impact Assessment Objectives and Background

SNC-Lavalin has been contracted by the North American Iron Corporation (hereinafter referred to as NAIC) to conduct an Environmental Impact Assessment, in accordance with the requirements of the *Environment Quality Act* (RSQ, c. Q.-2) and the *Regulation respecting environmental impact assessment and review* (RRQ, c Q-2, r.9, Article 2j) (Phase I) for the construction and operation, in Grande-Anse, Saguenay, of a nodular pig iron manufacturing plant with an annual capacity of 425,000 tons.

This environmental impact assessment follows the filing of a project notice with the Ministry of Sustainable Development, Environment and Fight against Climate Change (MDDELCC).

As provided for in Article 31.2 of the *Environmental Quality Act* (RSQ, c. Q-2), the Environmental Assessment Department of the MDDLECC has issued, in February 2016, a document entitled *Directive pour la réalisation d'une étude d'impact sur l'environnement d'une usine de fonte en gueuse sur le territoire de la Ville de Saguenay par la Société de fer de l'Atlantique Nord* (Dossier 3211-14-037) (Guidelines for the completion of an environmental impact assessment) outlining the nature, scope and breadth of the Environmental and Social Impact Assessment (ESIA) to be conducted.

The purpose of the ESIA is to identify, assess and minimize the environmental impacts of a project on the receiving environment and its components. This requires a multidisciplinary team of professionals to identify and analyze the various human, physical and biological valued components in the area. Field surveys and a public consultation process led to the selection of various measures to be implemented in order to mitigate the project's negative impacts as well as ways to maximize impacts that could potentially enhance positive effects. Overall, this impact assessment has made it possible to optimize the project's integration into the receiving environment.

1.1 Consultant

SNC-Lavalin is one of the world's largest engineering and construction firms and a major global player in infrastructure construction, operation and maintenance services. SNC-Lavalin has worked in the environmental field since 1973 and has a multidisciplinary team of approximately 1,000 professionals. This impact study was mainly conducted from SNC-Lavalin's Montreal office with the support of professionals from its Levis and Jonquière offices.

SNC-Lavalin hired **Subarctique**, a Chicoutimi-based firm specializing in archaeological studies. This firm has confirmed the archaeological value of the study area for both for the prehistoric and historic periods. The **BC2** firm, which specializes in urban planning, urban development and landscape architecture, is also involved in the project while being also responsible for performing the plant's landscape analysis. **BC2** will draw on the expertise of its Montreal office and its regional office located in Chicoutimi.

SNC-Lavalin has worked closely with the Italian firm **Tenova**, an engineering and equipment supply firm, and a global leader in high technology products and services for the metal industry. It provides the iron and steel industry with innovative technologies allowing their clients to increase the quality and reliability of their products, while reducing production and energy costs

and thereby increasing their environmental performance. Tenova, which has demonstrated substantial international presence with its involvement in projects on every continent, was contracted by NAIC to conduct the feasibility study for the nodular pig iron manufacturing plant. It is also responsible for providing the inputs required for the description of the project (Chapter 3).

1.2 Methodological Considerations

This study was prepared by a team of professionals (see Project Team section) using proven methods to identify, describe and assess the environmental and social impacts associated with the project and propose mitigation measures to minimize these impacts. Impacts are identified through the potential interaction of impact sources, i.e., the type of work to be carried out and equipment to be used, and the valued components of the project's receiving environment.

The description of the study area's components was based on existing information (documents, statistics, and maps), *ad hoc* field trips and data collected specifically for the project (field trips, and detailed inventories). This study also required consultations with a number of organizations.

The information presented herein is a summary of the existing environmental and social conditions at the time of the preparation of the EIA in the study area.

It should be noted that some maps and full-page figures prepared for the impact assessment are presented at the end of each chapter.

1.3 Report Structure

The impact study submitted to the MDDELCC was prepared in two volumes:

Volume 1: Pig Iron Plant Project in Grande-Anse
Environmental Impact Assessment
Main Report

Volume 2: Pig Iron Plant Project in Grande-Anse
Environmental Impact Assessment
Appendices

Chapter 2

Context

Table of Contents

2		Context	1
2.1		Project Promoter	1
	2.1.1	Grand River Ironsands	1
	2.1.2	Petmin	1
2.2		Project Background	2
2.3		Project Objectives	2
2.4		Project Justification	2
	2.4.1	Types of Merchant Pig Iron	3
	2.4.2	Advantages of Nodular Pig Iron	4
	2.4.3	Advantages and Disadvantages of Scrap Iron	5
	2.4.4	Direct Reduced Iron (DRI)	5
2.5		Pig Iron Market	6
	2.5.1	Global Context	6
	2.5.2	Increase in Electric-Arc-Furnace-Produced Steel	8
	2.5.3	Reduction in Merchant Pig Iron Production Capacity	9
	2.5.4	Targeted Market	9
2.6		Choosing Quebec	9
	2.6.1	Geographical Position of the Market	9
2.7		Site Selection	11
	2.7.1	The Saguenay Site	11
	2.7.2	Regulatory Context	12
2.8		Project Overview	12
2.9		Technology Selection	14
	2.9.1	Pig Iron Production Technologies	14
	2.9.2	Reducing Agent	23
	2.9.3	Cooling Methods	24
	2.9.4	Sanitary Wastewater Treatment Methods	25
	2.9.5	Process Wastewater Treatment Methods	25
	2.9.6	Atmospheric Emission Control	28
	2.9.7	CO_2 Management	29

List of Tables

Table 2.1	Project Promoter Contact Information	1
Table 2.2	Proportions of Chemical Components in Merchant Pig Iron (MPI)	4
Table 2.3	Main Grey and Ductile Iron Casting Producer Countries in 2013	8
Table 2.4	Advantages of Constructing a Nodular Pig Iron Facility in Quebec	10
Table 2.5	Traditional vs. DR Ironmaking	15
Table 2.6	Gas-based vs. Coal-based DR Ironmaking	20
Table 2.7	Comparison of Gas-based DR/EAF Plants	21

List of Figures

Figure 2.1	Market Potential for Pig Iron 2014 - 2025	7
Figure 2.2	Site Location	13

2 Context

2.1 Project Promoter

The project promoter is North Atlantic Iron Corporation (NAIC), a private joint venture formed in 2010 and registered in Quebec in December 2015, hereafter referred to as NAIC. NAIC is 60% owned by Grand River Ironsands Inc. (GRI) and 40% by Petmin Limited (Petmin). A description of these companies can be found in the following subsections. The contact information of the promoter can be found below in Table 2.1.

Table 2.1 Project Promoter Contact Information

Name	North Atlantic Iron Corporation
Address	805-1809 Barrington Street, Halifax, Nova Scotia, B3J 3K8 A project office will soon be opening in Quebec.
Project Contact	Liz MacKenzie, Director of Communications
Telephone	(902) 233-7255 (Local number to come)
Facsimile	(902) 835-0585 (Local number to come)
Email	liz@ironsands.ca
Quebec Company Number (NEQ) in the Quebec Company Register	1171449821

2.1.1 Grand River Ironsands

GRI is a private Canadian company founded in 2007. Its initial mission was to become a low-cost producer of high-purity pig iron using the mineralized sands of Labrador as feedstock. Today, through NAIC, GRI continues to pursue its goal of developing low-cost production of high-purity pig iron; however, this production will no longer be reliant on iron sands as feedstock. Instead NAIC will purchase readily available iron ore pellets from current producers, ideally those from Quebec established producers.

GRI is 56% held by a group of private Canadian investors and 44% by Metalo Manufacturing Inc., an investment company in mineral resources listed in the Canadian Securities Exchange (CSE).

2.1.2 Petmin

Petmin is a South African mining company founded in 1972 and listed on the Johannesburg Stock Exchange (JSE). Petmin is the most significant producer of anthracite coal in the country with an annual production of more than 1.3 million tonnes of this specialty product. In 2015, its stocks were evaluated at more than 130 million American dollars. Petmin has invested 25 million American dollars in the NAIC joint venture.

2.2 Project Background

The pig iron production facility project was originally planned to be in the center of Labrador, near Happy Valley-Goose Bay, where Grand River Ironsands (GRI) held the rights to the mineralized sands. These sands contain significant levels of magnetite, titanomagnetite, garnets (almandine), zircon and other potentially precious minerals. GRI partnered with Petmin and formed NAIC, initially, to develop, extract and process the mineral sands into commercially saleable products.

NAIC's business model has evolved over the years. A pig iron production facility in Labrador was added to the initial mineral extraction project. Then, as a result of the large decrease in the price of iron ore, the remoteness of the deposit and the difficulties in supplying electricity and natural gas to the site, NAIC decided to separate the development of the mining project from the pig iron project.

NAIC is now focused on developing a high-quality pig iron production facility using iron ore purchased from current producers, rather than from mineral sands. This allowed NAIC to evaluate many different sites in the United States and in Quebec, to determine the most optimal location for a pig iron production facility.

NAIC continues to evaluate the mineralized sands potential in its Happy Valley-Goose Bay deposit, however primary focus is the pig iron facility in Saguenay.

2.3 Project Objectives

The goal of the NAIC project is to construct and operate at Grande-Anse, in Saguenay, a facility producing 425,000 tonnes per year of high-quality pig iron in order to serve the foundry and steel mill markets in North America and Europe.

NAIC aims to produce nodular grade pig iron, distinguished from other merchant pig iron by its high purity as well as its low concentration in manganese, phosphorous and sulfur.

2.4 Project Justification

The production of steel using electric arc furnaces (non-integrated steel mills) and the production of cast iron in foundries require iron originating from different raw materials. Electric arc furnaces use recycled steel (**scrap iron**), **direct reduced iron (DRI)**, **hot briquetted iron (HBI)** and lower-quality **merchant pig iron**. Foundries use **recycled steel** as well as different qualities of **merchant pig iron**.

Compared to merchant pig iron, DRI and HBI have lower concentrations of iron and higher concentrations of impurities (silica and aluminum), causing the formation of larger quantities of slag. DRI and HBI thus cannot be used in the foundry production processes, making pig iron the raw material of choice. When foundries are focused on making high quality ductile iron castings, a specific grade and quality of merchant pig iron is required. This product is called **nodular pig iron**. Nodular pig iron has no substitute creating a stabilized demand and a premium price.

Scrap iron used in the foundries and electric arc furnaces contain impurities such as zinc, copper and lead that contaminate the final product. These undesirable elements are absent

from pig iron, which has become irreplaceable in the foundry industry for diluting the impurities to acceptable levels in their finished products. In addition, the supply of quality scrap iron is diminishing as a result of the increased demand of the NAFTA market for high-strength low-weight steel alloys, increasing the demand for merchant pig iron.

The following sections describe the different types of merchant pig iron as well as the materials that could substitute them in the fabrication of steel and iron products. The characteristics of each of these materials are provided in such a way as to distinguish them from nodular pig iron. The information is principally taken from the website *International Iron Metallics Association* (IIMA)[1].

2.4.1 Types of Merchant Pig Iron

Pig iron is the intermediate product of smelting iron ore. The term *pig iron* originates from metal that was originally cast into a mold that was shaped into a branching structure formed in sand, with individual ingots at right angles to a central channel or runner, similar in appearance to a litter of piglets (ingots) suckling on a sow (runner). When the metal had cooled and hardened, the ingots were simply broken from the runner, thus forming *pig iron*.

Today, pig iron is principally produced and consumed by integrated steel mills. However, “hot metal” from iron ore smelting in blast furnaces is directly transferred to the steel mill in liquid form. The term *pig iron* is thus inappropriate in this type of fabrication.

Merchant pig iron is cold iron, cast into ingots and sold as ferrous feedstock for the non-integrated steel and metal casting industries. It falls into the category of ferrous metals, of which iron and steel scrap make up by far the largest volume, followed by direct reduced iron (DRI) and hot briquetted iron (HBI).

Merchant pig iron is produced by dedicated merchant plants, all of whose production is sold to external customers. Some integrated steel mills produce blast furnace iron that is surplus to their internal requirements and this is also cast into ingots and sold as merchant pig iron.

Merchant pig iron contains at least 92% iron, for a degree of purity of around 96%. It is typically separated into three main categories:

- Basic pig iron, used mainly in electric arc steelmaking;
- Haematite pig iron, also known as foundry pig iron, used mainly in the manufacturing of grey iron castings in cupola furnaces[2];
- Nodular pig iron also known as ductile or spheroidal graphite[3], used in the manufacturing of ductile iron.

Table 2.2 presents the proportion of chemical components contained in merchant pig iron.

[1] Information from website http://metallics.org.uk/
[2] Cylindrically-shaped furnace on a vertical axis used during the second furnace melt
[3] Treated by magnesium, nodular pig iron is obtained by transforming the shape from lamellar to spheroidal or nodular.

Table 2.2 Proportions of Chemical Components in Merchant Pig Iron (MPI)

MPI Types	Iron	Carbon	Silicon	Manganese	Sulfur	Phosphorous
Basic Pig Iron	92%	3.5 – 4.5%	<1.5%	0.5 – 1.0%	<0.05%	<0.12%
Haematite Pig Iron	92%	3.5 – 4.5%	1.5-3.5%	0.5 – 1.0%	<0.05%	<0.12%
Ductile/Nodular Pig Iron	92%	3.5 – 4.5%	0.05-2.0%	<0.05%	<0.02%	<0.04%

2.4.2 Advantages of Nodular Pig Iron

Nodular pig iron is differentiated from other types of pig iron by its low manganese, phosphorous and sulfur contents, typically less than 0.05% for each element, which gives it significant advantages described below.

1. Low impurity content, allowing for:
   a. Dilution of undesirable elements in the melt;
   b. Better control and increased stability of the melting process;
   c. Tighter control of final casting composition, resulting in better mechanical properties of castings;
   d. Elimination of requirement for thermal treatment of castings, thus reducing production costs;
2. Lower melting temperature than scrap steel from electric arc furnaces, resulting in a lower energy requirement;
3. Higher bulk density than scrap steel, allowing for:
   a. Reduction in storage space;
   b. Reduced charge bucket use;
   c. Better electromagnetic effect, incurring a quicker melting process and thus reduced power consumption;
4. Lower surface area/volume ratio than scrap steel, reducing the oxidation (rust formation) and slag production;
5. An increase in the percentage of pig iron in the charge, leading generally to a higher nodule count in ductile iron.

With its high iron purity, the use of ductile pig iron allows steel mills as well as foundries to continue to use scrap iron, whose advantages and disadvantages are described below, as an iron source.

2.4.3 Advantages and Disadvantages of Scrap Iron

Scrap iron results from the recovery of metal, ferrous and non-ferrous[4], sourced from diverse materials recovered from businesses or private owners. The principal advantages to using scrap iron in the fabrication of steel and pig iron are:

› Reduction of environmental footprint, less waste in landfills, use of recycled materials;
› Reduction in consumption of raw materials;
› Energy and cost savings;
› Abundance and availability near production centers.

The principal disadvantages of using scrap iron are linked to the variation (in concentration and type) of other metals present in the scrap, that can thus end up in the atmospheric emissions, make the production of high-purity iron castings and steels more difficult and increase the production of slag.

2.4.4 Direct Reduced Iron (DRI)

Direct reduced iron (DRI), or sponge iron, is produced from the direct reduction (i.e. oxygen removal) of iron ore with reducing elements such as hydrogen gas and carbon monoxide, originating from natural gas or coal. DRI provides an alternative steel-production method from the conventional route of blast furnace and basic oxygen furnaces. DRI is an intermediate product and is a raw material for the production of steel in electric arc furnaces.

Once commercialized, DRI can come in different forms (lump, briquettes, or pellets). It can be transformed mechanically by hot compression to briquettes in order to reduce its porosity and tendency to oxidize. Once hot molded, DRI is called hot briquetted iron (HBI).

Advantages and Disadvantages of Direct Reduced Iron

For certain developing countries where supplies of cokefiable coal are limited, the production of DRI could be advantageous in the following ways:

1. Low investment costs and comparable performance to integrated steel mills;

2. High concentration of iron (90 to 94% total iron) and low concentration of impurities, creating an excellent raw material for non-integrated steel mills, allowing them to blend lower grade scrap iron for the rest of the load or to produce higher steel grades;

3. Stable and known chemical composition, certified by the producer;

4. Possibility of producing HBI, a compact form of DRI, allowing notably:

    a. Facility of transport, handling and storage of the product, HBI has a low reactivity with salty and fresh water;

[4] Ferrous metals are light iron, pig iron and heavy steel. Non-ferrous metals are copper, brass, lead, non-oxidizable steel, aluminum, bronze and zinc. These metals generally come from recovered parts such as auto parts, catalytic converters, production metal waste, demolition materials, home appliances, etc.).

b. Reduced costs and energy when consumed on the production site, as long as iron is not cooled but immediately transported and loaded into the electric arc furnace.

Finally, the ore and natural gas suppliers are often present in the same country, avoiding the costs associated with natural gas transport (the facility is normally situated near the natural gas source because it is normally more profitable to transport ore rather than gas).

DRI has, however, several disadvantages, which are the following:

1. Spontaneous ignition upon contact with air (pyrophoric);

2. Tendency to oxidize and produce rust when non-protected; it must be rapidly transformed during steel production;

3. Contact with water, particularly salty water, can generate hydrogen and lead to danger of explosion, which makes transportation difficult.

4. Higher level of slag formers than pig iron

The main disadvantage of DRI and HBI is that they cannot be used in foundries as a result of elevated levels of gangue forming oxides that stay in the DRI (i.e. CaO, Al_2O_3, SiO_2, MgO). These oxides represent 3% to 6% of the elements in DRI/HBI.

2.5 Pig Iron Market

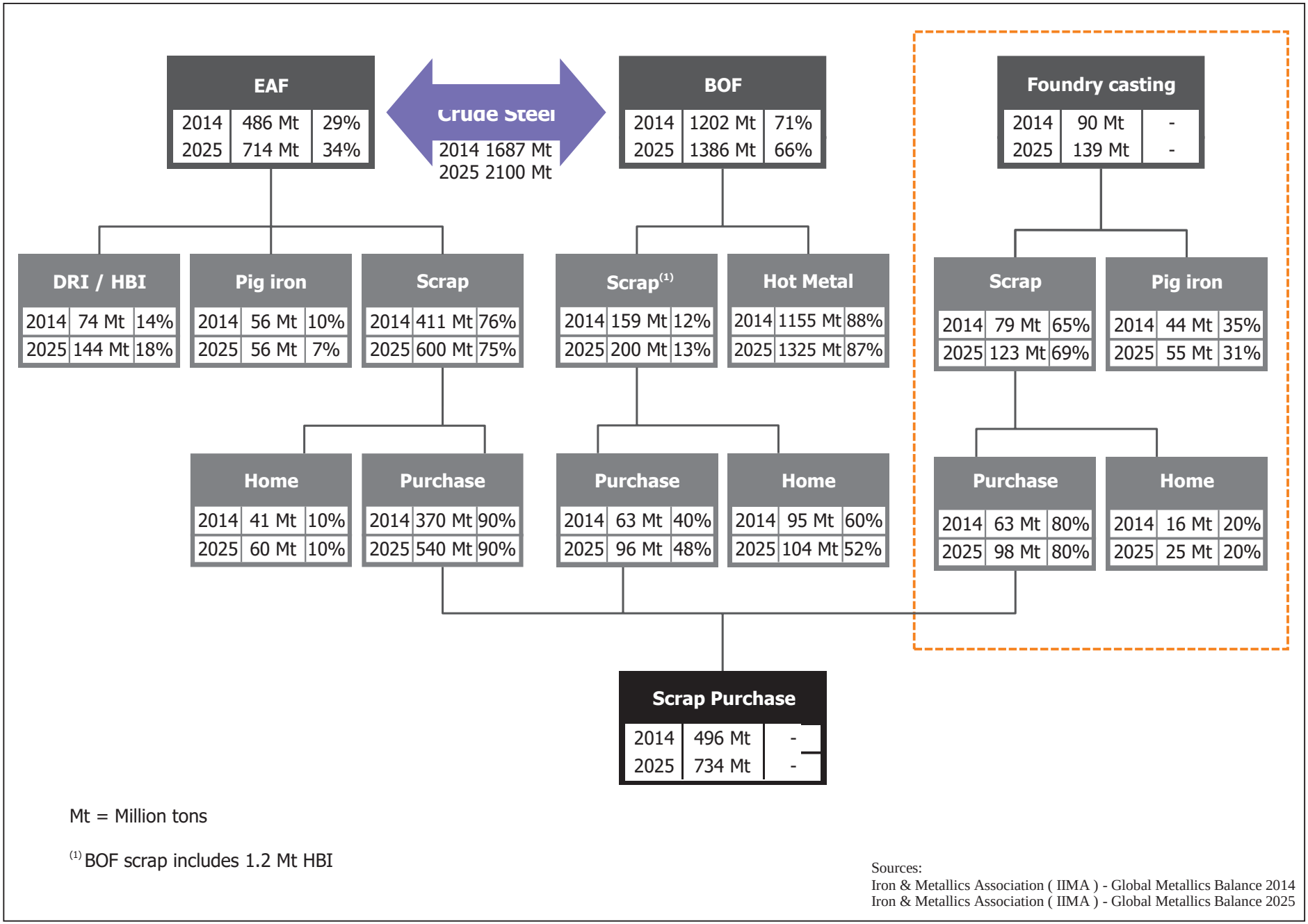
The merchant pig iron market can be divided into two categories within the primary metal transformation sector: the iron foundry and steel mill markets. The principal market targeted by NAIC for nodular pig iron are North American and European foundries, followed by non-integrated steel mills that would receive all production surplus. Figure 2.1 illustrates market opportunities for pig iron according to 2014 data as well as a projection for 2025.

2.5.1 Global Context

In 2014, the global merchant pig iron market was 100 million tonnes per year, of which 44 million tonnes were dedicated to foundries.

Table 2.3 presents the ten main countries that produced grey and ductile iron castings in 2013.

Figure 2.1 Pig Iron Market Opportunity 2014 - 2025



Mt = Million tons

(1) BOF scrap includes 1.2 Mt HBI

Sources:
Iron & Metallics Association (IIMA) - Global Metallics Balance 2014
Iron & Metallics Association (IIMA) - Global Metallics Balance 2025

T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_prel\snc634451_fig2-1_marche_fonte_let_160322.cdr

Table 2.3 Main Grey and Ductile Iron Casting Producer Countries in 2013

Countrv	Grey Iron (M t/y)	Ductile Iron (M t/y)	Total (M t/y)
China	20.6	11.6	32.2
United States	4.08	4.25	8.33
India	6.7	1.0	7.7
Germany	2.38	1.54	3.92
Japan	2.14	1.68	3.82
Russia	1.81	0.99	2.8
Brazil	1.83	0.75	2.57
South Korea	1.09	0.71	1.8
France	0.64	0.70	1.34
Italy	0.69	0.39	1.08
Total	**41.9**	**23.6**	**65.5**
Total without China	**21.3**	**12.0**	**33.4**

* Data has been rounded to facilitate reading;

Source: *Modern Casting – 48th Census of World Casting Production* (2014).

The total iron foundry market increased by almost eight million tons between 2007 and 2014 to 57.7 million tons. The United States also increased their production from 7.8 million tons in 2007 to 8.3 million tons in 2013. China is the top nodular castings producer with almost half the market (11.6 M t/y), followed by the United States (4.3 M t/y) and Germany (1.5 M t/y). The ductile pig iron market increased by 1.3 percent in 2013 compared to 2012 data.

The global demand for nodular pig iron is currently estimated at 1.2 to 1.5 million tons per year. According to the International Iron and Metallics Association, the demand for pig iron will have increased by 11 million tons in 2025.

2.5.2 Increase in Electric-Arc-Furnace-Produced Steel

The average annual rate of increase of the global electric-arc-furnace steel production market was 4.8% between 2010 and 2015. Much of this gain was in flat-rolled steel and specially graded steel. These types of steel products and grades require a mixture of steel scrap and alternative iron units such as merchant pig iron.

The global supply of steel scrap without impurities is deteriorating as multiple recycling stages can increase concentrations, and there is an increasing use of high strength low weight alloyed steels. The alloying agents end up being impurities in scrap steel that must then be managed by steel mills and foundries that recycle such scrap. These impurities can only be adjusted by dilution, through mixing the scrap with alternative iron units (such as pig iron) that do not contain impurities.

As a result of new electric arc furnace steel production process start-ups based in Asia, the Middle East and in Eastern Europe, it is highly likely that Russian and Chinese merchant pig iron producers will be less interested serving the North American market and would concentrate more on nearby customers.

2.5.3 Reduction in Merchant Pig Iron Production Capacity

Over the course of 2012 and 2013, difficulties in the steel market led to the closure or bankruptcy of facilities located in Russia, Brazil and the Ukraine reducing merchant pig iron production capacity. The integrated steel mills in Ukraine are susceptible to being repositioned on the local steel market, which is showing signs of equilibrium between supply and demand, decreasing merchant pig iron exports from Ukraine. Additionally, the largest global exporter of merchant pig iron is slowly withdrawing from the market as it strengthens its steel production (Koks Group, Russia). Potentially 2 million tons per year of merchant pig iron could be removed from the market when Koks begins to use it to make steel in Russia.

2.5.4 Targeted Market

The principal market targeted by NAIC is the American and European foundry market, followed by electric arc furnace steel mills. The value-added business model used by NAIC is based on an annual production of 425,000 tons of nodular merchant pig iron, for which the use of 700,000 tons of iron pellets is required. This raw material could easily come from local industries, such as the pellet export facilities of Arcelor Mittal and Rio Tinto located respectively in Port-Cartier and Sept-Iles.

The market targeted by NAIC is easily accessible by maritime transport for four to ten principal ductile pig iron producing nations (United States, Germany, France and Italy).

2.6 Choosing Quebec

2.6.1 Geographical Position of the Market

The principal consumers of nodular pig iron are mostly in the United States and Europe, around 400,000 and 500,000 tons per year respectively. Presently, the nodular pig iron consumed in the United States comes essentially from Brazil (220,000 t/y) followed by South Africa (150,000 t/y), Canada (35,000 t/y) and Russia (5,000 t/y). Russia mainly supplies Europe and Eastern Europe as a result of its geographic location.

It should be noted that nodular pig iron produced in Canada and South Africa come essentially from an intermediate product originating from the melting of ilmenite during the production of titanium dioxide. The production from these two countries is accessory and does not follow the market trends.

Producers in Russia are struggling to obtain the desired nodular pig iron quality criteria, notably for sulfur. This struggle is mainly due to the use of blast furnaces that are not adequately configured for the hot metal refining process.

The majority of iron ore from Brazil contains an elevated quantity of phosphorous and manganese, which causes a major inconvenience in the production of nodular pig iron. Additionally, Brazilian producers require 120 days to deliver the product after the order is placed. The delay includes the production of the pig iron, transport by truck to the port, delivery by boat to New Orleans and transport by barge to the Midwest.

As a result of high wait times for delivery and the quality of the nodular pig iron, few producers can supply the market of North America. The construction of a nodular pig iron fabrication facility in Quebec is thus strategic. Table 2.4 summarizes the advantages that strengthen this choice.

Table 2.4 Advantages of Constructing a Nodular Pig Iron Facility in Quebec

Variable	Advantage
1. Production and delivery (USA and Europe)	› Direct access to the Great Lakes and to the Atlantic Ocean (<5 days for delivery) › Reduced transportation costs to the USA and Europe (compared with Brazil and Russia) › Availability of inputs at reduced costs (e.g. iron ore, electricity, natural gas) › Low production costs and delivery costs allow for profitability through fluctuating economic cycles
2. Well-established American and European iron foundry market	› Potential in North America of 1 Mt/y, in addition to an analogous market in Europe › Sufficient market size to absorb the production of NAIC
3. Distant competition (Brazil, Russia, Ukraine, South Africa)	› Zero competition in North America and weak competition in Europe › Reduced logistics costs › Reduced geopolitical risks
4. Excess production can be purchased by non-integrated steel mills (vast market)	› > 4 Mt/y of merchant pig iron is imported by North-American steel mills
5. Quality of the product prevails over the quantity	› High quality pig iron produced in Quebec could be sold at a premium of up to $100 US/t compared to the price of basic pig iron sold to steel mills
6. Complements the market needs	› No rivalry with Canadian or American mines, foundries and steel mills

2.7 Site Selection

In total, 14 sites were evaluated of which five were in Canada and nine in the United States. Among the selection criteria used to compare the sites were:

› Accessibility of the maritime waterways (deep water port) as well as railway and roads;
› Availability and reliability of energy resources (natural gas and electricity);
› Proximity to raw material;
› Proximity to the markets of the United States and Europe;
› Site characteristics (zoning, land purchase, industrial infrastructure, etc.);
› Taxes;
› Accessibility to qualified labor.

In Quebec, three locations were considered: Sept-Iles, Port-Cartier and Saguenay. Sept-Iles and Port-Cartier were eliminated for lack of site availability and accessibility to natural gas as well as zoning in the case of Sept-Iles. The possibility of liquefied natural gas (LNG) supply was evaluated but judged to be too costly and unpredictable. There is no LNG receiving facility on the North Shore and the announced projects have no firm start-up date.

2.7.1 The Saguenay Site

NAIC chose to construct its pig iron production facility on industrial land belonging to the Saguenay Port Authority (APS), near the maritime terminal of Grande-Anse in the City of Saguenay, La Baie Borough.

In order to fulfill its mission, which consists of favoring the expansion of outside business as well as the industrialization and development of the inland region of Saguenay-Lac-Saint-Jean-Chibougamau-Chapais, the APS has recently developed the land in order to allow businesses to grow and use the proposed utilities. These properties are located on either side of the Chemin du quai Marcel-Dionne giving access to the jetty by the same name.

In 2015, APS saw the designation of the industrial-portuary zone by the Quebec government in the context of its maritime strategy. Globally, industrial-port zones will allow Quebec exports to increase through an improved integration of manufacturing to global supply chains (Quebec government, Stratégie maritime, 2015). This designation aligns with the general orientations of the APS that are strengthened by them. NAIC could thus benefit from the functional developments by sharing infrastructure and port services with the goal of increasing the efficiency of these activities in terms of logistics.

This federal industrial-port zone offers several advantages to the construction of a pig iron production facility:

› Deep water port accessible year-round situated at a reasonable distance from raw material suppliers of the market;
› Space available near to the port (2.4 km) and at the jetty (for temporary storage as needed);

- Commitment by the APS to construct a multi-user conveyor between the jetty and the industrial zone that could be used for the transport of pellets and pig iron;
- Site provided by the APS already cleared and leveled;
- Land at the heart of an industrial-use zone;
- Remoteness of urban perimeters allowing for the existence of major industrial operations;
- Availability and reliability of natural gas supply (commitment from Gaz Metro to extend its network to serve the facility);
- Availability and reliability of the electric network (commitment from Hydro Quebec to extend its network to serve the facility);
- Willingness of different levels of government to develop this sector for industry;
- Qualified labor in the steel industry sector.

The exact location of the site on the APS land was defined following a geotechnical study as well as discussions with APS that wishes to both set aside land for the construction of a future railway that would serve this sector, and to maintain its commitments to other private project promoters. The land would remain the property of APS and would be leased to NAIC via a long-term lease. The site location is presented in figure 2.2.

2.7.2 Regulatory Context

The regulations governing the land of the facility's location (project site) is intimately related to the site selection.

The site considered for the construction of the facility is found within Zone 71770, as outlined by the City of Saguenay. According to the zoning regulation for this zone, the allowed uses are predominantly industrial and port-related, to be carried out in the Grande-Anse sector.

The site zone is in line with the development of the land, planning unit 119, identified as a predominantly industrial zone whose vocations are linked to port activities in Grande-Anse. The site is located in the industrial expansion zone of which the Intermodal Maritime Industrial Park is part.

2.8 Project Overview

The project consists of the construction and operation of a nodular pig iron production facility from iron pellets. Annual forecasted production is 425,000 metric tons. Production of nodular pig iron will be carried out using known and proven technologies, which is direct reduction followed by smelting in an electric arc furnace. Natural gas is used as a reducer element as well as a combustible for the preheating furnace. The iron pellets originating from the pellet plants of the North Shore will be transported by boat and then conveyed or trucked to the facility. Bentonite will be used as a binder for the pellet fines that will be combined into briquettes to be reused as raw material. Lime will be used in the electric arc furnace to create the slag. Metal, liquid iron, will be casted into pig iron form. The different sources of atmospheric emission will be treated to reduce dust emissions. The wastewater generated by the processes will be treated and reused within the facility. With the exception of slag of the pig iron that will be stored outside, all other material will be contained.

Figure 2.2 Site Location

2.9 Technology Selection

2.9.1 Pig Iron Production Technologies

Three main technological pathways to produce pig iron out of iron ore are available:

› Traditional BF;
› Coal-based DR technologies followed by electric smelting;
› Gas-based DR technologies followed by electric smelting

The coal-based smelting reduction process (i.e. Corex/Finex process) and all the other emerging technologies with little commercialization are excluded from this review.

2.9.1.1 Traditional vs. Direct-Reduction Ironmaking

For over a century, pig iron and liquid steel have been produced at integrated mills that process virgin raw materials such as iron ore, coking coal, and a burden material like limestone and dolomite. As the name implies, integrated mills are characterized by networks of independent material and energy streams between processes including cokemaking, ironmaking, steelmaking, and steel finishing. An integrated mill producing nodular pig iron from virgin iron ore and coal would require a cokemaking plant and a BF.

Introduced in the late 1960s, direct reduction ironmaking is the most common alternative to BF ironmaking with iron ore pellets. In this process, synthesis gas (or syngas) which is a mixture of hydrogen (H_2) and carbon monoxide (CO), is generated, providing an effective reducing agent converting the iron ore into direct-reduced iron (DRI or sponge iron) in a furnace.

Several natural gas-based DRI processes are available on the market with the MIDREX and HYL technologies being the most common worldwide. They both have different features but all in all they provide a DRI product that can be loaded into EAFs as a clean substitute to ferrous scrap. Non-coking coal-based DRI processes are also available although more limited commercially. It uses, for example, a rotary hearth furnace in which a mixture of iron ore and pulverized coal is continuously fed and heated at varying temperatures to produce sponge iron (Fastmet process).

The primary benefit of DRI processes is that they can operate without coke or sinter. This aspect avoids the necessity for cokemaking plants and sinter machines that have significant environmental impacts and energy requirements. The use of natural gas instead of coal as the reducing agent also limits greatly the emissions associated with sulfur but also with carbon dioxide (CO_2). Other benefits but also inconveniences are associated with DR ironmaking. NAIC has selected the natural gas based direct reduction route. Table 2.5 generalizes these differences between the traditional and DR ironmaking technological pathways.

Table 2.5 Traditional vs. DR Ironmaking[5]

Features	Traditional BF (Blast Furnace)	DR (with gas) + EAF
Scale of Production	Long established and energy and resource efficient with unit plant throughputs of hot metal of 2 to 4.77 Mt/yr and greater.	Gas-based processes account for the vast majority of installed DR capacity worldwide, dominated by HYL and Midrex technologies. DRI is normally used as a virgin metallic feed, supplementing scrap in the EAF steelmaking route. DRI is also used as metalized burden in BF for coke reduction/hot metal productivity increase. DR plants range from 0.2–2.5 Mt/yr; Midrex being the largest module in operation based on the HYL ZR (ENERGIRON), already in the lower limit of the BF size.
Feedstocks	**Coal**: Coking coals required for cokemaking; coke breeze and anthracite required (where used) for sinter plants; coal for BF injection (can be non-coking coal specification). **BF Injectants**: Besides coal, oil (incl. waste oil), natural gas, plastics, and a flux material (i.e. limestone) are injected into the BF. **Metallics**: A wide range of feedstock of variable quality and specification can be used.	**Coal** (where used-minority of processes): A wide range of solid fuels from anthracite to lignite including charcoal can be used. **Gas** (where used): Sulphur content of gas must be low to avoid poisoning of the reformer catalyst and effecting product quality for the Midrex process. **Metallics**: As no physical change of state takes place in the process, high-quality pellets and lump ore are required.

[5] Adapted from European Commission, Integrated pollution prevention and control – Reference documents on best available techniques for the production of iron and steel, February 2008.

Features	Traditional BF (Blast Furnace)	DR (with gas) + EAF
Energy Requirements	Typically around 17–18 GJ/t of liquid iron (less gas, steam and heating credits from carbon in iron). The majority of energy comes from the coking coal (13–15 GJ/t LS) and fossil fuel (natural gas & oil) (2-3 GJ/t LS). Electricity requirements range between 150–250 kWh/t LS. Several measures can improve the energy efficiency of integrated mills,[6,7] including reduction of coal moisture, coke dry quenching, top pressure turbines at BF, etc. Most of these practices would result in lower fossil fuel use. However, the overall energy intensity of an integrated mill making the most of best practices is not expected to be much lower than 15 GJ/t LS.[8]	Typically 9.9–12.6 GJ/t solid DRI (gas-based) assuming 100% commercial DR grade pellets. Most energy comes from natural gas either as reducing agent or for direct-firing at the DR unit (9.9–11.5 GJ/t DRI) to which about 1 GJ/t DRI should be added for energy use at the EAF melt shop. Electricity requirements range between 30–130 kWh/t DRI for the DRI unit and 450-650 kWh/t LS for the EAF melt shop. Hot DRI can be directly charged to the EAF bringing most of its heat in the process and providing savings in electricity and fuel. In contrast, hot DRI is also known to contain a lot of gangue which leads to an increase in power consumption at the EAF.
Product Quality	Stable and of dependable quality.	Product subject to re-oxidation except if it is passivated or briquetted. The quality depends heavily on the quality of the feedstock. The DRI with a high level of carbon (> 3.5% C) of the HYL ZR process is more stable according to the tests carried out and the experiences of facilities. It provides supplementary energy to the EAF. In the case of NAIC, the hot DRI will be fed directly to the EAF and quality of the product is thus stable and reliable.

[6] European Commission, Integrated pollution prevention and control – Reference documents on best available techniques for the production of iron and steel, February 2008.
[7] United States Environmental Protection Agency, Available and emerging technologies for reducing greenhouse gas emissions from the iron and steel industry, October 2010.
[8] Canadian Industry Program for Energy Conservation, Benchmarking energy intensity in the Canadian steel industry, prepared for Canadian Steel Producers Associations and Natural Resources Canada, 2007.

Features	Traditional BF (Blast Furnace)	DR (with gas) + EAF
Environmental Performance	Main energy and carbon feedstock is coking coal, which inherently contains toxic chemicals including VOCs, PAHs and a variety of other chemicals like H_2S. Other releases at the cokemaking plant are dust along with some CO, SO_2 and NOx. Sinter plants release SO_2, NO_x, dust, VOCs, PCBs, PCDD/F and PAHs. BFs discharge dust and SO_2 from cast houses and NOx from the hot blast stoves. Dust fumes and CO are the main contaminants from BOFs. H_2S can also be a nuisance. This process route uses large quantities of water. In general, the wastes and by-products per tonne of liquid steel from the BF route are almost 3-times the ones from the EAF route. It exceeds 400 kg/t crude steel on average. However, it provides for the recycling of various solid wastes/by-products that would not be possible in various direct reduced iron treatment processes. For example, BF slag can be used for road construction or pelletized to make slag cement which reduces the demand for primary aggregates.	As most DR processes make use of iron pellets, the environmental impact of releases from the pelletization process should be taken into account. The DRI product typically contains 2–4% gangue requiring further energy for processing and additional environmental releases to be considered. Wastes and by-products for the DR/EAF route is less than 200 kg/t crude steel. Fines are processed in cold briquettes and recycled in the process. NOx is released at the gas reforming stage in the Midrex and HYL III processes. For Midrex, SCR technology is normally used to comply with NOx limits whilst for the HYLIII and HYL ZR, no need of additional systems are required. SO_2 emissions are limited by the sulphur content in the pellets and natural gas. In any case, for the HYL process, sulphur can potentially be removed from the CO_2 stream. Slag from smelting of the DRI in an EAF contains fewer impurities than those produced by the BF route and can be recycled as aggregate.

Features	Traditional BF (Blast Furnace)	DR (with gas) + EAF
	The desulphurising capability of the BF also allows for higher sulphur-containing fuels and reductants to be used in an environmentally friendly manner. It is important to remember that the traditional ironmaking route provides for many recycling and disposal opportunities for ferruginous arisings, filter cakes and oils from downstream steel production that may not be available in many reduction processes. The traditional route also has the ability to use a wide range of feedstocks and reductants of varying quality. The majority of GHGs (as CO_2) are emitted from the hot blast stove. A smaller amount of CO_2 emissions may also occur from flares, leaks in the ductwork for conveying the gas, and from emergency venting. The CO_2 emissions intensity per activity is 0.2–0.45 t CO_2/t coke for coke plants, 1.35–1.7 t CO_2/t HM for BF and <0.2 t CO_2/t LS for BOFs. Hence, typical CO_2 emissions intensities falls between 1.7–1.8 t CO_2/t LS for integrated mills. Although sharing 71% steel production, BF route represents a share of 82% of energy consumption and 88% of CO_2 emissions.	From the carbon footprint point of view, the DR/EAF route emits about 1 t CO_2/t LS. For the HYL ZR technology, total CO_2 emissions are about 0.92 tCO_2/t LS, which is reduced to about 0.68 tCO_2/t LS if selective CO_2 removal and commercialisation is integrated to the plant. Gas-based DR/EAF has an energy share of 4% and 3% of CO_2 emissions.
General and Cross-media Effects	Steel production through BF-BOF route has drastically declined during the last decade in North America and Europe while increasing in China, which accounts for about 46% of the total. The main reasons for this drop in reputation: large investments, large capacity to be feasible, significant environmental impact and the highest carbon footprint.	DR-EAF route can produce all steel qualities, presents much lower environmental effects and the lowest carbon footprint. This route is also flexible in terms of required mill capacity.

2.9.1.2 Gas-based vs. Coal-based DR Processes

As mentioned earlier, there are two general categories of DR processes on the market. There are those based on natural gas and those based on non-coking coal as the main energy and iron ore reductant source.

Two gas-based DR processes are more prominent: MIDREX and HYL technologies where the natural gas is steam-reformed in tubes filled with nickel-based catalysts into a mixture of H_2 and CO. The preheated syngas is eventually blown in from about the middle of a shaft furnace while the iron ore pellets are charged at the top. While descending, the ore is gradually reduced into DRI which can be discharged at the bottom of the furnace as hot DRI or cold DRI. The furnace exhaust gas containing up to 70% of residual syngas as well as dust, CO_2 and H_2O is cleaned, cooled, recompressed, and recycled back into the syngas circuit.

The HYL Energiron ZR process is another gas-based DR process that operates without a steam reformer.

The Fastmet coal-based DR process uses a similar concept as the syngas is generated from coal inside a rotary hearth furnace. In this process, a fine iron ore and pulverized non-coking coal are mixed together with a binder material before being pelletized and dried on site. These dried pellets are then layered on a rotary hearth furnace where they are gradually heated with fuel-fired burners that heat the atmosphere over the iron ore layer. Heat is transferred efficiently by radiation from the atmosphere to the surface of the pellets and by conduction from the pellet to its interior. As the temperature increases, CO is generated from coal which subsequently converts iron ore into DRI following a series of reaction mechanisms. The residence time of the iron material on the rotating determines the degree of metalized iron in the DRI. After that residence time, the material is discharged from the furnace and can be used as hot DRI, cold DRI or briquetted into HBI. The heat of the fully-combusted flue gas off to the gas cleaning unit can be recovered to dry the feedstock. The treated flue gas is then discharged to the atmosphere.

Table 2.6 generalizes the differences between gas-based and coal-based DR ironmaking. Advantages of gas-based DR processes include:

- Lower energy requirements;
- Better quality of DRI product with higher metallization and less sulfur;
- Lower CO_2, NOx and SO_2 emissions.

NAIC initial project development was a coal-based DR plant, somewhat similar to the FASMET process, which evolved into a natural gas-based DR process. More information on the selection factors that have driven the project towards a gas-based DR plant is presented in section 2.9.2.

Table 2.6 Gas-based vs. Coal-based DR Ironmaking

Features	Gas-based DR + EAF	Coal-based DR + EAF
Status	Industrial	Industrial
Type of Reactor	Shaft	Rotary hearth or rotary kiln
Iron Source	Pellet/Lump Ore	Fines/Concentrate
Energy Source	Natural gas	Lignite to higher rank coal
Process Main Characteristics	› Recycling of residual top gas. › Selective elimination of H_2O and CO_2 in reduction circuit is possible. › Low amount of slag produced.	› Mixing and drying of feedstock are required. › All carbon is released through flue gases. No residual gas recycling possible. › Higher amount of slag produced.
Typical Module Capacity (kt/y)	600 – 2,500	100 – 450
Land/visual	› More compact unit, less footprint › Some equipment are outdoors and are taller (on the order of 100 m)	› Larger footprint › Furnace is inside a building, height is approximately 50 m
Energy Requirements (GJ/t)	~9.9 – 11	~12.6
Electricity Requirements (kWh/t)	~30 – 110	< 10
Product	Cold/Hot DRI and HBI	Cold/Hot DRI and HBI
Metallization (%)	> 94	> 85
Carbon in DRI (%)	1 – 5 (depending on process)	3 – 5
Environmental	› CO2 removal: 0–60% is CO2 is potentially commercialized. › Reduction of 0.9–1.0 t of CO2/t DRI down to 0.6–0.7 t CO2/t DRI with selective CO2 removal and recovery. › NOx ≤ 40 ppm with the use of low-NOx burners. › SO2 emissions are limited with the use of natural gas as feedstock.	› Additional systems needed related to gases (NOx, sulfur, dust, coal handling, treatment, processing) to comply with regulation. › 1.5–1.6 t CO2/t DRI. › NOx is in the range of 0.3–1.5 kg/t DRI. › Sulfur is absorbed in the DRI which reduces its quality. High sulfur slag needs to be disposed. High SO2 emissions are also obtained (2–2.5 kg/t DRI)
Water Treatment Plant	More complex	Simple

2.9.1.3 Reformer vs. Reformerless Gas-based DR Processes

The Midrex and HYL gas-based DR technologies both use a natural gas steam reformer in their process layout to produce syngas but they still have different features. These differences include the DR shaft furnace configuration (i.e. number of reaction zones like preheating, reduction, cooling, and carburization) and operating parameters (i.e. different pressure and temperature). However, the main difference is the DR gas circuit configuration. For the HYL process, natural gas is first reformed into syngas which can be further refined into a gas with a higher percentage of H_2 using a water-gas shift reaction and CO_2 removal unit. The syngas feed is then mixed with the recycled DR exhaust gas and preheated before entering the shaft furnace.

The HYL Energiron ZR process on the other hand employs a DR route where natural gas is converted into H_2 and CO directly at the inlet of the DR shaft furnace, excluding the need for a stand-alone steam reformer. It also provides means to recycle the furnace off-gas by removing the bulk of CO_2 and H_2S. The amine-based CO_2 removal unit prevents its build up into the DR recycled gas circuit.

The current HYL Energiron ZR technology employs a continuous shaft furnace in which the operating conditions are characterized by high temperatures (>1,080 °C) and high pressures (6-8 bar at the top gas exit). Higher pressures allow lower gas velocities through the shaft, which minimize dust losses through top gas carry-over.

Table 2.7 generalizes the differences between the Midrex, HYL and HYL Energiron ZR technologies.

Table 2.7 Comparison of Gas-based DR/EAF Plants[9]

Features	Midrex	HYL	HYL ZR ENERIRON
Status	Industrial	Industrial	Industrial
Type of Process	Moving bed/continuous	Moving bed/continuous	Moving bed/continuous
Type of Reactor	Shaft	Shaft	Shaft
Iron Source	Pellet/lump ore	Pellet/lump ore	Pellet/lump ore
Pre-treatment of Natural Gas	Reformer	Reformer	None (in situ reforming)
EAF Melt Shop	Same equipment	Same equipment	Same equipment

[9] Based on information provided by Tenova

Features	Midrex	HYL	HYL ZR ENERIRON
Process Characteristics	› Recycling of top gas with fresh natural gas through a reformer. › All carbon (CO_2) released through flue gas. › Different configuration for each energy source.	› Recycling of top gas with freshly reformed natural gas. › Selective elimination of H2O and CO2 in the gas circuit. Up to 40% of CO2 can be removed. › Same configuration for each energy source.	› Recycling of top gas with fresh natural gas. › Selective elimination of H2O and CO2 in the gas circuit. Up to 60% of CO2 can be removed. › Same configuration for each energy source.
Current Module Capacity (t/y)	600 – 2,000	200 – 2,000	200 – 2,500
Typical Energy (GJ/t) Requirements at DR Unit	10.5	11.0	9.9
Typical Electricity (kWh/t) Requirements at DR Unit	110	30	75
Typical Electricity (kWh/t) Requirements at EAF Unit	380–430 (hot charging) 520–570 (cold charging)	380–430 (hot charging) 520–570 (cold charging)	380 (hot charging) 520 (cold charging)
Product	Cold/Hot DRI and HBI	Cold/Hot DRI and HBI	Cold/Hot DRI and HBI
Metallization (%)	> 94	> 94	> 94
Carbon (%)	1.0 – 2.5	1.0 – 3.0	2.0 – 5.0
Environmental	› 0.85 t CO_2/t LS › NOx ≤ 40 ppm with low NOx burners. › SO_2 emissions are limited with the use of natural gas as feedstock. › More graphite in DRI resulting in more dust emissions at the EAF.	› 0.9 t CO_2/t LS › 0.5–0.6 t CO_2/t LS with selective CO_2 removal and recovery › NOx ≤ 25 ppm with low NOx burners. › SO_2 emissions are limited with the use of natural gas as feedstock. › More graphite in DRI resulting in more dust emissions at the EAF.	› 0.8 t CO_2/t LS › 0.3–0.4 t CO_2/t LS with selective CO_2 removal and recovery › NOx ≤ 25 ppm with low NOx burners. › SO_2 emissions are limited with the use of natural gas as feedstock. › More iron in the form of Fe_3C which is less prone to be lost as dust at the EAF.

NAIC has selected the HYL Energiron ZR technology which includes the following advantages:

- Slightly lower energy requirements since the elimination of process water and CO_2 from the DR gas circuit improves syngas utilization;
- The higher carbon DRI is more stable and provides more chemical energy to the EAF, thus resulting in lower electricity requirements at the EAF;
- The improved presence of carbon into the EAF slag allows further precipitation of iron units contained in the furnace slag back into the liquid iron bath. Without carbon in slag, iron units would be lost into the EAF slag;
- The HYL Energiron ZR process provides DRI with more chemically combined carbon (i.e. Fe_3C) compared to other gas-based DR processes. Fe_3C is less prone to be lost as dust since it is chemically bonded with iron. In that state, the carbon is first melted before reacting with other agents. Meanwhile, graphite is not chemically bonded with iron and can quickly become dust and be lost in fumes upon contact with hot liquids in the EAF;
- High CO_2 abatement potential, if the CO_2 stream can be commercialized and used for other purposes.

2.9.2 Reducing Agent

The production of pig iron consists of concentrating iron in oxide form found naturally in ore. Oxygen bonded to iron is removed by a reducing element. This reducer element normally comes from a carbon source under the effect of heat and air, which will form carbon monoxide and hydrogen.

As seen in the preceding section, the reducing element selection is intimately related to the selection of technologies. The traditional route of the blast furnace and oxygen converter uses coke while direct reduction processes may use coal, natural gas or raw gas from coke furnaces. The reducing element choice is influenced by the possibility of integration with other processes, the energy balance, reducing agents also acting as a combustible, as well as the available raw material.

In the case of the NAIC project, it’s more of a choice of reducing element that influenced the technology choice.

The project initially developed by NAIC aimed at the reduction of a cold briquette in a rotary hearth furnace. The reducing element, coal, was mixed with iron ore concentrate as well as with a binder, bentonite, to form briquettes. These materials were fed into a rotary hearth furnace heated by natural gas. The coal and concentrate being intimately bound in the form of briquettes, it resulted in a very good metallization. The coal allowed for the reduction of iron oxides as well as the contribution of reaction heat.

The partial replacement of coal and coke by forest biomass, a renewable carbon source, as a reducing element in the traditional production route of blast furnaces is conceivable from a technological standpoint, if it is injected in the lower part of the blast furnace. Even the type of wood used may influence the subsequent coal properties obtained by pyrolysis. It is however an emerging technology that requires research and development (Research Institute of Sweden,

2015). For use in a rotary hearth furnace, technology originally foreseen by NAIC, the consumption in weight would be 5 to 6 times higher with biomass than with coal. New equipment would be required to crush the wood needing to be added to the briquette. As wood contains more humidity than coal, it would have had to have been dried, requiring more energy. Its volume per mass being more than two times higher than that of coal, several pieces of equipment would have had to have been oversized.

In other respects, wood used in the silicon metal production route is principally for increasing the porosity of the bed of the load placed in the furnace. As it contains carbon, wood is also used in part for the reduction that is satisfied mainly by a fixed source of carbon such as coal. Wood as a reducing element is incompatible with direct reduction technologies.

During the public consultations held in Saguenay at the beginning of winter of 2016, certain concerns were raised about the dust emissions linked to handling, storage and use of iron concentrate and coal. In addition, the government of Quebec announced in the wake of the Paris COP21 conference on climate change very ambitions objectives to reduce greenhouse gases: a 37.5% reduction in 2030 of 1990 levels (Cible de réduction d'émission de gaz à effet de serre du Québec pour 2030 – Document de consultation- 2015). In addition to the regulation on greenhouse gas cap and trade system, the government encourages promoters of new projects to maximize their efforts in reducing at the source GHG emissions. Finally, in April 2016, the government of Quebec announced its plan to adopt a "zero coal" law aiming to completely eliminate coal as a source of energy by 2030. Thus, a caution was put on using coal in the fabrication process proposed by NAIC. Note that coal was essentially used as a reducer element in the process, however its volatile content was put to use toward the energy required. In response to concerns from project sector residents and the provincial government, NAIC asked its technology providers to revise its approach and deliver a facility that did not use coal in order to reduce its dust and greenhouse gas emissions.

2.9.3 Cooling Methods

Production of pig iron from the smelting of DRI in an EAF requires a significant quantity of heat. Transformers, compressors, the hydraulic circuit, the electrode arms, the electrode clamps, the door and the roof of the electric arc furnace are all equipment that requires cooling.

Cooling is mainly carried out by indirect contact. The cooling fluid could be water (cooling tower) or air (air cooler).

A cooling tower is a heat exchanger that removes heat from water by putting it in contact with air. Heat transfer occurs through an exchange of heat between air (natural or forced circulation) and water by evaporation of a small part of water to cool. In this way, it is possible to cool to a temperature lower than the dry ambient temperature, which constitutes an important advantage of towers over air coolers. Make-up water must continuously be added in order to compensate for the losses by evaporation. A continuous blow-down must also be necessary to maintain the mineral concentrations of the water. Chemical additions are necessary to prevent corrosion, scaling and the proliferation of bacteria. Among the other disadvantages are the vapor cloud that in winter will become a visual pollutant as well as possibly lead to fog and icing of streets of neighboring roads.

Air coolers are made up of large-diameter fans that dissipate the heat in the atmosphere using fins configured like a conventional radiator. This choice of cooling route is justified when water is available in a limited quantity or when the receiving element is environmentally sensitive, since it uses no water conditioning chemicals. On the other hand, its efficiency varies as a function of meteorological conditions, with a low efficiency in summer and a high efficiency in winter. Its electricity consumption is also more significant and could be another source of noise.

Considering the small capacity of the receiving body of water and in order to minimize water emissions, NAIC has chosen to use a combination of the two cooling methods. The decision will be made as a function of the thermal loads to cool off different equipment.

Certain pieces of equipment must be cooled by direct contact with cooling water. Electrodes and pig iron casting molds are both cooled with water spraying. Treated process water is used for the electrodes and will reduce its oxidation. As for the pig iron mold, direct contact with potable water allows for rapid cooling of the thermal load.

2.9.4 Sanitary Wastewater Treatment Methods

The proposed project site is not serviced by the City of Saguenay's sewer, so the site must treat all wastewater produced at the facility.

A conventional sanitary wastewater treatment system is generally more reliable in the long run and is also preferable because they require less maintenance than non-conventional systems and infiltrate treated effluent directly into the ground.

Conventional systems consist of a septic tank followed by a spray field, which infiltrates water into the soil, where treatment is completed with bacteria. There is, thus, very little maintenance apart from emptying and cleaning the septic tank periodically. The spray fields, however, lose their effectiveness over time as they become saturated and must be reconstructed, approximately every thirty years. Spray fields also require pervious soil, and cannot be used with clay, silty clay or clayey silt.

The non-conventional alternative must be selected because local soils consist, for the most part, of rock, boulder-engineered backfill or clayey deposits, all of which are unsuitable for a conventional system. Some sand is present, but only in the middle of the facility, which is impractical for the location of the sanitary treatment system. In this non-conventional option, the system consists of a septic tank, an equalization tank for phosphorous precipitation, and Ecoflow(R) shell purifier unit, and a final UV disinfection unit. The purifier unit consists of a plastic or organic media on which thousands of bacteria colonies sit, treating the wastewater biologically as it passes through.

2.9.5 Process Wastewater Treatment Methods

The philosophy of management of wastewater generated by the facility aims to recover, treat and reuse process-generated water. According to the EPA (2002), the best practicable control technology currently available (BPT) includes a high recycling rate and solids removal using a

classifier and clarifier, cooling, sludge dewatering, and treatment of blowdown with multimedia filtration.

The system proposed by NAIC not only uses the BPT, but includes additional steps of treatment before discharge to surface water. Additionally, the pre-treated wastewater is treated by additional treatment units including an ammonia stripping tower, secondary clarification, and final sand filtration.

Considerable efforts are made to treat and recycle the effluents within the plant in order to minimize the discharge flowrate and reduce the water consumption. The ultimate objective would be to move towards a zero process effluent discharge plant.

During the detailed engineering of the project, NAIC will evaluate the different options available to reduce the flow of the final effluent, notably through increasing the number of cycles of concentration of the water in the two cooling circuits. The increase in the concentration cycle is influenced by:

› the capacity of the receiving environment;
› the quality of the water at the influent;
› the choice of water treatment technology;
› the desired water quality by the process.

The project site is not served by the sewer system of the City of Saguenay. The process water exceeding criteria must be treated before being discharged to the environment. Once treated, the water will be discharged to water course no. 5, a low-flow stream. Rather than discharging directly to a low-flow water course, a pipe discharging directly into the Saguenay River could have been constructed.

This alternative was quickly ruled out considering the costs of constructing a conduit of more than 2.4 km as well as the constraints and impacts related to work in a water course. The principal advantage of a discharge via an outlet pipe in the Saguenay is to be able to consider a certain dilution factor when establishing environmental discharge objectives, which are fixed depending on the capacity of the receiving environment.

As the discharge flow is relatively small, NAIC decided to rely on water treatment optimization techniques and the reuse of process water to aim for a facility without liquid discharge.

The water treatment techniques for the cooling towers are numerous: softening, descaling, reverse osmosis, demineralization, ion exchange resins, etc.; moreover, some of them can be combined. Generally speaking, softening is the most efficient technique in terms of quality of water produced and volumes of produced regeneration solution as well as being the least costly. It is however disadvantageous since it produces a fairly concentrated brine that cannot be discharged to the environment.

Saguenay potable water has a high level of hardness, at around 170 mg/l $CaCO_3$, and the frequency of the resin regeneration would also be quite high, increasing the volume of brine generated.

The quality of water desired for the two cooling circuits presents a significant problem in the selection of the cooling water treatment technique.

Theoretically, the number of concentration cycles in the two cooling circuits could be optimized up to 12 by softening around 75% of the make-up water, thus resulting in a reduction of the blowdown of around 80% and a reduction in the make-up water of around 25%.

The EAF cooling water circuit is in indirect contact and the treatment is insignificantly influenced by the reduction process. There are thus no constraints to its performance guarantee.

The cooling water from the QCT is in direct contact with the process gas. The experience of the technology provider, Tenova, is to use a concentration cycle lower than 3. Any modification of the number of concentration cycles must be evaluated specifically by Tenova who provides the performance guarantee of the reduction process.

In addition, in both cases, the treatment of the brine remains problematic. Softening allows for the blowdown to be reduced but generates a relatively high volume of brine considering the water hardness and requires a particularly high regeneration frequency. One of the envisioned options would be to recycle the brine upstream of the clarifier. Since the clarifier receives the quench water and the QCT cooling water, which are in direct contact with the process gas, it is necessary to evaluate the impact of this recirculation on the reduction process. Another option would be to concentrate the brine and produce solid salts.

The selection of the cooling water process will be thus evaluated during detailed engineering by the technology provider in collaboration with the cooling water treatment system provider. The impact study considers the use of untreated fresh water (potable water) as make-up water to the two cooling water circuits, presenting thus the worst case in terms of final effluent flow and consumed water volume.

The literature makes no mention of ammonia in the discharge of reduction facilities. However, the designer and the technology provider, Tenova, foresees concentrations of around 250 ppm in ammonia in the cooling circuit of the QCT. The wastewater produced by the DRI process will contain ammonia and nitrates that could be formed during the reduction reaction.

Biological and physical-chemical processes are available to eliminate ammonia in the water. Biological methods consist in oxidizing ammonia into nitrates (nitrification/de-nitrification) using autotrophic bacteria. This technique, usually used to decrease the organic load in parallel, is inconvenient in that it is sensitive to many chemical compounds. The physical-chemical methods are better adapted to industrial wastewater because of the variability of concentrations and flows. The physical-chemical methods the most used are extraction, adsorption onto resins and chlorination. Adsorption onto resins generated a liquid waste that has to be disposed while chlorination is mostly a polishing technique and implicates the use of hazardous materials and a control of the residual chlorine concentration at the exit.

The study in 2014 carried out by Hatch on the identification of the best available technologies economically achievable (BATEA) for the management and the control of mining effluent quality proposes to add total ammonia to the list of substances of Appendix 4 of the Metal Mining Effluent Regulations (MMER). For the mineral iron subsector, the BATEAs identified are decanting and precipitation with the addition of coagulant and flocculant. There could be natural ammonia degradation in the basins. The limit proposed is 8 mg/l of total ammonia. The BATEAs identified in this study, for the iron and other metal sectors, is not easily transposable to the pig iron sector or for the NAIC facility, the production technologies and the effluent flows to treat are different. The concentrations in ammonia vary according to the sector, from 4 mg/l to 12 mg/l.

The wastewater will be treated using an air extraction column, which will allow the ammonia concentration to be reduced to below 5 mg/l before being discharged to the final environmental receiver. This method, recommended for integrated steel mills[10] by the International Finance Corporation of the World Bank (IFC, 2007), is distinguished by the following advantages:

- Facility of operation and resistant to load variations;
- Does not require regeneration and does not generate wastewater;
- Is not affected by toxic compounds, in contrast with biological methods.

The dust contained in the process gas is transferred in part to the process water and is removed in the form of sludge after precipitation. The sludge, a source of iron, will be pressed, dried, put into briquettes and reintroduced in the reduction process. The recovered dust in the filtering bags of the baghouses will also be made up principally of iron. As with the sludge, this dust will be briquetted to be introduced to the reactor.

2.9.6 Atmospheric Emission Control

Classic particulate matter (PM) emission reduction technologies are mechanical collectors (cyclones), baghouses (fabric filters), electrostatic precipitators and wet scrubbers.

Cyclones

Cyclones use centrifugal force to remove particles, and are often used as pre-cleaners for more expensive final control technologies. Typically, the incoming gas stream enters a tangential inlet duct at the top of a conical shaped chamber inducing a circular motion downward. At the bottom of the cyclone, the gas turns and spirals up through the center of the outlet tube at the top of the cyclone. The particles reaching the cyclone's wall fall by gravity into the bottom hopper. High collection efficiencies are achieved if the gas stream contains high-density particulates subjected to greater centrifugal force.

Baghouses - NAIC Choice

Baghouses, or fabric filter collectors, are designed to capture particulate emissions from industrial stationary sources. Fabric filters are normally assembled vertically in bundles of tightly woven tubular bags and placed in isolable compartments. During operation, the dusty gas flows through the bag prior to its release into the atmosphere. A dust cake builds up on the

[10] This directive includes direct reduction processes as an alternative production route for primary steel.

tubular bags gradually improving the filtration capacity for smaller particles. The filter bags must be cleaned periodically as the differential pressure drop reaches a limit. Removed agglomerated dust is accumulated in a bin and periodically discharged. The NAIC project uses a jet-pulse baghouse to control dust emissions. With the pulse jet fabric filter, the particles are collected on the outside of the bags instead of the inside. The dust can thus be removed by a reverse pulse of high pressure air by injection at the top of the bags. When dust accumulates inside the bags, they have to eventually come off line for cleaning using either bag shaking or reverse-air techniques. The selected bag filter will be “negative pressure” type, with bag cleaning performed by means of compressed air. The filter will be constructed in such a way that the body is parted in separate cells to be cut off by dampers. The top of the filter is equipped with liftable covers to allow the periodic maintenance operation performed without the need to enter inside the filter shell.

Electrostatic Precipitators

Electrostatic precipitators use an electric field to move particulates out of the flowing gas stream onto collecting plates. They have high removal potential for all particulate sizes including the very fine. Gas-borne particles flow through a series of high-voltage discharge electrodes (ionizers) located between grounded parallel plates of sheet metal (collecting electrodes). An electric current is applied through discharge electrodes causing gas ionization. The particles charged by resulting ions migrate across the electric field onto the collecting plates. Periodically, the collecting plates are knocked mechanically to dislodge the particles into hoppers.

Wet Venturi Scrubber

The waste gas flows in a duct before entering a narrowed section (“throat”) where it accelerates and atomizes the incoming scrubbing liquid (normally water) at speeds over 50 m/s. After the throat section, the mixture decelerates and is sent to the entrainment section consisting of a cyclonic separator and/or a mist eliminator. It separates the clean gas from wetted particles that are recovered in a sink. The performance of a scrubber, which relies mostly on inertial impaction, is highly dependent on the PM size distribution. Particulates with diameters under 5 µm procure the highest efficiencies normally above 98%. It decreases exponentially with particle size. It is common to install a mechanical collector prior to the scrubber in order to reduce the coarse particulate loading and improve the scrubber’s collection efficiency.

The main advantage of baghouses over wet scrubbers is that they produce a dry solid, iron dust that can be fully recovered within the process. In comparison to electro-static precipitators and cyclones, they can handle gas stream fluctuations and can be adapted to SOx reduction.

2.9.7 CO_2 Management

As mentioned earlier, the reduction process will generate CO_2 which needs to be removed from the process gas circuit to avoid its build-up. Options with regard to the CO_2 stream by-product include:

- the incineration of the CO_2 stream for the oxidation of H_2S into SO_2, in which case the CO_2 will have no further use;

- the delivery of the raw CO_2 stream, as a valuable by-product to gas companies for further treatment and commercialization;
- the installation and operation of a sulfur removal system for CO_2 purification and immediate commercialization as a valuable by-product.

The option chosen by NAIC consists in oxidizing gaseous effluents in order to convert H_2S into SO_2. Steps have been taken with companies involved in the production of industrial gases, including CO_2, to assess their interest in recovering and capturing the CO_2 produced. The location of the plant away from potential consumers of CO_2 and the production rate, which is relatively low from a marketing point of view, means the CO_2 capture appears to be an unattractive alternative at this stage of the project, despite the avoided costs of recovering CO_2 as per the Regulation respecting a cap-and-trade system for greenhouse gas emission allowances.

Chapter 3

Project Description

Table of Contents

3		Project Description	1
3.1		General Facility Construction	1
3.2		Production Capacity	3
3.3		Process Description	4
	3.3.1	Iron Pellets Receiving and Handling	4
	3.3.2	Direct Reduced Iron	6
	3.3.3	Smelting in the Electric Arc Furnace and Pig Iron Casting	11
3.4		Auxiliary Services	12
	3.4.1	Steam Production	12
	3.4.2	Compressed Air Production	12
	3.4.3	Nitrogen Production	12
	3.4.4	Electric Substation	12
3.5		Material Storage and Handling	13
	3.5.1	Raw Material	13
	3.5.2	Chemical Products for Water Treatment	17
	3.5.3	Natural Gas and Combustibles	17
	3.5.4	Final Product – Pig Iron	17
3.6		Water Uses and Treatment	18
	3.6.1	Demineralization Unit	19
	3.6.2	Quenching Cooling Tower Water	21
	3.6.3	EAF Cooling Tower, DRI Conveyor and Pig Caster Cooling	21
	3.6.4	Industrial Wastewater Treatment	22
	3.6.5	Sanitary Wastewater Treatment	26
	3.6.6	Run-off Water Management	28
3.7		Solid and Hazardous Waste	30
	3.7.1	Slag	30
	3.7.2	Screening Fines	31
	3.7.3	Sludge: Wastewater Treatment and Baghouse	31
	3.7.4	Scrubbing Solution	31
	3.7.5	Centrifugation Sludge	31
	3.7.6	Refractory Bricks	31

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	3.7.7	Activated Carbon and Catalysts	32
	3.7.8	Waste Oil and Solvents	32
	3.7.9	Domestic Waste	32
	3.7.10	Empty Containers	32
3.8		Atmospheric Emissions	32
	3.8.1	Emission Standards	36
3.9		Noise Emissions	37
3.10		Supporting Infrastructure	38
	3.10.1	Natural Gas Supply	38
	3.10.2	Electricity Supply	38
	3.10.3	Water Supply	38
	3.10.4	Railway	38
	3.10.5	Port and Conveyor Facilities	38
3.11		Facility Pre-Start-up	39
3.12		Plant Closure	39
3.13		Construction Activities	40
	3.13.1	Construction Schedule	40
	3.13.2	Site Preparation	41
	3.13.3	Temporary Facilities	42
	3.13.4	Construction of Buildings and Equipment Installation	43
	3.13.5	Construction of the Storage Dome	43
3.14		Emissions and Discharges During Construction	44
	3.14.1	Dust	44
	3.14.2	Stormwater and Wastewater	44
	3.14.3	Solid Waste	44
	3.14.4	Noise	45

List of Tables

Table 3.1	Raw Materials and Products	14
Table 3.2	Flowrates of Streams to Treat and Reuse	24
Table 3.3	Expected Quality of Water Upstream and Downstream of the Final Treatment	26
Table 3.4	Sanitary Wastewater Characteristics	28
Table 3.5	Estimated Annual Air Emissions from the Cast Iron Manufacturing Plant (tons per year)	35
Table 3.6	Emission Standards	36
Table 3.7	Construction phases	41
Table 3.8	Equipment Used for Construction	46

List of Figures

Figure 3.1	Plant General Layout	2
Figure 3.2	Pig Iron Simplified Process Flow Diagram	5
Figure 3.3	Simplified Diagram: CO_2 Removal	9
Figure 3.4	Water Uses	20
Figure 3.5	Simplified Diagram: Industrial Wastewater Treatment	23
Figure 3.6	Simplified Diagram: Sanitary Wastewater and Run-off Water Treatment	27
Figure 3.7	Labour Requirements during Plant Construction	40

3 Project Description

3.1 General Facility Construction

The pig iron production facility will be constructed on a portion of lots 4 012 437 and 4 012 436, which belong to the Saguenay Port Authority (Port Saguenay), in an industrial sector near the maritime terminal of Grande-Anse in the City of Saguenay, La Baie borough. The project site covers an approximate area of 10.7 hectares. The geographic coordinates of its centroid are:

- Projection UTM NAD83 Time Zone 19 North X=362079.89 Y=5362187.94
- Projection MTM NAD83 Time Zone 7 North X=277898.43 Y=5362183.23

Figure 3.1 shows the general layout of the pig iron production facility.

The project site is located on the southern side of Chemin du Quai-Marcel-Dionne that leads to the Marcel-Dionne Jetty inside the Intermodal Marine Industrial Park. In the context of this study, north is considered to be perpendicular to *Chemin* du Quai-Marcel-Dionne. The facility site is bordered to the north by the future railroad, to the east by a property developed for industrial use (leveled, compacted and covered by crushed stone), to the south by abandoned agricultural land and to the west by disturbed forest. The properties adjacent to the site are all zoned for industrial use and set aside for development. The industrial activities nearby include the storage of material in a warehouse north of *Chemin* du Quai-Marcel-Dionne, and further east, road salt bulk storage.

The administrative building, parking lot, the main facility entrance, as well as the sanitary wastewater treatment plant are located at the northwest corner of the site. A second entrance is present in the northeast corner of the facility where the raw materials arrive. This access will also serve as an exit in case of emergency. A road spanning the facility site and internal access roads to production units as well as various facility buildings will also be present. The main building parking lot will be paved while the internal roads will have a surface of compact gravel. The internal road section between *Chemin* du Quai-Marcel-Dionne and the transfer building will be paved or concrete-covered instead of gravel-covered, to avoid the creation of dust from frequent truck traffic.

The pellet storage and handling equipment will be located in the northern section of the site. From east to west, the following installations are present: pellet transfer building, storage building, briquetting building followed by the screening and coating building. The fines storage silo will be outside of the building while the cement will be stored inside. A series of closed conveyors transport the pellets from one sector to another up to the reactor feed silo.

The majority of equipment from the CO_2 removal unit and from the reduction area will be located inside buildings that are more or less in the center of the facility. Only equipment such as the knock-out drums and the more bulky equipment will be outside. The noisier equipment such as air and process gas compressors will be located inside. The reactor is elevated (123 m) near the EAF so that the DRI can be fed by gravity and energy loss can be limited. The reactor is the highest structure in the facility.

361 800 | 362 000 | 362 200 | 362 400

5 362 400 | 5 362 200 | 5 362 000

Entrepôt de transit

Chemin du Quai-Marcel-Dionne

Secteur manutention du matériel
Material Handling Area

Secteur bâtiment fusion et coulée
Melting and Casting Area

Secteur réduction
Reduction Area

Secteur traitement des eaux
Water Traitment Area

Composantes du projet
Project Components

Aire de projet / Project Area

	Secteur manutention du matériel / Material Handling Area
1	Bâtiment de transfert / Transfer bui ldi ng
2	Bâtiment d'entreposage des boulettes / Pel let storage bui ldi ng
3	Bâtiment tami sage et enrobage / Screeni ng and coati ng buil di ng
28	Unité d'aggl omération / Briquetti ng pl ant
36	Si lo des fines / Fines sil o
	Secteur réduction / Reduction Area
4	Si los journali ers - boulettes / Day bin pellets
5	Four de préchauffe / Process gas heater
6	Réacteur - Réduction / DRI Reactor
7	Secteur de l a réduction / Reduction area
8	Chaudi ère auxili ai re / Auxili ary boi ler
9	Bâtiment et **(a)** unité d'enlèvement du CO_2 / Building and **(a)** CO_2 removal unit
10	Réservoir DMDS / DMDS tank
	Secteur bâtiment fusion et coulée / Melting and Casting Area
11	Secteur four à arc électrique FAE / EAF area
12	Salle des transformateurs - FAE / EAF transformers
13	Secteur entretien des poches / Ladle refractory maintenance area
14	Salle de contrôle et laboratiore / Control room and l ab
15	Secteur de l a coulée / Pi g caster area
16	Entreposage de l a fonte en gueuse / Pi g i ron storage
17	Préchauffage des poches / Laddle preheater
18	Secteur entretien du FAE / Furnace shell reparation area
29	Dépoussi éreur FAE / EAF Baghouse
	Secteur traitement des eaux / Water Traitment Area
19	Unité de traitement des eaux / Water treatment plant
20	Réservoir d'eau / Water tank
21	Cl arificateur / Cl arifi er
22	Aérorefroidisseurs / Air cool ers
23	Tours de refroidi ssement / Cooling towers
24	Traitement des eaux usées sanitaires / Sanitary water treatment area
25	Bassin de rétenti on eaux pluviales / Settling pond
26	Sous-station électrique / Electrical sub-station
27	Torchère / Flare
30	Salle électri que - Dépoussiéreur FAE / Electrical room EAF Baghouse
31	Entreposage des scories / Slag storage
32	Poste de ravitail lement di ésel / Fuel diesel stati on
33	Stati on mesurage gaz naturel / Natural gas stati on
34	Bureaux admi nistrati fs / Administrati ve area
35	Stati onnement / Parking

NAIC

SNC·LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay / Pig Iron Production Plant - Saguenay

Figure 3.1 / Figure 3.1
Agencement général de l'usine de fabrication de fonte en gueuse
Pig Iron Plant General Layout

Sources :
Dessin CAD3786-TARG-X-LY-000-003 REDESIGN ALTERNATIVA II.dwg, Tenova, 2016
Ville de Saguenay, imagerie 2015

Projet / Project : 634451
Projection MTM, fuseau 7, NAD83

0 20 40 m
1/2 000

Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified
00	2016/06/28	Finale / Final	L. Bathalon	L. Lachapelle

Format 11x17

Envir01: T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_f3-1_agencement_general_usine_f00.mxd

The smelting and casting building are located in the eastern sector of the facility and is divided into several sections. From south to north are the following: EAF the electrical transformers; the ladle preheating; an electric room on top of which is located the laboratory, offices and control room; and the maintenance areas for the EAF and ladles. At the north-east corner of the building, sits the pig caster and the pig iron storage building formed with four open bays on the sides. The height of the smelting and casting building varies from 25 to 40 m depending on the section. The main baghouse of the smelting and casting sector is situated west of the plant. The height of the EAF baghouse chimney stack is more than 33 m.

The principal electric substation of the facility is located in the southwest corner of the site. In addition to this sub-station, each facility sector possesses its own electric room. A natural gas metering station and a diesel fuel refilling station are respectively located at the northern and southern areas of the facility site.

The water treatment plant area is located in the southern part of the site. The building contains a demineralization unit, conditioning and treatment chemicals, sand filters, belt filter presses, the ammonia extraction tower, the lamella clarifier, pumps as well as an electric room. A water storage tank, ten evaporative air coolers, the cooling towers with their respective basin as well as the primary clarifier with a diameter of 14.5 m are located on each side of this building.

Finally, south of this site are located the stormwater retention basin and the slag storage area.

The site layout was designed to be able to accommodate a possible project expansion.

3.2 Production Capacity

The design production capacity of the pig iron facility is 53.8 t/h, or 425,000 tons per year (t/y). This design capacity, also called the average capacity, is based on 7900 hours of operation per year. This production rate takes into account an annual shutdown of three weeks for inspection and planned maintenance work, a four hour per week shutdown of the EAF in order to change the refractory lining as well as the production shutdowns, planned or unplanned, for equipment maintenance or repair. It is probable that the shutdowns are more frequent during the first year of operation as a result of the employee learning curve.

The maximum production capacity will be based on the 10% inflated design production rate as well as for a maximum number of days of operation, or 365 days. The maximum production capacity will be thus 59.2 t/h or 518,600 t/y.

The environmental impacts for the maximum production capacity will be evaluated.

Production will be continuous, 24 hours per day, 7 days per week. Only the electric arc furnace operation is semi-continuous or batch as there is always a smelting cycle followed by a casting cycle.

The lifetime of these facilities is estimated to be more than 50 years. The facility will remain in operation as long as it is safe, productive and profitable to do so.

The pig iron production facility will create around one hundred skilled jobs, among which are estimated to be the following:

- Around 20 managers, including the facility director, the sector-specific directors, employees working in health and safety, environment, human resources and in administration, purchasing and sales;
- Around 10 process, production, maintenance and optimization engineers (project engineers);
- Around 60 operation technicians (field and control room technicians, laboratory, material handling)
- Around 15 technicians (electricians, mechanics, welders, instrumentation, laboratory workers)

3.3 Process Description

The production of nodular grade pig iron consists of the reduction of iron oxide contained in raw material (iron pellets) to metalized iron, the removal of impurities (gangue) through the addition of a flux material during the smelting and casting of the liquid iron into forms called “pigs”.

Natural gas, when heated, provides carbon monoxide and hydrogen, which are reducing elements. Other materials used in the fabrication process include lime and dololime, used as a flux, as well as bentonite, used for the briquetting process. Natural gas will also be used as a source of combustion.

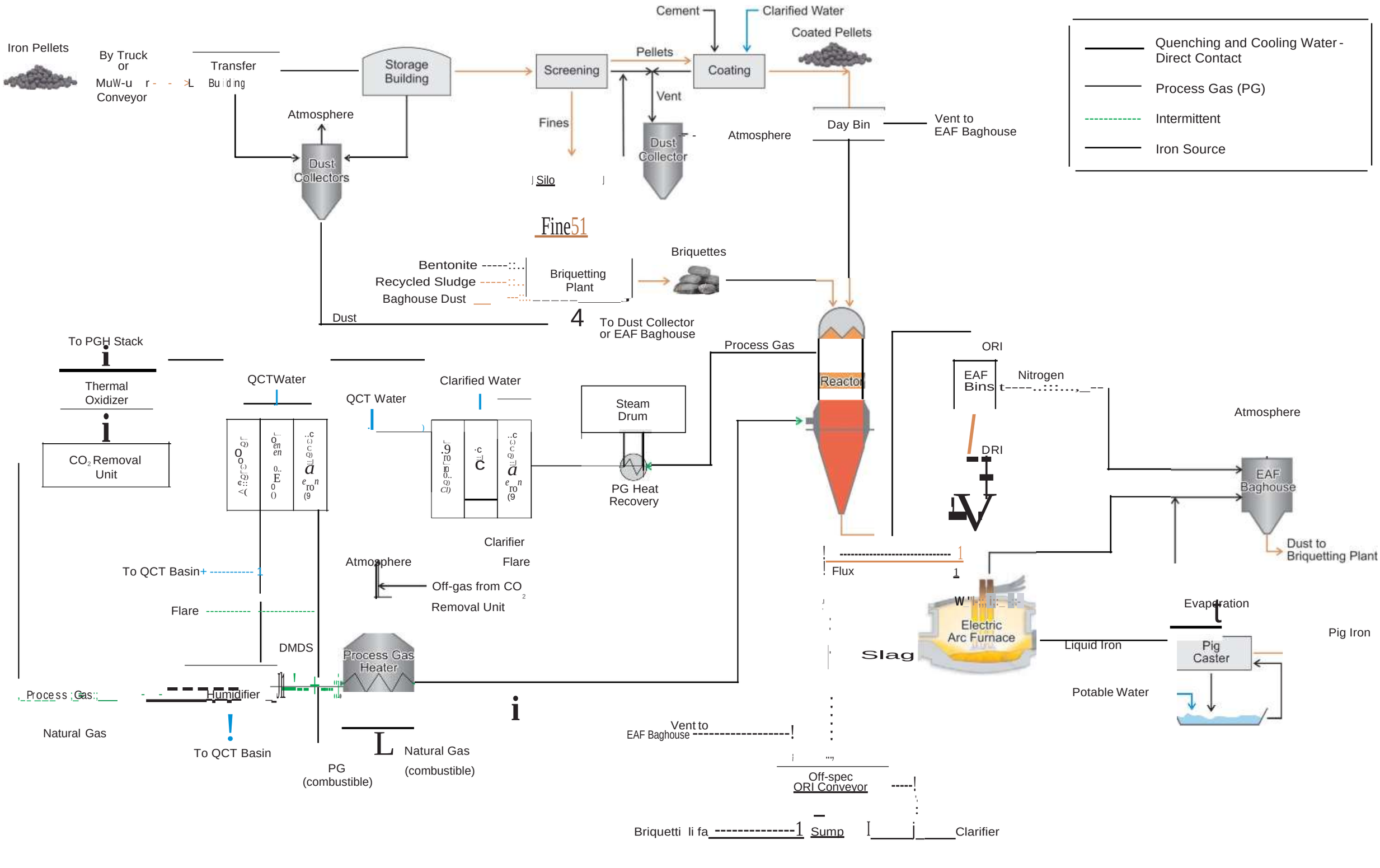
The North Atlantic Iron Corporation (NAIC) process for the production of pig iron requires: (i) pellet handling and screening, (ii) production of direct reduced iron (DRI) in a reactor, (iii) smelting of the DRI in an electric arc furnace (EAF) and (iv) casting of the liquid iron into forms called pigs. Figure 3.2 illustrates the different steps of the production processes.

3.3.1 Iron Pellets Receiving and Handling

The iron ore pellets will be delivered by boat to Port Saguenay. The pellets will be discharged by gravity onto a conveyor at the bottom of the boat, then lifted to a bridge and transferred to an unloading spire conveyor. The pellets will be unloaded onto the jetty for temporary storage. Loading trucks will transport the pellets onto a mobile conveyor that will transfer them to a feeding hopper of a multi-user conveyor. The unloading rate of the boat will be a maximum of 5500 t/h while the loading rate of the multi-user conveyor will be lower, to be defined by the APS.

The multi-user conveyor will be constructed and operated by the APS. In the event that the multi-user conveyor is not selected or is unavailable, the pellets will be loaded into trucks to be transported to the facility site. The loading rate would then be approximately 400 t/h, 24 hours per day. All material handling operations between the facility and the boat will be the responsibility of the APS.

Figure 3.2 Pig Iron Simplified Process Flow Diagram



From the conveyor, the pellets will be dumped into a transfer building, from which they will be placed onto a covered transfer conveyor, completely enclosed, to a storage dome or building. The transfer building will have a double function and will also allow the loading of pig iron to the conveyor to transport to the jetty and load onto the ship. In the case where the pellets are transported by truck, the trucks will unload the material in a hopper inside the transfer building to minimize dust emissions and the pig iron would be trucked to the port directly from the storage building. The transfer building vent will be sent to a baghouse.

The choice of the on-site pellet storage method is not yet finalized. One option being reviewed is storage in one or two concrete domes with a storage capacity of 46,000 tons each. Their diameter would be around 35 m and their height around 30 m. It is possible that the domes be replaced by a more conventional building, offering a similar storage capacity but with lower costs.

A completely enclosed reclaiming conveyor will transfer the pellets to the screening area. Fine particles entrained in the pellets must be removed before the pellets are reduced in the reactor. The fines are then stored in a silo with a capacity of 200 m^3 before being sent to a briquetting unit where they will be mixed with wastewater sludge, baghouse dust as well as with a binder to form briquettes. By sending the briquettes to the reactor, the iron contained within the fines, the dust as well as the water treatment sludge can be recovered. The silo vent from the fines screening is connected to the screening and coating building ventilation system, which itself is connected to a baghouse.

The briquetting operation consists of mixing and compacting the iron-containing waste materials according to certain controlled ratios with a binding agent composed of bentonite and a silicate solution. The water treatment unit sludge will be dried before being mixed in. The briquettes thus formed will be then dried, and from storage silos, sent to the reactor from a conveyor. The fines transfer, dried sludge, dust, bentonite and briquette silo vents will be linked to baghouses, as will be the ventilation of the mixer/compactor. All these operations are confined to the interior of a building.

Once the fines are screened, the pellets are coated with a layer of cement to prevent them from sticking together and blocking the flow to the reactor. The coated pellets are stored in day bins with a total capacity of 620 m^3. From these silos, the pellets will be fed to the reactor.

4.1.1 Direct Reduced Iron

The direct reduction of iron oxides into metallic iron is accomplished by reacting in a counter-current fashion in a reactor the iron pellets with reducing gases. Oxygen attached chemically to the iron reacts with hydrogen (H_2) and carbon monoxide (CO), therein producing highly metalized pellets, called direct reduced iron (DRI).

Reducing gases are generated directly by in-situ reforming of natural gas inside the reactor. Once treated, the reaction gases are reintroduced into the reactor with a fresh natural gas make-up. For this process, called “Zero Reformer” (ZR), the reactor could be imagined as two reactors in series:

1. A top cylindrical zone is where the reduction reactions determine the product metallization; and
2. An intermediate zone, which is the more active zone, for in-situ reforming, pellet reduction and the carburization reactions that control the final carbon content of the product.

The bottom cone is only used for discharging the product into the silos and hoppers before being transferred to the EAF.

The iron pellets are fed to the top of the reactor, via hoppers, and flow by gravity through the hot reducing gases as they ascend the reactor bed in a counter-current fashion. Natural gas is continuously added to process gas. This mixture of natural gas and process gas is heated to a temperature of 950°C in a process gas heater and then mixed with oxygen in order to increase its temperature by partial and controlled combustion before being finally fed to the reactor. The distribution of gas across the bed of the reactor is uniform and insures an intimate contact between it and the solid pellets.

The metallic iron of the pellet acts as the catalyst of the methane cracking reaction, and the gas is converted into reforming gas (H_2 and CO). The operating temperature in the reactor is maintained above 1,080°C.

In-situ Reforming Reactions

$CH_4 + H_2O \rightarrow CO + 3H_2$

$CH_4 + CO_2 \rightarrow 2CO + 2H_2(g)$

These reactions occur in the lower part of the reaction zone, which means that hydrogen and carbon monoxide are produced in the intermediate zone of the reactor and move toward the upper part of the reactor, where they encounter iron pellets that thus undergo the following reduction reactions:

Reduction Reactions

$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

$Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3\ H_2O$

Carburization Reaction

$3Fe + CH_4 \rightarrow Fe_3C + 2H_2$

Reduction and carburization reactions take place simultaneously in the cylindrical portion of the reactor, depending on the temperature, which is the main driving force for the kinetics of each particular reaction. Based on the operating temperatures of the ZR process, the hydrogen-based dry reduction reactions are favored, allowing the production of highly metalized DRI with a high level of metallization.

The catalyst, in this case the iron (Fe) in the pellet, is continuously regenerated by the counterflow of gases with the fall of the pellets by gravity into the reactor. The carburization

reaction which is favored in the ZR process has the advantage of producing DRI with more than 90% carbon fixed as Fe_3C.

The reactor operates at a pressure of around 9 bar absolute allowing a high reactor productivity of about 9 t/h per m^2. The pressurized operation also minimizes dust losses through top gas carry-over. This is reflected in low raw material consumption, which keeps the operating cost low.

A rotary valve, located at the bottom of the vessel, regulates the continuous gravity flow of the charge downward through the reactor. DRI is distributed into two pressurized buffer bins (EAF bins) by automated mechanisms. From these EAF bins, the hot DRI, now containing 94% metalized iron, is transferred into the EAF feed hopper.

At the reactor exit, the process gas temperature is around 400°C to 450°C. In passing through a heat recovery unit, the thermal energy of this gas is recovered in the form of steam. The process gas is then passed through a quench followed by a venturi, which favor the extraction of solids as well as cool the gas. Scrubbed gas is then passed through a process gas separator where the quench water is separated from the process gas. The quench water is sent to the wastewater treatment unit for solid recovery. Once cleaned, it is reused as quenching water.

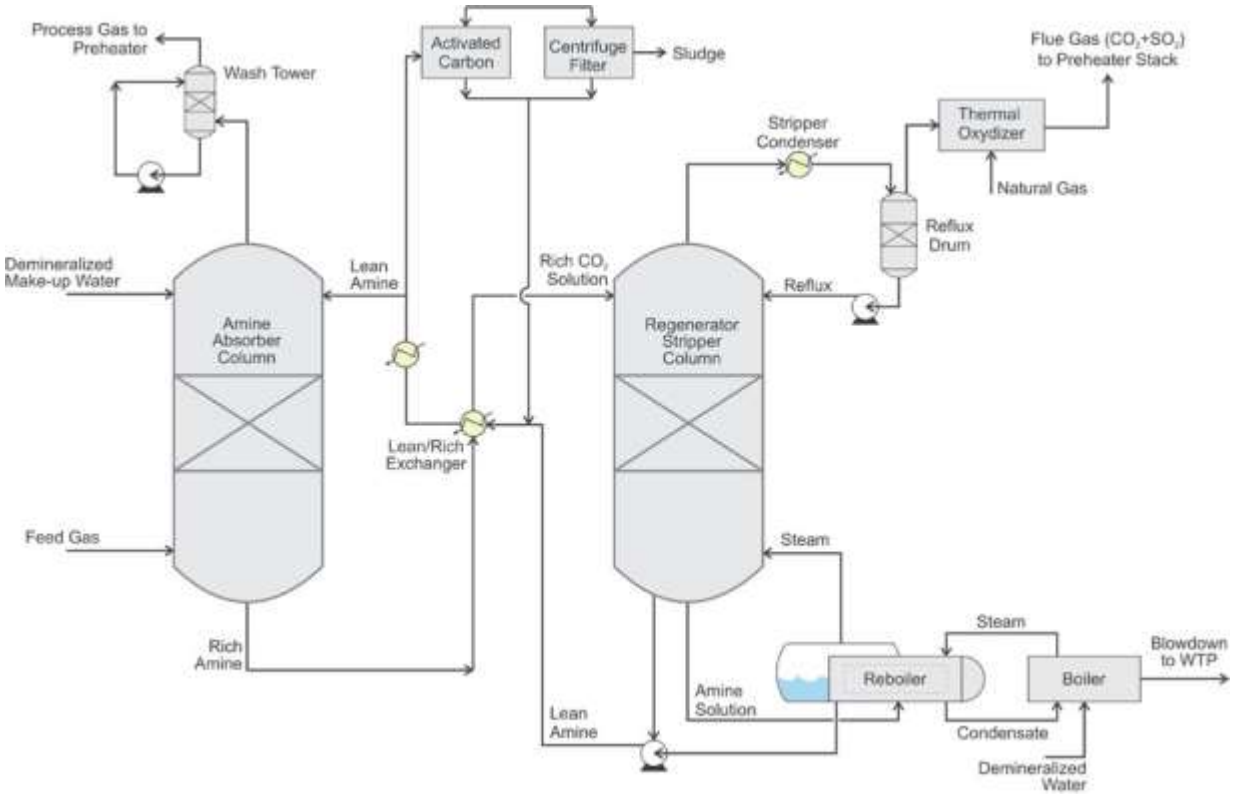
The scrubbed gas exiting the separator is further cooled in a quenching cooling tower to condense the water produced in the reduction process. The gas is then compressed and after-cooled. One portion of the quenched gas is fed to the process gas heater as a combustible, while another portion is sent to the CO_2 removal unit. Once the CO_2 is removed, the compressed process gas is mixed with make-up natural gas and is fed to the process gas heater thus closing the reduction gas cycle.

The condensed water is sent to the cooling tower and once cooled is sent back to the reduction unit as a quenching and cooling agent.

3.3.2.1 CO_2 Removal

CO_2 must be removed from gas exiting the reduction reactor in order to avoid being accumulated in the process gas that is used as a reducing element. The system is composed of two columns of which the first is used to absorb the acid gases (CO_2 and H_2S) and the second releases acid gases and regenerates amine. Figure 3.3 presents a simplified process flow diagram of this unit. CO_2 and H_2S are extracted by absorption, gas circulates in the absorber and enters into contact while going countercurrent to the methyl diethanolamine solution (MDEA at a concentration of around 50%) containing no absorbed acid gases (regenerated amine).

Figure 3.3 Simplified Diagram: CO_2 Removal



The gas at the top of the absorber is washed with water in order to prevent amine build-up in the treated gas. Demineralized water is continuously added in the absorber to make up for the water lost in the purified process gas and in the acid gases of the regenerator.

From the absorber, the amine solution containing absorbed acid gases (enriched amine) is heated via a heat exchanger and sent to the desorption column where it is further heated with a reboiler, allowing carbon dioxide (CO_2) and hydrogen sulfide (H_2S) to be released. From the regenerator exit, water vapor is extracted by a condenser and waste gas containing CO_2 and H_2S is transferred to a thermal oxidation unit to oxidize H_2S and SO_2. The off-gas from the thermal oxidation unit is transferred to the process gas heater chimney. Finally, the regenerated amine solution is returned to the absorber after being cooled to achieve the required temperature while the process gas is returned to the reduction unit.

Part of the regenerated amine flow is filtered with activated carbon and by centrifugation in order to avoid the build-up of solids within the amine and extent its life-use. The centrifugation will generate a sludge, containing mainly iron dust and a mix of water and MDEA. The sludge will be disposed off site.

The space necessary for a CO_2 recovery unit will be allocated in the case that commercialization becomes possible and economically feasible.

3.3.2.2 H_2S injection

Dimethyl disulfide (DMDS) is first heated by being mixed with a portion of the process gas and then injected into a small catalyst bed that is molybdenum and cobalt-based, where it is converted to H_2S and then added to make-up gas (maximum concentration of 25 ppmvd) upstream of the process gas heater. The H_2S allows the internal surfaces of the process gas heater to be protected from corrosion.

3.3.2.3 Reduction Process Start-up

The reactor takes approximately twenty-four hours to start-up. Initially during start-up, the reactor is empty, cold and pressurized with N_2 gas. The feed rate of the package boiler is increased. The reduction circuit is pressurized with nitrogen. The process gas heater and the reduction-sector compressor are started and iron pellets are fed to the reactor, which is full for around eleven hours of start-up. The amine solution is preheated using steam from the package boiler. During this time, only nitrogen is fed into the reduction circuit. Starting from the tenth hour of start-up, before adding natural gas as a reducing agent, the preheated gases are sent to the gas quencher. The temperature at the exit of the process gas heater gradually increases and reaches 850°C after eleven hours of start-up.

During the twelfth hour of start-up, injection of natural gas as a reducing agent commences, oxygen is added downstream of the process gas heater, process gas is gradually formed, and, starting from the thirteenth hour, reducing gas is fed to the reactor and the reduction of pellets commences. Over a period of around two hours, part of the process gas exiting the reactor is sent to the flare as it does not have the required quality to be used as a combustible in the process gas heater. The other part is sent to the CO_2 removal unit.

Over the next eight hours, the flowrates of natural gas (as a source of reducing gas) and process gas reach their steady value and the adjustment of operation parameters allows for the operation to reach steady-state. At the end of the twenty-fourth hour, the DRI has the desired quality and the normal production rate is attained.

Over several hours, the DRI metallization rate is less than the desired level. The off-spec DRI produced during start-up is send to a conveyor where its temperature is reduced through contact direct with water in a quenching cooling conveyor. The off-spec DRI is recovered in the EAF where it is fed at a low input rate.

3.3.2.4 Reduction Process Shutdown

During the first five hours of reduction process shutdown, the production rate is gradually slowed, until the injection of natural gas as a reducing agent is halted, the addition of combustion oxygen is stopped (downstream of the process gas heater) and the CO_2 removal unit is shutdown. Starting from the sixth hour, the feeding of reducing gas to the reactor is replaced by nitrogen and reducing gas is diverted to the gas washer. Process gas from the reactor is then sent to the flare. The reactor is emptied. The amine solution is cooled.

The temperature of the process gas heater is gradually decreased until the fourteenth hour when it is completely shutdown. Over the next six hours, the reactor is completely emptied and the reducing gas compressor is shutdown. The reduction circuit, including the reactor is finally purged with nitrogen for the last two hours of shutdown.

3.3.2.5 Flare

The flare allows the process gas to be burned in a safe manner during shutdown and start-up of the reactor and also during the transitory conditions (for example when the quality of the process gas is such that it cannot be used as a combustible for the process gas heater). During normal process conditions, only gas exiting the gas removal unit from the wash water and direct contact cooling is sent to the flare. A pilot flame will always be present in order to ensure rapid lighting of the flare in the presence of gas.

The flare will be designed to limit the intensity of heat radiated to the ground to a maximum acceptable level, as a function of the thermal radiation values recommended for the personnel in the reference document “API RP 521: Pressure-Relieving and Depressuring Systems”. The efficiency of methane destruction and other organic compounds will be at a minimum 98%. The height of the flare is estimated to be 50 m.

3.3.3 Smelting in the Electric Arc Furnace and Pig Iron Casting

The third step of the process consists of liquefying the hot DRI pellets in an electric arc furnace (EAF) at around 1500°C, producing two distinct phases: metal and slag. The heat of melting of the pellets is achieved using an electric current generated by three graphite electrodes.

A buffer silo (receiving hopper) is needed to couple the continuous reduction process to the semi-continuous melting process. The feed rate to the EAF is 63.5 t/h. The EAF operating cycle, known as a tap-to-tap cycle, as a function of the feed rate and electrical supply as a function of time elapsed is described below.

- The total melting cycle lasts around 132 minutes.
- Over the first 112 minutes, the hot DRI (approximately 675°C) is fed to the EAF at a rate of 1.2 tons per minute for around 60 minutes.
- The feed rate is 1.2 t per minute for an approximate duration of sixty minutes and is then increased to around 1.4 t per minute for around forty to forty-five minutes and eventually diminishes to close to 1.2 t per minute over the last 5 to 7 minutes.
- While the DRI is being loaded, the electric supply varies between 32 and 37 MW.
- The heat produced by the electric arc furnace melts the DRI at a temperature above 1500°C until 120 tons of liquid metal are produced.
- During the next twenty minutes, the electric current ceases, and the loading of the EAF is interrupted. The slag is deposited, and the last batch is sampled.
- Then, slag is removed and the metal is tapped.
- Once the tapping is finished, around 12 minutes are necessary to prepare the equipment for the next cycle. It’s during this period that the level of graphite electrodes is adjusted.

In order to minimize heat losses during the transport of hot DRI between the reactor and the EAF, the reactor is around thirty meters higher and placed near the EAF in order to feed by gravity.

During the loading of DRI in the EAF, a mixture of lime and dololime is added (around 0.8 t/batch or 0.43 t/h). Bauxite can be added to adjust the characteristics of the slag. This flux agent facilitates the separation of impurities contained in the pellets and controls the quality of the pig iron.

Metal, now containing more than 96% iron, is poured into ladles and transported to the pig caster where it is cooled by direct contact with water. Water evaporates upon contact with hot metal and make-up water is added to the circuit. Pig iron is then stored under a shelter in different bays according to the batch for them to cure. The bays are covered with a roof but the sides are open in order to allow access to the truck-loaders.

The slag pot can hold several EAF loads. Once full, the pot is put aside, outside of the passive cooling building. A truck transports the pot containing cooled and solidified slag to the storage area. Close to ground level, the truck angles the pot and the block of slag falls to the ground. Then, the blocks of slag are broken with a truck shovel and loaded into trucks to be transported to an outside facility. During the crushing and loading activities, any dust visible beyond two meters will be controlled by spraying water.

3.4 Auxiliary Services

3.4.1 Steam Production

A package boiler, with a calorific capacity of 3.7 MW, will supply the steam necessary to the CO_2 removal unit as well as the energy necessary during the start-ups and shutdowns of the facility. The majority of the time, the auxiliary boiler will function at a weak load.

3.4.2 Compressed Air Production

Compressed air will be used for the pneumatic control valves in the facility as well as all the pneumatic tools and equipment. The compressed air unit will be composed of compressors and air driers and compressed air tank.

3.4.3 Nitrogen Production

Nitrogen will be used principally for the equipment blowdown during shutdowns and the pressurization of the reactor during start-up. The nitrogen production station will be provided by a third party. It will be generally composed of a compressor, membranes and a storage tank. The production capacity will be 2200 Nm^3/h.

3.4.4 Electric Substation

An electric substation, including a transformer and a static compensator will be installed outside the production areas, at the south-western corner of the facility. The capacity of the main transformer of the project varied between 54 and 90 MW allowing thus a possible future increase in production.

The transformer will be installed in a retention basin with a fire-proof crushed stone bed to contain any accidental spill. The basin will have a retention capacity equal to 110% of the volume of oil contained in the transformer. The transformers as well as the related safety and maintenance installations will be designed to conform to Hydro-Quebec standards.

3.5 Material Storage and Handling

Table 3.1 lists relevant information pertaining to raw materials, finished products, combustibles and chemicals that will be found at the complex, including:

› Physical state of the material or product
› Transportation mode and frequency
› Material usage at the complex
› Storage type (tanks, drums, bags or other)
› Maximum stored quantities
› Average and annual maximum expected consumption/production.

3.5.1 Raw Material

The majority of the raw material will be delivered by boat from Quebecois facilities such as Arcelor Mittal in Port-Cartier or from Rio Tinto in Sept-Iles. With an average cargo weight of 27,500 tons, between 24 and 30 ships per year will pull up to the docks of Port Saguenay according to the average and maximum production capacities, respectively. Port Saguenay will provide a temporary storage space for the cargo.

Once at the facility site, the iron pellets will be transported into a transfer building and then into a dome or a storage shelter. In the two cases, the pellets will be sheltered from the elements and the storage area vent will be connected to a baghouse. The site storage capacity will be less than 100,000 tons.

Lime, dololime and bauxite will be stored in silos (capacity of 120 m^3 each) outside of the smelting and casting building. Their vent will be connected to the EAF baghouse duct system. Around a hundred trucks per month will be necessary to supply the facility.

Cement will also be delivered by truck and stored in a silo located inside of the screening and coating building. Between 4,000 and 5,000 tons per year will be required to supply the facility, or around fifteen trucks per month.

Table 3.1 Raw Materials and Products

Material	Use	State (L, G, S)	Mode of Transport	Transport Frequency	Storage Type/ Location	Maximum Stored Quantity	Annual Average Consumption Or Production[1]	Annual Maximum Consumption or Production[2]
Raw Material								
Iron Ore Pellets	Iron Source	S	Boat (27,500 t)	24-30 ships/year	Temporary Pile at the Jetty; Piles within Storage Buildings or Domes	100,000 t	680,190 t	830,000 t
Natural Gas	Reducing and Combustion Agent	G	Pipeline	Continuous	N/A	N/A	135,000,000 Nm^3	165,000,000 Nm^3
Lime (CaO), Dololime, and Bauxite	Flux	S	Truck	100 to 120 trucks/month	Silo Outside of the Smelting and Casting Building	120 m^3/ product	30,000 t	36,000 t
Cement	Pellet Coating	S	Truck	13 to 17 trucks/month	Silo Inside the Screening and Coating Building	40 m^3	4,000 t	5,000 t
Bentonite	Briquettes Binder	S	Truck	3 to 4 trucks/month	Silo Inside the Briquetting Building	20 m^3	1,025 t	1,300 t
Silicate Solution	Briquettes Binder	L	Truck	5 to 6 trucks/month	Tank Inside the Briquetting Building	20 m^3	1,460 t	1,800 t
Others								
Diesel	Emergency Generator and Heavy Mobile Equipment	L	Truck	TBD	Tank/ Fuel Station	200,000 l	TBD	TBD

[1] The average consumption rates are based on 7900 operation hours per year.

[2] The maximum consumption rates are based on the average hourly consumption rates increased by 10% assuming 8760 operation hours per year.

Material	Use	State (L, G, S)	Mode of Transport	Transport Frequency	Storage Type/ Location	Maximum Stored Quantity	Annual Average Consumption Or Production[1]	Annual Maximum Consumption or Production[2]
Catalysts	Mo-Co for H_2S Generation	S	Truck	1 truck/20-25 years	TBD	50 m^3	NA	NA
Graphite Electrodes	EAF Electrodes	S	Truck	3-4 trucks/Month	In Bulk Outside near to the Smelting and Casting Building	150 t or 10-15 rods	850 t	1,000 t
Refractory	EAF and Molten Metal Ladle Liner	S	Truck	3-4 Trucks/Month	In bulk, inside the smelting and casting building	30 t	870 t	1,000 t
Hydrous Aluminium Silicate	Anti-adhesive liner of the casting machine molds	S	Truck	1-2 trucks/year	Bags inside the smelting and casting building	20 t	18 t	20 t
Dimethyl Disulfide (DMDS)	Added to the PGH for Corrosion Inhibition	L	Truck	1 Truck/ Month	Tank Outdoors in Reduction Area	30 m^3	25 t	30 t
Activated methyl diethanolamine (aMDEA)	CO_2 Absorption	L	Truck	1 Truck/ Month	Drums or Totes Inside CO_2 Removal Building	1 t	3,5 t	4,5 t
Anti-foaming Agent (Amerel 1500 or 2000)	Added to the aMDEA Solution	L	Truck	1 Truck/ Month	Drums Inside CO_2 Absorption Building	100 l	50 l	100 l
Activated Carbon	Filtration of the aMDEA Solution	S	Truck	1 Truck/ Year	Drums	5.1 t	10 t	12 t
Water Conditioning Chemicals	Cooling Tower and Boiler	L	Truck	1 Truck/ Month	Drums or Totes Inside Water Building	2-4 t	12 t	14 t
Polymer Flocculant (NALCO 71606 or Magna Floc LT25, or equivalent)	Precipitation of Solids in Clarifiers	S	Truck	1 Truck/Year	Drums or Totes Inside Water Building	2-4 t	10 to 20 t	11 to 21 t

Material	Use	State (L, G, S)	Mode of Transport	Transport Frequency	Storage Type/ Location	Maximum Stored Quantity	Annual Average Consumption Or Production[1]	Annual Maximum Consumption or Production[2]
Coagulant (Ferric Chloride 33% solution, $FeCl_3$, or equivalent)	Coagulation of Solids/Lamella Clarifier	L	Truck	1 Truck/ Year	Drums or Totes Inside Water Building	1-2 t	3 to 6 t	3.5 to 6.5 t
Products and By-Products								
Slag	By-Product	S	Truck	8-10 Trucks/ Day	Outdoor Pile on Impermeable Surface	4,500-5,000 t	70,000 t	85,000 t
Pig Iron	Final Product	S	Boat	16-19 Ships/ Year	Storage Building; Pile at the Jetty	24,000 t	425,000 t	518,000 t

Bentonite as well as a silicate solution will be stored inside the briquetting building in tanks with a capacity of 20 m^3 each. Between 2,500 and 3,100 tons per year will be required, or around 10 trucks per month.

Graphite electrodes will be stored outside close to the EAF building while the refractory for the lining of the EAF and ladles will be stored inside along with the bags of hydrous aluminum silicate.

Dimethyl disulfide (DMDS) will be stored outside in a 30 m^3 tank located in the reduction sector. The tank will be equipped with a retention basin that can contain 110% of the tank capacity. One truck per year will be necessary to supply the facility.

A make-up of 3.5 to 4.5 t/y of activated methyl diethanolamine (aMDEA) solution is required to compensate for the loss in the sludge produced by centrifugation. Activated carbon will also be replaced periodically at a rate ranging from 10 to 12 t/y. The aMDEA and activated carbon will be stored in barrels in the CO_2 removal building.

The anti-foaming agent (Amerel 1500 or Amerel 2000) may be added to the amine. The maximum foreseen quantity is between 50 and 100 liters per year, or less than one barrel per year. The barrel will be stored inside the building.

3.5.2 Chemical Products for Water Treatment

Various chemical products are required for the treatment of water before its use in the facility as well as after use before being discharged to the stream.

Table A.1 in Appendix A presents the different chemical products necessary for the two cooling water circuits as well as for the water treatment before being discharged to the stream. All products will be stored in barrels or totes inside buildings with the exception of the polymer, which will be stored in a tank, inside the building. The safety data sheets of these products are also included in this Appendix.

3.5.3 Natural Gas and Combustibles

A diesel filling station including a storage tank with a storage capacity of 200,000 liters will be present on site to refill the tanks of the mobile heavy machinery of the facility. The emergency generator will have its own diesel tank with a capacity of 3,000 liters. The capacity of the tank at the filling station as well as the annual consumption will be confirmed during detailed engineering. The tanks will be installed in a retention dyke that can contain 110% of the tank volume. The filling area will also be confined.

3.5.4 Final Product – Pig Iron

Pig iron will be stored in a shelter situated immediately to the south of the casting sector. The storage capacity will be around 24,000 tons. The pig iron will be transported to the storage building, in different bays, by loading trucks. The pig iron will then be transported to a transfer building and placed on the multi-user conveyor that will bring it to the jetty or alternatively by truck should the conveyor be not selected. A temporary storage area will be dedicated on the

jetty for the pig iron that will be then loaded onto the boats for dispatch. Alternatively, depending on the location of the clientele, it is possible to deliver the pig iron by truck. Between 16 and 19 ships per year will be necessary to dispatch the pig iron to the clients.

3.6 Water Uses and Treatment

The water systems in the facility are designed to minimize the amount of fresh water consumed from the municipal water supply as well as the amount discharged into the environment. A variety of cooling strategies will be used to accomplish this goal, taking into account the limitations of the potable water supply, the minimization of the environmental discharge and the specific or particular needs of the equipment and gas to cool. Air coolers will be used in addition to cooling towers in an open circuit, in direct and indirect contact, as well as closed cooling circuits in indirect contact.

The ultimate objective of the facility's water management strategy is to reuse 100% of the wastewater generated for a zero-discharge plant. Despite efforts to achieve this goal, a residual flow must be discharged. There will be three discharge points, one for process wastewater, one for runoff water and one for sanitary wastewater. The three effluents will be discharged to water course number 5.

Potable water originating from the municipal water supply of the City of Saguenay will be used as industrial water, with and without treatment. Approximately 126 m^3/h of fresh water from the municipal supply will be required for the facility's various industrial water needs, which are mainly for cooling of process equipment, through direct and indirect contact, treating gas and for the production of demineralized water. Approximately 0.5 m^3/hr will be used for sanitary and laboratory needs.

One of the strategies for reducing the total flow of consumed water and the flow of the final effluent is to soften a portion of the make-up water to the cooling towers in order to be able to increase the number of cooling tower concentration cycles.

This strategy, which could result to a reduction of up to 80% of the blowdown flowrate, also has some constraints which require a more in depth analysis. The hardness of the potable water being quite high (see Appendix C), ions exchange treatment systems would generate a significant flow of brine at the regeneration cycle.

This strategy, which will allow the blowdown flowrate to be reduced by more than 80%, involves however constraints that must be evaluated more in depth. Given that the potable water has a high hardness level (see Appendix C), the treatment systems that use ion exchange will generate a significant flowrate of brine during the regeneration cycle.

Also, concerning the make-up water to the QCT, only trials carried out during production will allow the technical feasibility to be validated for the water softening and thus increase the number of concentration cycles. The principal constraint is related to the equipment manufacturer guarantee that fixes the number of concentration cycles in order to control the water chemistry that is influenced by direct contact with process gas.

NAIC will evaluate the technical feasibility of the increase in the number of QCT cooling water concentration cycles during its operation. As for the indirect contact cooling water at the EAF sector, the optimization of the number of concentration cycles will be initiated at the detailed engineering stage.

For the purpose of the ESIA, flowrates are provided without optimization of the number of concentration cycles of cooling water.

The municipal potable water system will provide as needed the water necessary to combat fire.

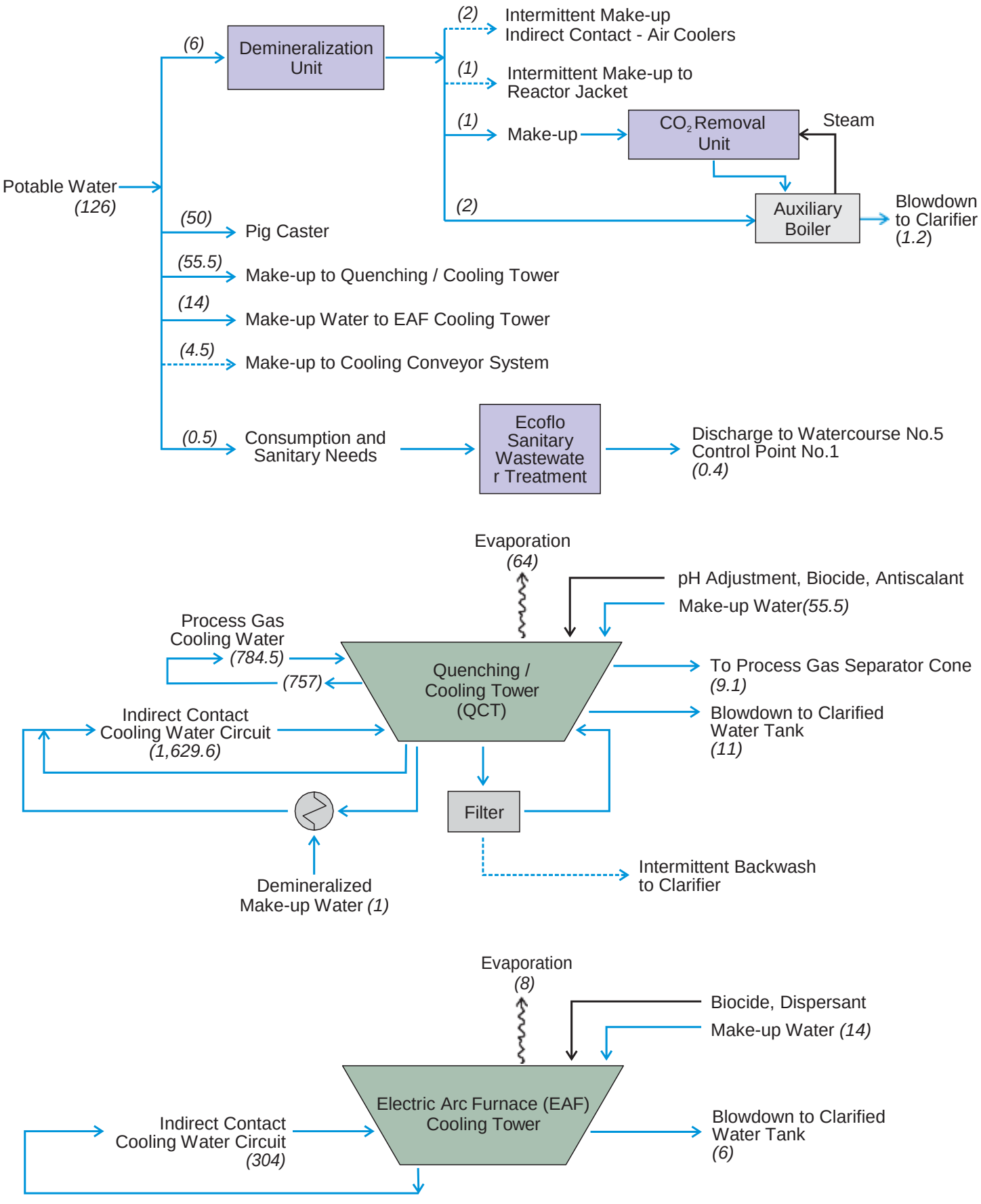
Figure 3.4 shows the different water uses of the facility.

3.6.1 Demineralization Unit

A small demineralized water flow will be necessary to produce steam at the auxiliary boiler water (2 m^3/hr) as well as for make-up to the amine solution in the CO_2 removal unit (1 m^3/hr). The system is also capable of an additional production of 3 m^3/hr when needed to make up for losses in two cooling water closed circuits, one with air coolers and one for the reactor jacket. The losses could be generated by maintenance work that would necessitate the emptying of the circuit. Water will be analyzed before its emptying to determine if it can be sent to the wastewater treatment plant of the facility or if it can be eliminated off site.

The demineralization unit will consist of two ion exchange resins. The quality of the demineralized water is ensured by a periodic regeneration of the resins with a strong acid, either hydrochloric, for the cationic bed and with a strong base, or with caustic soda, for the anionic bed. The resin rinsing will last an average of one hour per bed per day, for a flowrate of around 5 m^3/h. The effluent will be accumulated in a basin, the pH will be adjusted as needed, and then it will be transferred to the wastewater treatment system at an adjusted average varying between 0.5 m^3/h and 5 m^3/h. Considering the small effluent flow of the regeneration it can be sent to the primary clarifier.

Figure 3.4 Water Uses



(0) Average Flow (m^3/h)

3.6.2 Quenching Cooling Tower Water

Approximately 55.5 m^3/hr of make-up water (potable water) will be required to make-up for losses (evaporation and blow-down) in the water circuit of the reduction sector Quenching Cooling Tower (QCT). This tower serves principally to cool various cooling water circuits through direct contact with process gas and indirect contact with reduction-sector equipment.

A water stream of 757 m^3/hr cools and cleans reduction process gas through direct contact (process gas quenching water upstream of the compressor as well as compressor cooling water). A portion of the water is first cooled as it passes by air coolers. Water that was in contact with process gas passes through to a degasser venting to the flare before recycling to the QCT.

The reduction reaction produces an excess of water. Thus 784.5 m^3/h of water from the reduction sector are sent to the QCT to be cooled while only 757 m^3/h of water from the QCT basin will serve to clean and cool the gas. A flow of 9.1 m^3/h is returned to the lower part of the gas separator to agitate the bottom of the process gas separator to keep moving the dust particles and to avoid clogging the return stream. This effluent, loaded with solids, is sent to the primary clarifier.

A second loop containing 1629.6 m^3/hr of indirect contact cooling water is sent to the QCT. This water cools equipment from the reduction sector (hydraulic unit, control room air conditioning, process gas compressor and air compressor cooler).

Part of the water from the QCT basin is sent back to the reduction sector to cool and clean the gas. Another part of the water from the QCT passes through a third cooling circuit of the reactor jacket, in a closed circuit. Lastly, another part passes through a heat exchanger to condense a small fraction of the amine regenerator.

Water from the cooling tower is treated with sulfuric acid, biocide and antiscalants to control the pH, biological growth and calcium and magnesium build-up in the piping and equipment. Around one quarter of the total flow circulating in the QCT is filtered. The filters are cleaned periodically (approximately over one hour per day) generating a flow of 30 m^3/hr that will be sent to the primary clarifier. Water will also be lost through evaporation (64 m^3/hr). The number of water concentration cycles is fixed at 2.3, the cooling tower has 4 cells unit and the heat loss is around 40 MW.

3.6.3 EAF Cooling Tower, DRI Conveyor and Pig Caster Cooling

Approximately 14 m^3/hr of fresh make-up water will be required for losses through evaporation and blowdown in the cooling tower related to the electric arc furnace (EAF) equipment. A flow of around 304 m^3/hr of water circulates in the piping and cools equipment (electrode clamp ring, busbar and secondary cables, electrode supports, exterior casting hole and the transformer) through indirect contact. Dispersant and biocides will be added to the cooling tower basin. A continuous purge of 6 m^3/hr is necessary to maintain the proper concentration of minerals in the system. The blowdown is sent to the clarified water basin. The number of concentration cycles is fixed at 4, the cooling tower has two cells and the heat loss is of around 4 MW.

Water is also used in a closed-circuit to cool the exterior shell of the EAF, the furnace door and the hood of the EAF gas conduit. Circuit water is initially treated with a corrosion inhibitor and a biocide. As needed, demineralized make-up water will fulfill the circuit losses, following maintenance work for example.

During shut-downs and start-ups of the reduction process, the first DRI produced does not have sufficient metalized iron. Off-spec DRI is placed on a conveyor and cooled by direct contact with water. Cooling water from the conveyor is sent to a pit where the heaviest particles accumulate and will then be recovered in a briquetting unit. The water from the pit, laden with solids, goes to a hydrocyclone where the solids are collected and sent to a clarifier from the blowdown at 4.2 m^3/hr. Make-up water with the same flowrate is thus necessary. This flow would only occur during shut-down and start-up of the reduction unit and would last around one day.

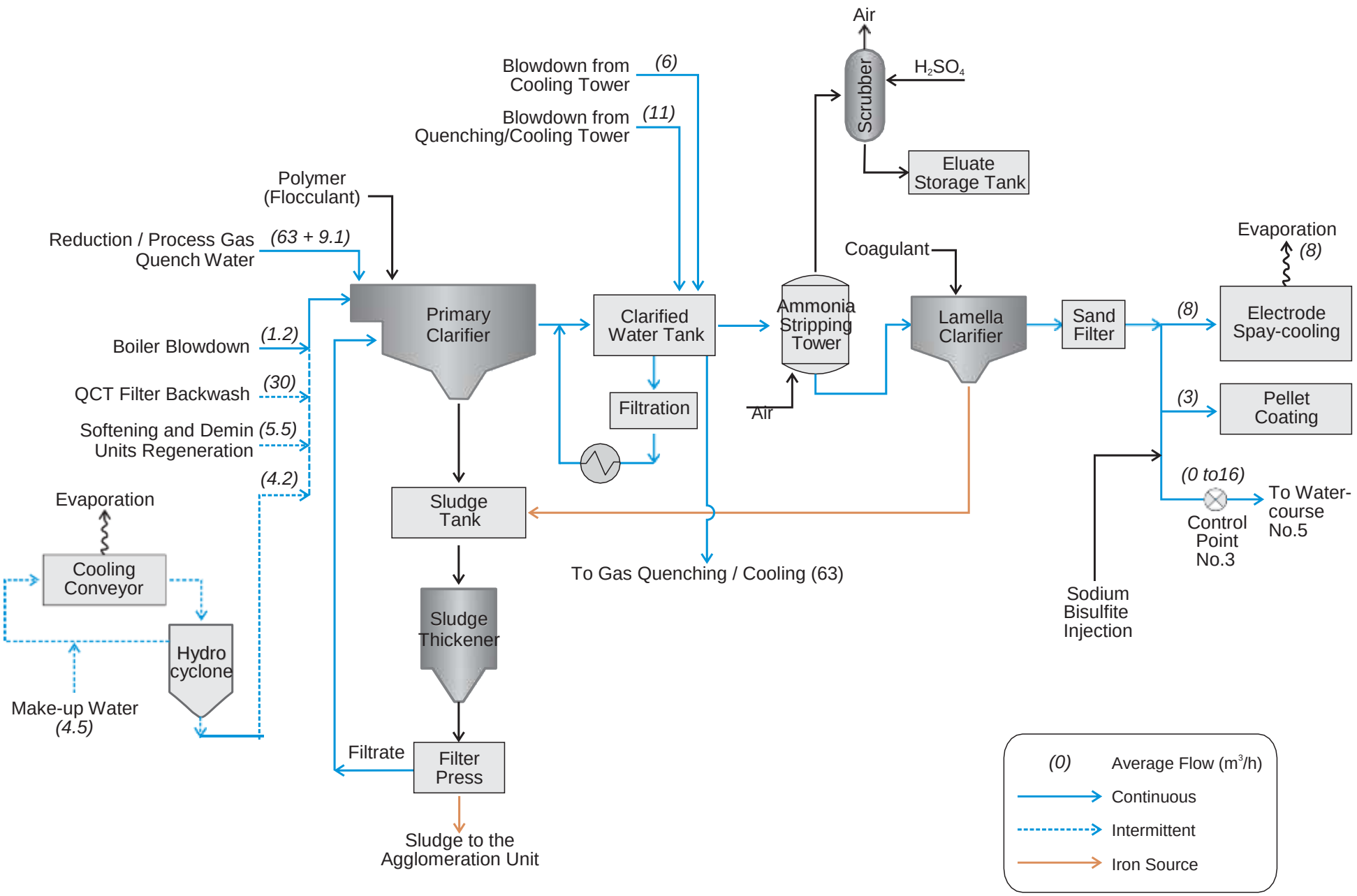
Potable water at an average of 50 m^3/hr is also necessary for direct-contact of the casting machine. Water partly evaporates upon contact with the product and flows by gravity to a basin beneath the casting machine where it is continuously recirculated. As the water is in direct contact with the high-quality ductile iron, it is necessary to use potable water. Additionally, the use of potable water prevents the formation of mineral deposits and thus reduces the quantity of solids generated. The ventilation from the casting area is through the EAF baghouse ducting system.

3.6.4 Industrial Wastewater Treatment

Figure 3.5 illustrates the principal industrial wastewater treatment steps.

Industrial wastewater is mainly generated through the use of water to directly cool and clean process gas streams. As water is in direct contact with process gas, solids, contained in the gas are present in the wastewater. The treatment process consists principally of removing solids through the use of a primary clarifier and addition of a polymer to flocculate the solids. Sludge that is generated will be sent to an accumulation basin which will feed the sludge thickener, followed by a belt filter press. The filtrate will be returned to the primary clarifier and the sludge will be recovered in a briquetting unit to be made into briquettes and recycled to the reactor. The moisture content of the sludge is around 30% at the filter press exit.

Figure 3.5 Simplified Diagram : Industrial Waste Water Treatment



The principal continuous and intermittent effluents are identified in Table 3.2.

Table 3.2 Flowrates of Streams to Treat and Reuse

Effluent	Flowrate (m^3/h)	Duration
Effluents to Treat (permanent flows: 90.3 m^3/h)		
Process Gas Quench and Cooling Water (Reduction)	72.1	Continuous
Quenching Cooling Tower Blowdown	11	Continuous
EAF Cooling Tower Blowdown	6	Continuous
Boiler Blowdown	1.2	Continuous
Filter Cleaning of the QCT	*30*	*Intermittent (once daily for 1 hour)*
Conveyor Cooling Water (Hydrocyclone)	*4.2*	*Intermittent (24 hours during each start-up and shut-down)*
Regeneration of the Demineralization Unit	*5*	*Intermittent (once per day for one hour)*
Treated and Reused Water (74.5 m^3/h)		
Process Gas Quench and Cooling Water (Reduction)	63	Continuous
Electrode Spray-Cooling	8	110 minutes per 130 minute tapping cycle
Pellet Coating	3	Continuous (depending on the pellet moisture level)
Water in the Sludge	0.5	Continuous
Water Discharged to Water Course No. 5 (15.8 m^3/h or from 0 to 16 m^3/h)		

Water exiting the primary clarifier flows to the clarified water tank. Sulfuric acid is added here to adjust the pH. A portion of the clarified water is then returned to the reduction sector to quench and cool the process gases while another portion undergoes a secondary treatment.

The effluent contains a certain ammonia concentration that comes from the reduction sector. Under certain conditions, ammonia can be generated during the cracking of natural gas. Ammonia is found in the process gases and then condensed in the quenching and cooling water. Ammonia in the effluent will be removed in an extraction tower by an upward moving air current. Ammonia will be transferred from the water to the air. A sulfuric acid scrubber will allow the air to be treated before being released to the atmosphere. The scrubbing solution, 0.8 m^3/d, will be collected in a tank of 12,000 liters.

The effluent is treated and sent to a second clarifier, called the lamellar clarifier, where through pH adjustment, as well as addition of coagulant, the heavy metals are transformed into non-soluble oxides that are deposited on the bottom of the clarifier when the water passes into the lamellar section. The sludge will be collected and sent to the primary sludge clarifier.

At the exit of the lamellar clarifier, the pH will again be adjusted and the clarified water will pass through a sand filter. The filter will be periodically cleaned with filter water flowing backwards and the cleaning effluent will be returned upstream of the lamellar clarifier.

From the exit of the sand filter, 8 m^3/h will be used for the spray cooling of the electrodes, so the water will be lost through evaporation. This flow is almost continuous, the electrodes being cooled more than 90% of the time. Another 3 m^3/h will be used for the pellet coating where the water is consumed to form cement. The flow can vary depending on the humidity of the pellets. Both flowrates are average values.

The residual flow (0 to 16 m^3/h) will be discharged to water course no. 5 via control point no. 3. Before discharge, an injection of sodium bisulfite controls the concentration of total residual chloride at the exit to the value equal to the limit of detection which is 0.001 mg/l of total residual chloride. Chlorine comes principally from biocides added to the cooling water circuits.

The expected quality of the water downstream of the primary clarifier and before discharge to stream no. 5 is provided in Table 3.3.

Table 3.3 Expected Quality of Water Upstream and Downstream of the Final Treatment

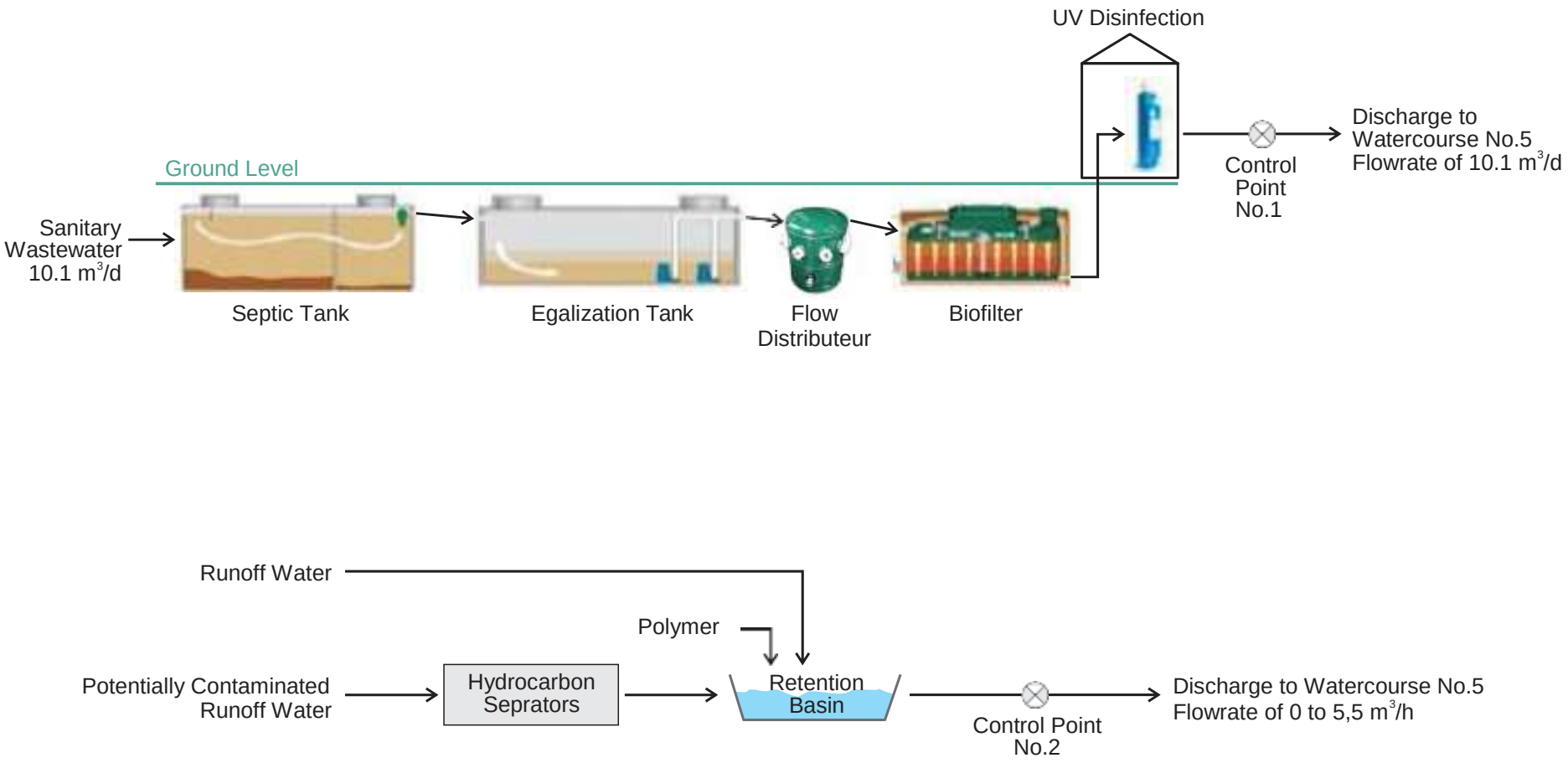
Parameter	Downstream of Primary Clarifier	At the Control Point before Final Discharge To Stream No. 5
pH	8 ppm	6 to 9.5
Temperature	50°C	40°C
Total Hardness ($CaCO_3$)	<600 mg/l	500 mg/l
Total Alkalinity ($CaCO_3$)	<350 mg/l	120 mg/l
Total Iron	<1 mg/l	0.2 mg/l
Petroleum Hydrocarbons ($C_{10}C_{50}$)	<10 mg/l	<2 mg/l
Total Ammonia Nitrogen	<250 mg/l	5 mg/l
Nitrates (NO_3)	<50 mg/l	5 mg/l
Sulfates	<800 mg/l	460 mg/l
Total Suspended Solids	<50 mg/l	10 mg/l
Chlorides	<500 mg/l	200 mg/l

3.6.5 Sanitary Wastewater Treatment

Sanitary wastewater will be treated on site as the sector is not served by a municipal sanitary sewer. Four treatment steps will be necessary, including a large-capacity septic tank (primary treatment for solids removal) followed by electrocoagulation (tertiary treatment for the removal of phosphorous), biofiltration (secondary treatment) and a polishing unit (tertiary) for disinfection. Figure 3.6 illustrates the sanitary wastewater and stormwater treatment chain.

The septic tank will remove part of the solids. At the exit of the septic tank, the water is sent to a phosphate removal unit where a continuously light intensity electric current between two submerged electrodes will allow phosphate coagulation. Sludge containing phosphates will be returned to the septic tank. Treated water will then pass through an Ecoflo biofilter where they will pass through the entire filtering media. Contaminants are degraded by bacteria present on the surface of the biofilter. Finally, at the exit of the biofilter, water is disinfected through ultraviolet rays in order to reduce the residual concentrations of pathogens.

Figure 3.6 Simplified Diagram : Sanitary Waste Water and Run-off Water Treatment



The design criteria are the following:

› Operation: 24-hours per day, 7 days per week
› Number of daytime employees (Monday to Friday): 85
› Number of night and weekend employees: 40
› No showers
› Worker clothing washed off-site
› No phosphate-based soap will be used in the facility

According to the guide for the Study of conventional Domestic Wastewater Treatment Technologies, the average flow to treat is 10.1 m^3/day with peaks of 7 liters/min. The estimated quantities of the principal contaminants, upstream and downstream of the system, are indicated in Table 3.4.

Table 3.4 Sanitary Wastewater Characteristics

Parameter	Concentration Before Treatment	Concentration After Treatment
BOD_5	250 mg/l	2 mg/l
TSS	300 mg/l	2 mg/l
Total Phosphorous	10 mg/l	0.1 mg/l
Fecal Coliform	Not defined	<10 CFU/100ml

A control point (no. 1) will be installed before the effluent in water course number 5.

3.6.6 Run-off Water Management

All site run-off water will be drained to peripheral drainage ditches that converge to a retention basin before being discharged to the environment. The principal objective of the design of the drainage system is to control the flow of the run-off water so that the prevailing hydraulic flow that existed before construction of the facility remains the same. Drainage ditches will be designed to be able to hold one hour of rainfall for a 25-year storm (35.8 mm). The basin will be designed to accommodate a 100-year storm over 24 hours (96 mm) as well as the maximum rain level over 3 hours and a recurrence of 100 years (54 mm). Depending on the areas covered by asphalt, gravel or structures, the runoff coefficients, pluviometry as well as the water quality, the retention basin will be sized at 4,800 m^3. The sizing of the basin will be confirmed during detailed engineering.

Three types of contaminants are likely to be found in the runoff water: suspended solids, iron and hydrocarbons.

Typically, around 80-100 mg/l of total suspended solids are found in runoff water (MDDELCC, Stormwater Management Guide). Runoff water will reside in the basin for a minimum period of 24 hours, allowing around 80% of the solids to be removed.

The possibility of the runoff water containing iron is relatively low. The conveyors are completely enclosed, so neither the pellets nor the pig iron will be exposed to the elements. The points of transfer are equipped with scrubbers. Only slag will be stored outside. Despite confinement measures, it is prudent to consider a means for iron removal before discharge to the environment. Therefore, it is necessary to reserve a minimum amount of space in the basin to allow for coagulation. The permanent volume of 200 m^3 is fixed at 10% of the volume of a medium-intensity precipitation. Water volume in the basin varies between a minimum of 200 m^3 and a maximum of 4800 m^3, which corresponds to the 100-year storm added to the minimal permanent volume.

There is always a risk that runoff water contains oils and greases in the process area exposed to the elements, particularly in the reduction sector, the electric sub-station and the diesel refueling area. The potential contaminated surface area is reduced at the source by the presence of buildings for the majority of equipment in the reduction sector. These sectors would have their own retention structures, and drainage water would pass through a hydrocarbon separation unit before being discharged into the peripheral ditches followed by the retention basin. The hydrocarbon separators will achieve a concentration of less than 2 mg/l in $C_{10}C_{50}$ at the exit of the separators.

An additional protection barrier will be added to the CO_2 removal area. This area is the only one in the facility that has another potential runoff water contaminant. As amine solution is present in several pieces of equipment, it is imperative that this sector be isolated. The zone will be surrounded by an embankment wall so that any spill containing amine would be recovered separately from the other runoff water, avoiding its contamination. Amine is contained in an enclosed circuit; control and retention of a leak is ensured through the monitoring of the amine feed rate to the make-up circuit. Before emptying the retention wall area to the retention basin, the water will be analyzed to validate the absence of amine. An operational procedure will be written to describe this operation.

As with the amine sector, an operational procedure will be developed for the management of rain water that accumulates in the diesel tank and filling area and electric substation retention dykes. The retention dyke valves will be maintained in a closed position and will be open only after the absence of visual evidence of an oil film on the top of the water is confirmed.

The discharge of the retention basin of the stormwater will fluctuate with the seasons. It is assumed that the flowrate will be zero during winter, which is more or less between the beginning of December to the end of April. According to the historical precipitation data from the Environment Canada Bagotville monitoring station, between 1981 and 2010, the average total annual precipitation (rain and snow) was 664 mm. Considering the runoff coefficients of buildings and gravel, the average retention basin release flowrate will be 0 to 5.5 m^3/h during summer months. Before the winter period, the basin will be emptied to its minimal permanent level in order to accommodate snow melt.

A control point will be placed at the exit of the retention basin. The discharge conduit will be connected to stream no. 5.

3.7 Solid and Hazardous Waste

The nature, origin, approximate quantities and the management methods of different solid wastes generated at the facility are presented in the following sections. The hazardous waste materials will be stored in accordance with the applicable regulation and then dispatched off-site by authorized transport means to disposal or recycling sites operated by authorized firms.

3.7.1 Slag

Slag will be stored outside on an impermeable surface with a permeability coefficient of less than $1x10^{-6}$ cm/s. The exact location of the slag storage as well as its storage capacity will be defined during detailed engineering. For the purposes of the study, the storage area is shown in Figure 3.1, in the southeastern part of the facility. In this sector, a layer of clay around 6 to 9 meters deep can be found. Again, for the purposes of the study, the storage capacity of the slag will be equivalent to that produced in 21 days of production, or around 4,500 to 5,000 tons of slag.

Between 70,000 and 85,000 tons per year of slag will be produced depending on the production rate of pig iron, either average or maximum. Between 8 and 10 trucks per day will be necessary to transport the slag from the facility to their repurposing site.

According to Appendix 4 of the Quebec Waste Regulation (règlement sur les matières résiduelles), slag is defined as a hazardous waste, and identified as E10. The slag that will be produced by NAIC does not have the characteristics of a hazardous waste. The slag will be made up of gangue, which is the minerals that have no value that are contained in the pellets, and flux. Furthermore, slag from steel mills and foundries are usually repurposed as aggregate, in Quebec and elsewhere in the world. In 2002, the Ministry of Environment published a guide for repurposing non-hazardous inorganic waste from industrial sources as a construction material: http://www.mddelcc.gouv.qc.ca/matieres/mat_res/inorganique/index.htm. On page 4 of this guide, in the introduction, it is mentioned that the guide was published to encourage the repurposing of foundry sand, steel mill slag, mining residue, etc. The guide thus assumes that the slag is a non-hazardous waste. However, the regulation on hazardous waste adopted after the publication of this guide has pronounced that slag is a hazardous waste.

The economic feasibility of the project assumes that the slag can be repurposed as an aggregate and that it will not need to be managed as a hazardous waste, either in storage, handling or disposal. The project design and the impact study use the hypothesis that the slag is non-hazardous waste and that it can be repurposed.

NAIC has first defined the slag characterization by modeling before proceeding with production trials to generate slag. The methodology followed for this modeling is presented at Appendix B1. The typical iron pellet composition as provided by Arcelor Mittal in Port-Cartier area also joined in this appendix.

NAIC possesses one foundry (EAF) on a small-scale in its Forks Specialty Metals (FSM) facilities. These facilities were used for different tests in the context of the project development including those necessary for the slag characterization. The trials were carried out in June 2016 according to the above mentioned Guide. The results of the tests available at the moment of the ESIA writing are presented at Appendix B3.

The results will enable the slag classification according to categories I, II or III which are corresponding to the different end-use possibilities of the slag as defined in the Repurposing Guide, see Appendix B2.

3.7.2 Screening Fines

The fines from iron pellet screening will be recovered in a silo to be later made into briquettes. A total of approximately 26,000 t of fines will be recovered annually.

3.7.3 Sludge: Wastewater Treatment and Baghouse

The design of the facility foresees that 100% of the sludge from the wastewater treatment plant (industrial and storm) and 100% of the dust captured by the baghouse are recovered in the briquettes that will be reinserted into the reactor. The quality of the dust of different baghouses and sludges will be analyzed in order to form a mixture whose concentration of iron is controlled. Approximately 4,045 t/y of dust and sludge will thus be recovered.

In the case that the quality of the sludge or dust does not allow their recovery in the reactor, as an anomaly, they will be eliminated as hazardous waste.

3.7.4 Scrubbing Solution

A sulfuric acid scrubber at the wastewater treatment plant will generate a used scrubber solution of ammonium sulfate. Around 300 cubic meters per year of this hazardous waste will be eliminated by an external company.

3.7.5 Centrifugation Sludge

There will be a sludge produced from centrifuge at the CO_2 removal unit that will contain a certain quantity of aMDEA and iron dust. This sludge cannot be reused within the process, and will be managed as a hazardous waste. Around 15 tons per year will be generated.

3.7.6 Refractory Bricks

Around 600 tons of waste refractory bricks will be generated annually. These bricks are generated from maintenance work, or the relining of the inside of the EAF and the casting ladles. The bricks do not have the characteristics of hazardous waste. They will be either recycled or eliminated in a dry landfill.

3.7.7 Activated Carbon and Catalysts

A molybdenum and cobalt-based catalyst is used for the generation of hydrogen sulfide. The lifetime of this catalyst is estimated to be between 20 and 25 years. The quantity to dispose of will be approximately 50 m^3.

Catalyst suppliers generally recover the used catalysts and regenerate them. Otherwise, the used catalysts will be characterized, stored and disposed of according to applicable regulations.

3.7.8 Waste Oil and Solvents

Captured waste oil from the oil separators, as well as all other waste oil from various pieces of equipment in the facility, will be collected in barrels, stored temporarily on site and transported off-site by an authorized firm. It is difficult at this stage of the project to provide an estimation of the quantities that will be generated annually.

Solvents will be used for chemical analyses in the laboratory. Used solvents will be stored temporarily on site then transported off-site by an authorized firm. Several liters of waste solvents will be generated annually by the laboratory.

3.7.9 Domestic Waste

In view of the future prohibition of organic waste landfilling announced in the Québec Policy on Waste Management, NAIC intends to work with the City of Saguenay and align itself with the measures undertaken by the City in view of the ban, as stated in its 2016-2020 Revised Waste Management Plan of the City of Saguenay and the Fjord du Saguenay RCM.

Domestic waste generated on the facility site of NAIC will be principally made up of organic waste generated by the cafeteria and other sanitary waste. They will be disposed of in identified garbage bins and periodically emptied into roll-off containers. These containers will be regularly transported by a sub-contractor to a landfill or compost site if the facility pre-sorts the waste.

Containers allowing the sorting and the collection of recyclable materials (paper, cardboard, glass, metal, plastic, wood) will be installed in various locations throughout the facility. These materials will be sent to the local sorting centers.

3.7.10 Empty Containers

Empty containers, such as soiled barrels, will be transported off site by an authorized firm and managed according to applicable regulations.

3.8 Atmospheric Emissions

The cast iron plant will contain several atmospheric contaminant emission sources. The continuous emission sources in the reduction area will include the following:

› Flue gases from the reduction gas preheating furnace (process gas composed of 16.4% of methane and natural gas);

- Flue gas after the oxidation of the hydrogen sulphide contained in the gas of the CO_2 removal system;
- The pilot of the natural gas-fueled flare;
- Flue gases from the auxiliary boiler;
- Ammonia emissions from the acid scrubber of the wastewater treatment unit.

The continuous emission sources in the smelting and casting areas include the following:

- Gases emitted during the smelting, the opening of the electric arc furnace and casting area. These gases are collected by the building's ventilation system and are routed to the dust collector;
- Combustion gases from the ladles' heaters.

The dust and combustion sources associated with the transfer and handling of materials such as pellets, fines, briquettes and direct reduced iron (DRI) include the following:

- Unloading of pellets in the transfer building whose vent is connected to a baghouse;
- Loading of pellets in the storage building in which the vent is connected to a baghouse;
- Screening operations and coating of the pellets inside a building where the vent is connected to a baghouse;
- The vent of the briquetting building directed towards a baghouse;
- The two sludge dryers of the water treatment unit and briquettes, both located in the briquetting unit;
- The vents of the reactor's loading hopper and the electric arc furnace which are directed towards the gas collection system of the main baghouse of the smelting and casting area;

The intermittent sources used in emergencies, shutdowns and start-ups include the following:

- Dust emissions generated during the cooling of the off-specification DRI conveyor are routed towards the baghouse of the smelting and casting area;
- The flare of the process gases used as fuel (combustion products for a methane-rich gas);
- Exhaust gases from the diesel-fueled engine of the emergency generator (light heating oil, diesel, combustion products).

Finally, intermittent sources related to trucking operations within the plant will be considered for:

- Slag between the smelting area and the storage area;
- Sludge between the water treatment unit and the briquetting unit;
- Fines between the fines' silo and the briquetting unit;
- Dusts between the baghouse of the smelting and casting building area and the briquetting unit.

If the pellets and pig iron are trucked between the plant and the jetty, combustion emissions from the heavy trucks used as well as fugitive dust emissions associated with pellet storage and loading will be considered with respect to the cumulative impacts.

Table 3.5 presents estimated annual air emissions from fixed and mobile sources for the pig iron manufacturing plant's maximum production capacity, i.e. 8760 hours of operation.

Table 3.5 Estimated Annual Air Emissions from the Cast Iron Manufacturing Plant (tons per year)

		A2	A3	A4	A5	A6	A7	A8	A9	A10		A11	
Contaminants	**Preheating Furnace**	**Auxiliary Boiler**	**Flare[(2)] and Pilot**	**Melting and Casting Baghouse (EAF)**	**Transfer Building Baghouse**	**Storage Building Baghouse**	**Baghouse of the Screening and Coating Building**	**Stack of the Briquetting Unit**	**Scrubber**	**Emergency Diesel Generator**	**Total Fixed Sources**	**Trucking within the plant**	**Total All Sources**
NOx	56.27	0.54	0.39	53.75	0	0	0	0.56	0	1.56	113.1	0.01	**113.1**
CO	79.76	1.05	1.31	14.5	0	0	0	1.23	0	0.12	98.0	0.00	**98.0**
SO_2	45.18	0.01	0.00	0.05	0	0	0	0.01	0	0.00	45.3	0.00	**45.3**
PMt = $PM_{2.5}$	7.22	0.10	0.71	42.79	1.16	1.93	1.16	1.10	0	0.01	56.17	3.04	**59.2**
TOC	10.45	0.14	2.12	6.14	0	0	0	0.16	0	0.03	19.0	0.08	**19.1**
VOCs	5.22	0.07	2.10	5.73	0	0	0	0.08	0	0.03	13.2	0.00	**13.2**
NH_3	0	0	0	0	0	0	0	0	1.45	0	1.4	0.00	**1**
CO_2	277,592	1,470	1,371	44,525	0	0	0	1,719	0	153	326,830	1.05	**326,831**
CH_4	2.45	0.03	5.58	0.17	0.00	0.00	0.00	0.15	0.00	0.01	8.39	0.00	**8.4**
N_2O	2.18	0.03	0.02	0.15	0.00	0.00	0.00	0.03	0.00	0.02	2.43	0.00	**2.4**
GHG CO_2eq	278,320	1,478	1,493	44,576	0	0	0	1,732	0	161	327,760	1.05	**327,760**

Notes: The “0” values indicate that the contaminant is absent or at trace levels.

(1) VOCs, excluding methane and ethane, as defined in the Clean Air Regulation (CAR).

(2) Annual emissions of the flare include emissions from the four shut-down/start-up events.

(3) The PM_t emissions are not equal to the $PM_{2.5}$ emissions for mobile sources, they are respectively 3.04 and 0.81 t/y. The value of PM_t has been recorded.

All emission rates (kg/h) presented are based on a production rate equivalent to 110% of the plant's nominal hourly capacity. Where emissions are variable, estimates of annual emissions are based on average emissions.

A more detailed description of each emission source including the emission calculation hypotheses can be found in Appendix D1.

3.8.1 Emission Standards

Table 3.6 compares the facility design criteria and the atmospheric emission standards fixed by the Clean Air Regulation (CAR) of Quebec and the Multi-sector Air Pollutants Regulations (SOR/2016-151) of Canada (MAPR). As shown in this table, the atmospheric emissions related to the NAIC project in Saguenay respect the applicable standards.

Table 3.6 Emission Standards

Equipment	Regulated Activity	Regulated Contaminant	Facility Design Criterion	Emission Standard
Pig Iron Production Process	Coating, Briquetting, Pellet Reduction, Smelting and Pig Iron Casting	Particulate Matter	Baghouse Guarantee of 9.2 mg/Rm^3 PM emissions estimated at 5.44 kg/h	16.8 kg/h Article 148
Baghouses for the Briquetting Unit	Particulate Matter from the Industrial Process	Particulate Matter	Baghouse guarantee of 9.2 mg/Rm^3	30 mg/Rm^3
Baghouses from the transfer and storage buildings	Handling of pellets and product	Particulate Matter	Baghouse guarantee of 9.2 mg/Rm^3	30 mg/Rm^3
Gas Preheater	Natural gas and process gas combustion	NOx	≤25 g/GJ	≤26 g/GJ (Article 65 CAR; nominal calorific capacity >30 MW) ≤25 g/GJ (Article 7 of the MAPR; Gap between the preheated air and ambient air > 155 °C)
Package boiler	Combustion of natural gas	NOx	≤18 g/GJ	≤26 g/GJ (article 65 CAR; nominal calorific capacity ≥3 and ≤30 MW) ≤18 g/GJ (article 6 of the MAPR, yield > 90%)

According to article 148 of Chapter IX, Section IV concerning steel production facilities, a pig iron or steel production process must not emit into the atmosphere any particle concentrations above the emissions limits prescribed in Appendix C of the CAR.

The particle emission limits described in Appendix C are defined as a function of the process feed rate, which is itself determined by the weight of the total material introduced into an industrial process during a complete operation cycle, excluding liquid and gaseous combustibles

and air. The definition of process limits is important to define the applicable standard. In the case of the pig iron production facility, all the activities have been included within the same process, with the exception of the handling, transfer and storage of iron pellets. The pellet coating operation was considered to be a physical change of material, the same type as the briquetting operation. As the screening operations are carried out in the same building as the coating operations, whose emissions are evacuated through the same stack, they have been included in the process. Finally, emissions from sources A5 and A6, the transfer and storage building baghouses, as well as the intermittent sources such as the flares or the emergency generator as well as the trucking activities and steam production have been excluded from the calculation. Sources A1, A4, A7 and A8 were considered.

The briquetting activities are subject to the emission standards in Article 10, 12th paragraph, or a maximum emission of 30 mg/Rm^3. This may appear contradictory with the emission standard of article 148, which includes the emissions from the briquetting operations. If the briquetting unit was excluded from the calculation of the emissions standard, the latter would be the same as the briquettes will be fed continuously to the reactor. The emission rate would however be lower as the briquetting unit emissions would then be excluded from the calculation. Whether the briquetting activities are subjected to article 10 or article 148, the facility emissions will be in compliance.

Transfer, sliding and handling activities are targeted by article 10 and should not emit into the atmosphere particle emission concentrations above 30 mg/Rm^3.

Nitrogen oxide emissions from the gas preheater as well as those from the package boiler are targeted by article 65 of section III, Chapter VI of Title II of the CAR. As the gas preheater's feed power is above 30 MW, the maximum nitrogen oxide emission values must be 40 g/GJ while those of the package boiler must be 26 g/GJ for a nominal calorific capacity of 4.5 MW. At the federal level, the MAPR also limits the NOx emissions from heating apparatuses, or at 25 and 18 g/GJ for the gas preheater and the boiler.

3.9 Noise Emissions

The noise generated by the operation of the NAIC plant could potentially affect the nearby communities' sound environment. The noise sources can be divided into two categories: fixed sources within the perimeter of the plant and transportation of materials between the plant and the wharf.

The stationary sources will consist mainly of the mechanical equipment required for the manufacturing processes. The process equipment will be mainly located inside the plant's buildings, which will reduce the noise outside. The most significant sources that are not located inside the buildings include the cooling towers, the air coolers, the preheating furnace fans, the EAF baghouse and other baghouses, the electrical substation power transformer and ventilation of buildings. The transportation of sludge, fines and dust by means of mobile equipment from their place of production to the briquetting unit's building and the transportation of slag pots to the storage area are noise sources that will be considered in the NAIC plant's stationary sources.

In order to address the project's cumulative impacts, the trucking of pellets and pig iron between the wharf and the plant site will be considered. The APS will be responsible for handling and transportation operations from the dock to the plant.

3.10 Supporting Infrastructure

3.10.1 Natural Gas Supply

Natural gas will be supplied by Gaz Metro. Currently, only the urbanized sectors of the boroughs of Jonquiere, Chicoutimi and La Baie possess a natural gas distribution network. The Grande-Anse intermodal marine industrial park does not possess a connection to the existing network. Gaz Metro must therefore install a gas line that would link the facility to the distribution network; a conduit of 250 mm (less than 10 inches) over a distance of 16 km is currently under study, of which the final route is not yet defined by Gaz Metro. This conduit could potentially pass along the existing road or railroad up to the facility. The hook-up point is located near the airport, on *Chemin* Saint-Anicet. Gaz Metro will be responsible for obtaining the environmental authorizations necessary for the extension of the network.

3.10.2 Electricity Supply

Electric energy supply to the facility of around 75 MVA will be obtained from the Hydro-Quebec distribution network. A new electric line of 161 kV will be necessary over a distance of around 8 to 22 km depending on the hook-up solution that will be used. By the end of 2016 Hydro-Quebec will have completed its planning study. This plan will help determine the optimal connection. The extension of the power grid is the responsibility of Hydro-Quebec which will ensure any required environmental permits have been secured.

3.10.3 Water Supply

The potential project site is currently served by the potable water supply network via *Chemin* de la Grande-Anse. In order to meet the water needs of the facility, an additional conduit will be constructed between the St-Anicet reservoir and the facility site. A conduit with a 250 mm diameter (allowing for a flow of 210 m^3/h) following the existing railway corridor, over a distance of around 15 km. This project will be carried out by the City of Saguenay to improve water distribution to the Grande-Anse Intermodal Marine Industrial Park.

3.10.4 Railway

No modification to the railway is required. At this stage of the project, it is not foreseen that material will be received or delivered by train.

3.10.5 Port and Conveyor Facilities

The raw material as well as the final product will be received and expedited by boat. The port facilities of Grande-Anse will be used. The ship dimensions, around 220 m in length, are standard and do not require modification to the existing jetty. Two temporary storage spaces must be reserved at the jetty for the reception of iron pellets and expedition of the pig iron. The Saguenay Port Authority (APS) is responsible for reception, handling and delivery of material between the jetty and the NAIC facility. Two options are under study by the APS. The first

consists of installing a new multi-user conveyor, 2.4 km long, and the second consists of transporting the material by truck between the facility and the jetty.

In the case of the conveyor, mobile equipment (conveyor and hopper) will be provided at the jetty in order to maintain operation flexibility. For trucking, only loading trucks and transport trucks will be necessary.

3.11 Facility Pre-Start-up

Once the plant is physically completed, pre-commissioning activities must be carried out. The main activities involved in this process are:

› Hydrostatic testing of piping and equipment;
› Rinsing and cleaning of lines and pipes;
› Checking of leaks in critical lines;
› Purging of process lines with nitrogen;
› Blowing of steam lines;
› Checking of control instrumentation;
› Load testing of all motors, fans, etc.

Management of wastewater produced during the pre-start-up phase will be defined during detailed engineering. It is possible that chemical products for cleaning equipment/conduits are used. The most likely management option will be that of disposing wastewater off-site. Complementary information will be provided during the request for a certificate of authorization for the construction of the facility.

3.12 Plant Closure

At the end of its useful life, the plant will be closed and dismantled according to the regulations enforced when closure takes place. Decommissioning of an industrial site may require, but is not limited to, the following activities with consideration of the legal requirements when the plant will cease its operations:

› Preparation of a decommissioning plan for the disposal of assets of closed operations;
› Dismantling and demolition of facilities;
› Recycling of dismantled materials and equipment still reusable where feasible;
› Disposal of other materials, obsolete equipment and demolition debris;
› Clean-up and rehabilitation of site if required – contaminated soils and groundwater;
› Reuse of site for an industrial facility or other compatible use.

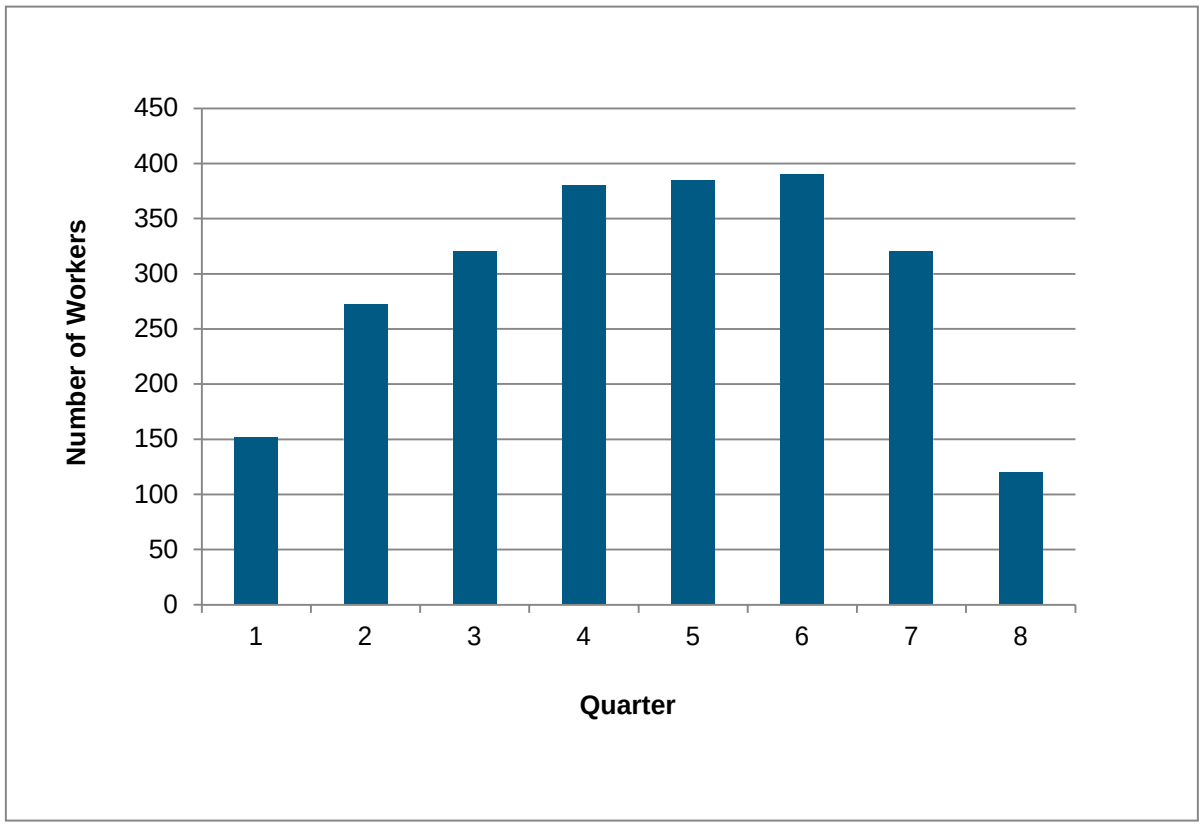
3.13 Construction Activities

3.13.1 Construction Schedule

Construction of the pig iron plant is foreseen to be carried out over a 22 month period. Construction is scheduled to start in Q2 of 2017, once the appropriate permits are obtained. Plant commissioning is scheduled for Q2 of 2019.

The manpower needed will vary during the construction phase. The anticipated evolution of the number of workers required on-site during the 3 years of construction is presented in Figure 3.7. Up to 390 workers will be required during the construction peak.

Figure 3.7 Labour Requirements during Plant Construction



The main construction phases are divided into several activities, as presented in Table 3.7.

Table 3.7 Construction phases

Activities	Period (approx.) (months)
Mobilization & Site preparation: Excavation and leveling Soil compacting Construction of temporary access roads Implementation of temporary facilities; construction site trailers, offices and sanitary facilities Earth works and ditches Preparation of foundation, drain systems	3
Construction work: Erection of foundations Engineering; process area, electrical substation, buildings etc. Process, mechanical, electrical, instrumentation work	19
Testing: Pre-commissioning and commissioning	2
Demobilization: Dismantling of temporary facilities	2

3.13.2 Site Preparation

Construction activities will take place on a vacant lot of the APS that will have already been cleared, stripped and leveled with granular material.

Site preparation work will include installation of temporary facilities, surveying, earthworks, grading, internal drainage ditch and temporary retention pond excavation.

The proposed site will have been previously leveled and mass excavation will have been completed. Only works of detailed excavation and minor earth excavation will be required (66,500 m^3). Controlled blasting will be required where the bedrock outcrops (10,000 m^3). The scope of work for site preparation as well as the foundation types and construction methods for each piece of the infrastructure to be built on-site will be determined in detailed engineering. The expected scope of work during construction is as given below.

- Earthworks (excavation) 76,500 m^3
- Earthworks (backfilling) 101,000 m^3
- Concrete and concrete paving 18,700 m^3
- Buildings 505,820 m^3

Type A granular material (sand and gravel) will be used for building foundations, on-site roads, parking and storage areas. Sand quarries, gravel pits and concrete plants used in this project will possess the required permits by the Ministry. Part of the granular material could come from leveling work carried out by the Saguenay Port Authority.

Site assessment work did not reveal any contamination on site. The excavated material, principally the crushed stone and rock will be transported to a dry landfill or rather managed by the Saguenay Port Authority for future needs.

Water or an authorized dust suppressant will be used as needed to limit dust emissions due to traffic on the construction site.

Excavation as well as the installation of the peripheral drainage ditches will be realized beforehand by the Saguenay Port Authority. Surface water will drain to these ditches and will then flow to a retention basin to settle suspended solids as needed.

3.13.3 Temporary Facilities

A number of temporary facilities will be required during the construction phase, most of them being “site trailer” type. These temporary buildings will include trailers for contractors, a project office, human resources office, guard house, first aid services, etc. Different construction activities will require handling of materials such as reinforcement steel, concrete formwork, steel plates, polyurethane insulation, etc. A laydown area is planned within the project site, which will also double as a parking lot during the construction period. Each contractor will have its own dedicated area for temporary buildings and material storage. The laydown area and the temporary construction facilities will be located partly on the project site and may extend on the premises of APS, either on land eastern of the site or on the northern side of the *Chemin* du Quai-Marcel-Dionne.

Sanitary facilities will be available on site, will be self-sufficient and emptied periodically by a specialized firm.

Water will be provided by a temporary tie-in to the municipal potable water pipe located along the *Chemin* du Quai-Marcel-Dionne. Water for human consumption will be commercial bottled water. The contractors will provide their lunchrooms with the necessary equipment.

Concrete mixer truck washing will take place at the concrete plant. Only the concrete mixers slides will be cleaned on an on-site washing area. Washing water will be collected in a basin lined with a geo-membrane. High pH water will be neutralized before discharge to the storm water runoff retention pond. The pH will be maintained between 6.0 and 9.5 by adding diluted acid. Residual concrete will be disposed of in rubbish containers for dry materials. The location of the concrete wash area will be specified in the application for the certificate of authorization that will be submitted for construction. In addition to being waterproof, this washing area will be located more than 100 m away from any watercourse.

A temporary connection to the 25 kV distribution network will supply electricity to the construction site, for which needs are estimated at 10,000 kVA. Temporary power will be distributed around the site on overhead lines, underground cables and distribution boxes.

Temporary structures, equipment and facilities will be dismantled at the end of the construction phase.

3.13.4 Construction of Buildings and Equipment Installation

Foundations of buildings, production and auxiliary services units, as well as fire protection water tanks will be poured once the excavation is completed. Concrete needed for construction of these foundations and other components of the plant will be supplied by contractors. Erection of buildings and structures will be carried out following the pouring of foundations and slabs.

Most of the material and equipment will be delivered on-site in large, pre-assembled sections to reduce installation time. They will be delivered by truck or ship, in the case of large dimension equipment or heavy loads. A traffic plan will be developed to support the logistics of equipment deliveries according to their origin (transport by boat or truck). Equipment transportation by boat will be coordinated with the port authorities. Road transport will be made according to current regulations (i.e.: limitations during the thaw period, oversized vehicles permit, etc.).

Piping and electrical network will be established simultaneously with final phases of major equipment installation. Once these phases are near completion, the exterior finishing work, such as paving of roads and parking lots as well as landscaping will be completed.

3.13.5 Construction of the Storage Dome

Dome construction will be completed in the following order:

› Foundations and tunnels construction
› Airform fabrication and inflation
› Application of polyurethane foam insulation
› Steel-reinforced concrete application

Foundation type and construction method for the dome will be defined at detailed engineering. It is foreseen that a concrete slab will be casted on a layer of lean concrete above well compacted soil or rockfill. A concrete ring beam is put in place at ground level and tunnels for reclaim are integrated into the dome’s foundation.

The airform is then bolted to the ring beam. Construction equipment and materials are staged beforehand inside the footprint of the airform. The PVC airform is inflated using large fans to form the dome shape and maintain inflation pressure. The airform creates a protected environment, allowing for construction to continue inside the dome in almost any weather condition. The dome structure erection is rather fast.

Multiple layers of polyurethane foam are applied inside the air-supported PVC airform. A network of fasteners are inserted in and steel reinforcing is placed on top and connected to these fasteners, creating a grid across the entire interior surface of the dome. Once the foam hardens, this layer serves a structural role in supporting the initial layers of steel matting and concrete.

Construction if completed with multiple applications of shotcrete materials and reinforcing steel rebar are applied until the necessary design thickness is achieved

3.14 Emissions and Discharges During Construction

3.14.1 Dust

Truck and heavy machinery traffic on site during preparatory earthworks are likely to create dust emissions that will be reduced through the use of dust controls (water, calcium chloride, or other authorized substances) as needed, such as water or a product judged to be acceptable for the environment and thus certified by the bureau de la normalization du Quebec (BNQ), standard NG 2410-300 ”Dust-control for non-asphalted roads and other similar surfaces is authorized”.

3.14.2 Stormwater and Wastewater

A retention pond will be set up during the construction period to manage run-off water on site, although the majority of it tends to seep into the fill of crushed stones. This pond will be designed to contain a run-off volume equivalent to a maximum of 24 hours of rain for a 25 year return period. The volume of the stormwater retention pond during the construction period will be defined during the detailed engineering. The pond discharge will ultimately flow into water stream no.5. The discharge point(s) to ditches will be identified during detailed engineering.

If necessary, passive treatment systems will be installed in the pond or within the peripheral ditches to further reduce the concentrations of contaminants prior to final discharge. For example, these systems could be filter berms to retain suspended solids (TSS) or hydrophobic absorbents to help capture oils.

Water quality criteria will be 25 mg/L for TSS and 2 mg/L for C_{10}-C_{50} hydrocarbons. The pond will be equipped with a manual valve that can be closed in case of a spill.

Wastewater from washing of concrete mixer trucks will be managed as described in section 3.11.3. After treatment, they will be discharged into the storm water retention pond. Washing takes about 25 liters of water per slide. The daily volume generated by the washing is estimated at 125 liters for an average of 5 concrete trucks per day during a period of 13 months.

3.14.3 Solid Waste

Several types of construction waste material will be generated during plant construction. Waste management and control procedures will be implemented in order to properly sort, store and dispose of waste. The 4 R’s waste hierarchy approach will be applied to waste management during construction. The main types of construction waste material are presented in the following paragraphs.

Waste Oil

Most of the oil changes on equipment, such as excavators and cranes, will be conducted off-site. Contractors will be required to make their oil changes on heavy machinery (such as excavators and cranes) prior to site mobilization. Therefore the needs for on-site oil changes will be greatly reduced.

In the rare cases where it may occur, a special procedure will be established for on-site oil changes. Among others requirements, it will consist of the obligation to proceed with oil changes at a distance of at least 10 m from ditches, wetlands and water mediums and to use an

absorbing hydrophobic cloth or a retention basin under the equipment to protect the soil. No oil storage will be allowed on-site; therefore contractors will be required to dispose of their waste oil without delay in an authorized site and in accordance with regulations.

Construction Debris

Leftover construction materials will be recovered by the contractors for re-use, recycling or disposal. All leftover concrete that cannot be recovered and crushed for re-use as granular fill will be recovered and will serve as recycled aggregate on other construction sites. Concrete waste that cannot be recovered should be transported to a construction or demolition debris placement site or a subsurface containment site.

The construction waste management will comply with the Guidelines on the Management of Concrete, Brick and Asphalt Derived from Construction and Demolition Work and from the Freestone Sector.

Domestic Waste

Domestic waste primarily originates from contractor's trailers and is mainly comprised of organic waste. This type of waste will be eliminated in a sanitary landfill site. Paper, glass, plastic and cardboard scrap will be recycled by local recyclers.

In view of the future prohibition of organic waste landfilling announced in the Québec Policy on Waste Management, NAIC intends to work with the City of Saguenay and align itself with the measures undertaken by the City in view of the ban, as stated in its 2016-2020 Revised Waste Management Plan of the City of Saguenay and the Fjord du Saguenay RCM.

Sanitary Waste

Portable toilets will be used on the site during the construction. These will be managed by specialized firms for disposal off-site.

3.14.4 Noise

Machinery used during the construction phase will include excavators, concrete mixing trucks, dump-trucks and cranes. Site preparation and construction of building foundation activities will cause the most noise to sites neighboring the project site. All construction activities will take place at the project site.

Activities that could cause noise are the following:

- Site preparation and leveling work;
- Pouring concrete foundation slabs;
- Construction of the steel frame.

During the construction period, an increase in around 100 to 390 workers is to be expected over a period of around 2 years. Increased road traffic during rush hour, from 6 AM to 7 AM and between 3 PM and 6 PM is to be expected. Construction will take place between 7 AM and 7 PM.

The supply of necessary materials for site preparation and construction will also lead to an increased amount of road traffic near the site. With the assumption that PSA will manage 50% of the material, 65 to 130 trucks per day will pass on the nearby road between 7 AM and 7 PM during the first 4 months of construction. Then, trucking will fall to 5 trucks a day to which 5 concrete mixing truck per day will be added.

Table 3.8 presents the type of equipment used as well as the quantity present on the construction site at one time.

Table 3.8 Equipment Used for Construction

Equipment Type	Quantity On-Site at Peak	Period
Truck	10 to 12	Month 0 to Month 13
Concrete Truck	3 to 5	Month 3 to Month 16
Bulldozer	3	Month 0 to Month 13
Excavator	4	Month 0 to Month 13
Crane	3 to 5	Month 3 to Month 21
Compactor	3	Month 0 to Month 13
Drill Rigs	2	Month 0 to Month 4
Concrete Pump Truck	3	Month 3 to Month 16

Chapter 4

Study Area

Table of Contents

4		Description of the Environment	1
4.1		Study Area	1
	4.1.1	Delineation of the Study Areas	1
	4.1.2	Project Area	1
	4.1.3	Local Study Area	1
	4.1.4	Extended Study Area	1
4.2		Physical Environment	2
	4.2.1	Climate	2
	4.2.2	Air Quality	6
	4.2.3	Physiography	9
	4.2.4	Hydrography and Surface Water Quality	9
	4.2.5	Geology and Soil Quality	11
	4.2.6	Hydrogeology and Groundwater	14
4.3		Biological Environment	15
	4.3.1	Vegetation	15
	4.3.2	Wildlife	19
	4.3.3	Threatened, Vulnerable or Endangered Species	22
	4.3.4	Protected Areas, Conservation Areas and Sensitive Areas	28
4.4		Human Environment	28
	4.4.1	Administrative Framework	28
	4.4.2	Socioeconomic Profile	29
	4.4.3	Land Use	41
	4.4.4	Infrastructure and Public Services	46
	4.4.5	Historical and Archaeological Heritage	54
4.5		Noise Environment	55
	4.5.1	Initial Condition	55
	4.5.2	Noise Limits	56
4.6		Visual Environment	58
	4.6.1	Regional Landscape	58
	4.6.2	Landscape of the Local Study Area	59
	4.6.3	Identification of Landscape Units	59

List of Tables

Table 4.1	Study Areas Considered Based on the Receiving Environment's Component	2
Table 4.2	Climate Normals in Bagotville (from 1981 to 2010)	4
Table 4.3	Stations Selected for Air Quality Description Purposes (2012 to 2014)	6
Table 4.4	Ambient Air Quality Standards	7
Table 4.5	Measurements of O_3 from 2012 to 2014 at the Chicoutimi Station	8
Table 4.6	PM_T (µg/m³) Measurements at the La Baie Station from 2012 to 2014	8
Table 4.7	$PM_{2.5}$ (µg/m³) Measurements at the Chicoutimi Station from 2012 to 2014	9
Table 4.8	Watersheds Present in the Study Area	10
Table 4.9	Study Area Vegetation Profile	16
Table 4.10	Distribution of Wetland Types Present in the Study Area	18
Table 4.11	Wetlands Charactérized[1] in the Study Area	19
Table 4.12	Special Status Plant Species in or Near the Study Area	23
Table 4.13	Special Status Species Possibly Present in or Nearby the Local Study Area[1]	25
Table 4.14	Population Data for the Regional Study Area	31
Table 4.15	Distribution of the Population of the Regional Study Area by Age	32
Table 4.16	Educational Attainment (Population Aged 15 and Over)	34
Table 4.17	Comparative Employment Data by Sector	37
Table 4.18	Main Employers in the City of Saguenay	38
Table 4.19	Employment and Unemployment Rate in 2011	38
Table 4.20	Individual and Household Income (CAD)	39
Table 4.21	Land Allocation in the Study Area	41
Table 4.22	Land Use in the Study Area	44
Table 4.23	Type, Origin and Destination of the Main Goods Handled at the Grande-Anse Terminal	48
Table 4.24	Results of Initial Noise Level Measurements in Sensitive Areas	56
Table 4.25.	Summary of Noise Limits for the Project's Stationary Sources	57
Table 4.26	Summary of Noise Limits for the Construction of the Project	58

List of Figures

Figure 4.1	Wind Rose at the Bagotville Weather Station (2010 to 2014)	3
Figure 4.2	Schematic View of a Section of the Saguenay Graben	13
Figure 4.3	Territories of Saguenay-Lac-Saint-Jean and their Population	30
Figure 4.4	Post-secondary Education Subjects Studied by the Population of the Study Area	35
Figure 4.5	Economic Development Index for the Saguenay-Lac-St-Jean Region	36
Figure 4.6	Number of Ships Docked on the Saguenay River between 1990 and 2015	49
Figure 4.7	Intersection of *Rang* Saint-Mathieu and *Rue* des Cormiers	60
Figure 4.8	*Chemin* St-Joseph	60
Figure 4.9	Quai des Croisières, La Baie	61
Figure 4.10	View towards the Grande-Anse Marine Terminal from the Saguenay's North Shore	62
Figure 4.11	Vacant land where the future pig iron plant will be constructed	62
Figure 4.12	Railway link to the Grande-Anse Intermodal Marine Industrial Park	63
Figure 4.13	Forest area forming the buffer zone between the site, Rue Saint-Martin and the Saguenay River	63
Figure 4.14	View towards the Saguenay from *Chemin* St-Martin	64
Figure 4.15	*Chemin* Saint-Martin	64
Figure 4.16	Saguenay river seen from Saint-Fulgence	65
Figure 4.17	View of the flats, St-Fulgence	65
Figure 4.18	Terrasse of the Auberge de la Tourelle	66
Figure 4.19	Beach located south of Cap Jaseax	66
Figure 4.20	View of *Chemin* Saint-Martin from the Auberge de la Tourelle	67

4 Description of the Environment

4.1 Study Area

The plant site is the central point from which the boundaries of the area to be used for the description of the project's environment were established. It is located about 5 and 8 kilometers respectively away from the urban areas of the District of La Baie and the District of Chicoutimi in the City of Saguenay.

4.1.1 Delineation of the Study Areas

A study area is mainly determined by the environmental components (biophysical and human environments) likely to be affected by the project. Based on the components analyzed, various physical boundaries are considered. Table 4.1 shows the location of the proposed study area(s) for each of the components to be analyzed. Map 4.1 shows the boundaries of the three reference study areas.

4.1.2 Project Area

The project area is the area likely to host the project's facilities (Map 4.1). This area corresponds to the plant's built area. The location of the geotechnical drill holes and field survey areas used for soil and groundwater characterization purposes could extend beyond the project footprint since the exact location of the site was confirmed after the results of the geotechnical study were confirmed. The project area is used for the description of the environmental components that will be directly affected, i.e. modified, disrupted or destroyed by the construction of the project.

4.1.3 Local Study Area

With respect to the biophysical environment and some components of the human environment, the local study area corresponds to the perimeter around the project area within a radius of 2.5 km. This perimeter corresponds to the area likely to be impacted by project-related activities. The proposed local study area extends over 19.65 km² (1965 ha).

4.1.4 Extended Study Area

The analysis of the extended study area looks into regional activities as well as components that could be impacted by the project on a regional scale. Some components could be impacted beyond the boundaries of the local study area. With respect to the area's socioeconomic profile and regional infrastructure, the extended study area is located within a radius of about 15 km around the core zone of the local study area. This extended area stretches up to the boundaries of the City of Saguenay. The Saguenay-Lac-Saint-Jean region was also considered where relevant. The extended study area corresponds approximately to the geographic focus of Map 4.1 and exceeds its boundaries, if considered at the regional scale.

Table 4.1 Study Areas Considered Based on the Receiving Environment's Component

Component	Study Area Considered
Physical Environment	
Climate	Extended
Air quality	Extended
Physiography	Project Area
Hydrography and surface water quality	Project Area/Local
Geology and soil quality	Project Area/Local
Hydrogeology and groundwater quality	Project Area
Biological Environment	
Vegetation	Local
Mammals	Local
Avifauna	Local
Fish fauna	Local
Herpetofauna	Local
Species at risk	Local/Extended
Wildlife habitat and conservation area	Local/Extended
Human Environment	
Administrative framework	Extended
Socioeconomic profile	Extended
Land use	Local
Historical and archaeological heritage	Local
Soundscape	Local
Visual environment	Local/Extended

4.2 Physical Environment

4.2.1 Climate

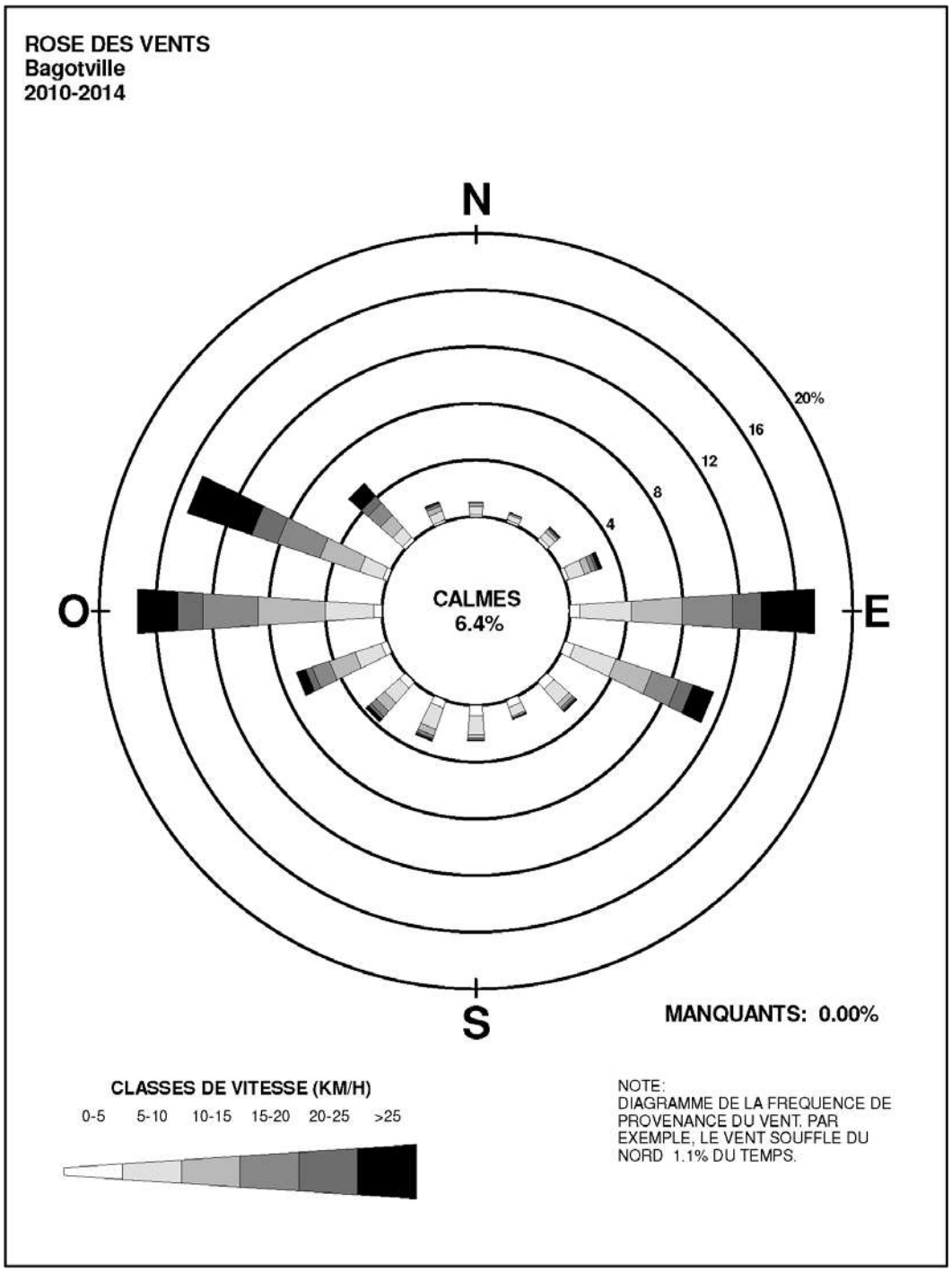
The study area is located in the Saguenay River Valley. On the surface, regional winds generally blow in the east-west corridor of the Valley, as shown by the wind rose of the Bagotville weather station (Figure 4.1) located some 12.3 km southwest of the proposed plant site. The location of this station is shown in Map 4.1.

The average wind speed is 15.6 km/h. The prevailing winds in terms of frequency and intensity blow from the West (19%) and East (19.2%) sectors. Therefore, the East and West sectors of the project site are more likely to be affected by the project's air emissions.

Based on the Quebec climate classification adopted by the MDDELCC (Gérardin and McKenney, 2001), the Saguenay-Lac-St-Jean region has a mild subpolar climate (the average temperature ranges between 1.9 and 4.5 °C). This is a sub-humid climate (annual rainfall ranges between 800 and 1360 mm) with a long period of plant growth (over 180 days per year).

Table 4.2 shows the climate normals established by Environment Canada based on observations made from 1981 to 2010[1] at the Bagotville weather station.

Figure 4.1 Wind Rose at the Bagotville Weather Station (2010 to 2014)



[1] Climate normals are published every ten years

Table 4.2 Climate Normals in Bagotville (from 1981 to 2010)

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Temperature													
Daily average (°C)	-15.7	-13.0	-6.3	2.6	9.9	15.6	18.4	17.1	12.1	5.3	-2.0	-10.4	2.8
Daily maximum (°C)	-10.1	-7.4	-0.6	7.9	16.3	22.0	24.2	23.0	17.5	9.6	1.8	-5.7	8.2
Daily minimum (°C)	-21.1	-18.7	-12.0	-2.8	3.4	9.2	12.4	11.1	6.5	1.0	-5.7	-15.0	-2.6
Extreme maximum (°C)	15.2	13.6	22.2	30.4	34.4	36.3	38.4	36.1	33.3	28.3	22.9	14.4	
Extreme minimum (°C)	40.6	-43.3	-33.6	-24.4	-10.4	-2.2	0.9	0.8	-6.7	-12.2	-25.6	-39.5	
Precipitation													
Rainfall (mm)	6.5	5.7	13.8	39.9	77.6	88.0	111.8	91.2	102.6	77.0	37.8	11.8	663.8
Snowfall (cm)	64.8	55.3	45.6	24.1	3.4	0.0	0.0	0.0	0.1	8.3	46.6	73.4	321.7
Precipitation (mm)	57.9	50.8	52.2	62.2	80.8	88.0	111.8	91.2	102.7	85.2	78.0	69.8	930.6
Extreme daily rainfall (mm)	45.7	17.0	26.4	28.4	49.0	72.4	98.4	57.0	75.4	45.0	55.2	24.6	
Extreme daily snowfall (cm)	39.6	33.0	38.9	27.9	19.3	6.9	0.0	0.0	4.1	27.3	30.8	44.5	
Extreme daily precipitation (mm)	45.7	33.0	39.4	41.0	49.0	72.4	98.4	57.0	75.4	45.0	55.2	44.5	
Extreme daily snow cover (cm)	141	153	121	88	30	1	0	1	3	11	49	89	
Days with maximum temperature													
<= 0 °C	28.2	23.7	15.5	1.8	0	0	0	0	0	0.17	10.8	24.7	104.9
> 0 °C	2.8	4.5	15.5	28.2	31	30	31	31	30	30.8	19.2	6.3	260.3
> 10 °C	0.13	0.13	1.4	9.5	26	29.7	31	31	28.2	12.9	2.1	0.13	172.3
> 20 °C	0	0	0	0.80	8.3	18.8	25.4	23.4	8.7	1.4	0.03	0	86.8
> 30 °C	0	0	0	0.03	0.53	2.3	2.9	1.6	0.31	0	0	0	7.7
> 35 °C	0	0	0	0	0	0.10	0.10	0	0	0	0	0	0.20
Days with minimum temperature													
> 0 °C	0.07	0.30	1.1	8.1	24.1	29.7	31	31	27.9	18	4.1	0.23	175.5
<= 2 °C	31	28.1	30.9	27	12.2	1	0	0.13	5.1	19.1	28.7	31	214.1
<= 0 °C	30.9	27.9	29.9	21.9	6.9	0.27	0	0	2.1	13	25.9	30.8	189.7
< -2 °	30.6	27.5	27.5	15	2.8	0	0	0	0.34	7.1	21.1	29.6	161.5
< -10 °C	27.6	23.7	17.6	2.3	0.03	0	0	0	0	0	6	22	99.2
< -20 °C	18.5	13.5	5.5	0.07	0	0	0	0	0	0	0.41	8.6	46.6
< - 30 °C	4.2	1.5	0.33	0	0	0	0	0	0	0	0	0.97	7
Days with rain													
>= 0.2 mm	1.7	1.7	3.7	9.8	14.8	14.9	16.6	15.5	16.1	15.4	8.6	3.2	122.1
>= 5 mm	0.43	0.40	1.1	2.9	5.4	5.8	7.1	5.7	6.2	5.1	2.5	0.77	43.4
>= 10 mm	0.20	0.17	0.40	1.1	2.2	2.9	3.7	2.7	3.5	2.4	1.1	0.27	20.7

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
>= 25 mm	0	0	0	0.07	0.37	0.37	0.69	0.50	0.72	0.37	0.07	0	3.2
Days with snow													
>= 0.2 cm	19.1	15.4	13.1	7.2	1.1	0	0	0	0.07	3.5	13.7	19.6	92.8
>= 5 cm	4.1	3.6	3.4	1.4	0.20	0	0	0	0	0.60	3.4	5	21.7
>= 10 cm	1.2	1.5	0.93	0.63	0.13	0	0	0	0	0.13	1.1	1.8	7.4
>= 25 cm	0.07	0.07	0	0	0	0	0	0	0	0	0.07	0.10	0.31
Days with precipitation													
>= 0.2 mm	19.2	15.8	15	14.3	15.1	14.9	16.6	15.5	16.1	16.9	19	20	198.4
>= 5 mm	3.5	3.3	3.9	4.5	5.6	5.8	7.1	5.7	6.2	5.8	5.5	4.8	61.8
>= 10 mm	1.1	1.1	1.1	1.6	2.3	2.9	3.7	2.7	3.5	2.6	2	1.7	26.5
>= 25 mm	0.07	0.07	0.03	0.13	0.37	0.37	0.69	0.50	0.72	0.37	0.14	0.10	3.6
Days with precipitation													
Degrees/day													
Above 24 °C	0	0	0	0	0	0.9	2	0.8	0.2	0	0	0	3.9
Above 18 °C	0	0	0	0	2.9	23.4	45.7	31.6	6.4	0.1	0	0	110.1
Above 15 °C	0	0	0	0.2	11.8	59.9	111.5	82.9	19.9	1	0	0	287.2
Above 10 °C	0	0	0	2.8	55.4	172.7	259.6	219.9	84.8	10	0.3	0	805.5
Above 5 °C	.1	0.2	1.4	22.9	158.5	319.3	414.5	374.4	211.8	55.5	4.6	0.2	1563.3
Above 0 °C	1.1	2.3	17	101.8	306.5	469.2	569.5	529.4	360.6	167.6	34.9	2.8	2562.8
Below 0 °C	486.2	370.2	213.3	25.3	0.2	0	0	0	0	3.3	91.8	324.4	1514.7
Below 5 °C	640.1	509.2	352.7	96.4	7.2	0	0	0	1.2	46.2	211.5	476.8	2341.4
Below 10 °C	795	650.2	506.4	226.3	59	3.5	0.1	0.5	24.2	155.8	357.2	631.6	3409.8
Below 15 °C	950	791.4	661.4	373.7	170.5	40.7	6.9	18.5	109.3	301.7	506.9	786.6	4717.6
Below 18 °C	1.043	876.1	754.4	463.5	254.6	94.2	34.1	60.2	185.8	393.8	596.9	879.6	5636.2

4.2.2 Air Quality

Air quality in the La Baie region has been subject to a MDDELCC monitoring program since 1987. However, since only total suspended particulates (PM_T) are measured there, data from the Chicoutimi station are also presented. This MDDELCC station has also been measuring particulates smaller than 2.5 µm ($PM_{2.5}$) since 2002.

The following sections provide a more detailed description of the results of air quality measurements in the region based on the latest data available.

4.2.2.1 Selection of Measurement Stations

The air quality measurement station closest to the project site is located in La Baie, some 6.3 km away from the project site. Only one parameter, i.e. total suspended particulates (PM_T), is measured there. PM_T concentrations are measured by sequential sampling over a period of 24 hours automatically every six days. PM_T data were analyzed for the period from 2012 to 2014.

The Chicoutimi ambient air quality monitoring station is located 13.9 km away from the project site. Only particulate matters of a diameter smaller than 2.5 µm ($PM_{2.5}$) are measured there. $PM_{2.5}$ data were also analyzed for the period from 2012 to 2014.

The characteristics of the selected stations are presented in Table 4.3. The locations of the MDDELCC station in La Baie and Chicoutimi are indicated in Map 4.1.

Table 4.3 Stations Selected for Air Quality Description Purposes (2012 to 2014)

Station	Contaminant	Operator	Location from the Plant Site
La Baie	Total suspended particulates (PM_T)	MDDELCC (Nº02202)	Urban area 6.3 km south of the boundaries of the project site
Chicoutimi	Suspended particulates <2.5 microns ($PM_{2.5}$) Ozone (O_3)	MDDELCC (Nº02022)	Urban area, 13.9 km west of the boundaries of the project site

4.2.2.2 Air Quality Standards

Table 4.4 presents ambient air quality standards specified in the *Clean Air Regulation* (CAR) and the new Canadian standards for particulates and the ozone layer published in May 2013. Air quality assessment in the context of this chapter is conducted in accordance with CAR standards.

Table 4.4 Ambient Air Quality Standards

Pollutants/Durations		*Clean Air Regulation* (CAR) Standards	Canadian Ambient Air Quality Standards (CAAQS)
Ozone O_3 (µg/m^3)	1h	160	-
	8h	125	124 (63 ppb) by 2015 and 122 (62 ppb) by 2020(1)
Total particulates PM_T (µg/m^3)	24h	120	-
Fine particulates <2.5 microns $PM_{2.5}$ (µg/m^3)	24h	30	28 by 2015 and 27 by 2020(2)
	1 an	-	10 by 2015 and 8.8 by 2020(3)

Source: MDDELCC, 2016a
Notes: (1) Three-year average of the 4th highest annual measurement of the daily maximum average concentration over 8 hours
(2) Annual average of the 98th percentile, calculated over three consecutive years.
(3) Annual average concentrations.

4.2.2.3 Gaseous Contaminants (NO_2, SO_2, CO and O_3)

None of the ambient air quality stations located near the project site measures NOx, SO_2 and CO. Only ozone is measured and the Chicoutimi station is the only place where it is measured. SO_2 is measured at the Parc Berthier station (No. 02016) in Jonquière, but was not considered in this study because this station is located too far away from the project site (23.9 km). Due to its proximity to Rio Tinto's Jonquière Complex facilities, measurements conducted at this station are not representative of air quality in the region or the proposed site for the project.

In the absence of major industrial sources in the vicinity of the proposed site and since ambient concentrations of NO_2 and CO are usually higher in major urban centers near major highways, it appears that the concentrations of these contaminants are very low in the study area. In fact these contaminants are not subject to any particular long term supervision in the region.

Table 4.5 summarizes the results for ozone measured continuously. These results include annual averages as well as the maximum hourly concentrations over 8 or 24 hours. The 98th and 99th percentile of hourly data over 8 or 24 hours, are also presented in order to illustrate the significant difference between the absolute maximum values recorded 98% and 99% of the time.

No exceedance of the standards for O_3 was observed from 2012 to 2014. The concentrations of this contaminant remain below the standards by a large margin.

Table 4.5 Measurements of O_3 from 2012 to 2014 at the Chicoutimi Station

Periods	Statistics	Years			Standards
		2012	2013	2014	
1h	Maximum	64	61	57	82 ppb
	99th centile	52	50	47	N.A.
	98th centile	49	47	44	N.A.
8h	Maximum	60	56	54	64 ppb
	99th centile	50	49	45	N.A.
	98th centile	48	46	43	N.A.
Annual	Average	27	26	24	N.A.

Source: MDDELCC, 2016a
N.A Not applicable

4.2.2.4 Particulate Contaminants (PM_T, PM_{10} and $PM_{2.5}$)

Suspended particulates have highly variable sizes, as their diameters range from 0.1 µm to 100 µm. Numerous studies have shown the absence of a no-threshold effect for particulates. They have also shown that even a low concentration of particulates in the atmosphere can affect human health. The current causes of concern are related to fine and respirable suspended particulates. The smaller the particulates, the more they can penetrate deep into the respiratory tract, increasing the risk of adverse health effects.

Fine particulates are divided into two categories: particulates whose diameter is smaller than 10 µm (PM_{10}) and those with a diameter smaller than 2.5 µm ($PM_{2.5}$). These two categories of particulates are called respirable particulates. $PM_{2.5}$ particulates are a major component of smog and the main component of winter smog. However, only PM_T and $PM_{2.5}$ particulates are measured at the La Baie and Chicoutimi sites.

Table 4.6 presents the results of particulate matter measurements for PM_T at the La Baie station for the period from 2012 to 2014. Table 4.7 presents the results of particulate matter measurements for $PM_{2.5}$at the MDDELCC Chicoutimi station for the same period.

Table 4.6 PM_T (µg/m³) Measurements at the La Baie Station from 2012 to 2014

Parameters	Years			Standards
	2012	2013	2014	
Daily maximum	107	76	68	120
99th centile	80	73	67	N.A
98th centile	59	70	66	N.A
Annual average	29	28	29	N.A

Source: MDDELCC, 2016a
N.A Not applicable

Table 4.7 $PM_{2.5}$ (µg/m³) Measurements at the Chicoutimi Station from 2012 to 2014

Parameters	Years			Standards
	2012	2013	2014	
Daily maximum (exceedance of the standard)	31 (1)	82 (1)	30	30 (CAR)
99th centile	23	21	21	N.A
98th centile	21	18	19	N.A
98th centile (average over 3 years)	19.3			27 (Canada, by 2020)
Annual average	8	6	9	N.A
Three-year average	7.7			8,8 (Canada, by 2020)

Source: MDDELCC, 2016a
N.A Not applicable

No exceedances of the daily CAR standards for PM_T (120 mg/m³) were observed during this period. For $PM_{2.5}$, an exceedance of the CAR standard was observed in 2012 and again in 2013. Despite these exceedances, the frequency of criteria exceedances is significantly lower than in the south-west of Quebec. $PM_{2.5}$ concentrations in ambient air in Chicoutimi already meet the new Canadian standards for 2020.

4.2.3 Physiography

The project implementation site is located at an elevation of about 140 m above mean sea level (Genivar, 2013). Based on data on the Ecoforest map[2] (SIEF) of the Ministry of Forests, Wildlife and Parks (MFFP), the terrain near the project site is rather flat with slopes ranging from zero to 15%. The site also features moderate slopes (with a tilt ranging from 16 to 30%) and steep slopes (with a tilt of 41%) (Genivar, 2013).

However, the lands identified for the construction of the new infrastructure in the project area mainly slope towards a complex of intermittent streams (watercourses 5, 8, 9 and 10, Map 4.2) which flows eastward and into the Saguenay River some 2 km away from the site. The plant site has a general slope of about 2% with a rocky ridge of about 5 m in height in the northeast sector of the project area. A 450 m X 350 m blasted rock embankment platform with a thickness of 1.3 to 5.3 m stands northeast of the site (SNC-Lavalin 2016).

4.2.4 Hydrography and Surface Water Quality

The project implementation site is located about 1.3 km from the Saguenay River. Several intermittent and permanent watercourses are found near the site. Drainage ditches are also present there (Genivar, 2013). According to data from the Ecoforest map, drainage flow in the study area is mainly considered as good or moderate, but fast in places (Genivar, 2013).

The study area occupies a small section of the Saguenay watershed (0.005%). Five sub-watersheds cut across the local study area (Table 4.8). The Tremblay sub-watershed is entirely located within the study area and drains into the Saguenay River, like the sub-watersheds of streams 06F80000 and Leo-Jean. The sub-watersheds of Anse à Poulette and Anse à

[2] http://www.mffp.gouv.qc.ca/forets/inventaire/fiches/carte-ecoforestiere.jsp

Benjamin drain their waters towards the Baie des Ha! Ha! in the southeast. These two groups of sub-watersheds are separated by the watershed divide located on a terrace at an elevation of 141 m. (Laboratoires S.L., 2002).

Table 4.8 Watersheds Present in the Study Area

Name of Watershed	Level	Total Area of the Sub-Watershed	Area in the Study Area	Fraction of the Watershed in the Study Area
		Ha	ha	(%)
Saguenay	**1**	**8,708,281**	**470.3**	**0.005**
Tremblay	2	156.4	156.4	100
Watercourse 06f80000	2	677.3	545.6	81
Anse à Poulette	2	543.4	122.6	23
Anse à Benjamin	2	2,164.5	506.8	23
Leo-Jean	2	129.3	15.3	12

4.2.4.1 Saguenay River

The Saguenay River (Ville de Saguenay, 2012) is the main river in the study area. It is located approximately 1.3 km from the project area, part of which lies in the local study area. At the Grande-Anse terminal, the Saguenay River is 13.8 m deep and 2,200 m wide (AECOM and IBI/DAA, 2011). A water quality measurement station (06290002) is located at a distance of 1.5 km upstream of the study area, at the pedestrian bridge of Sainte-Anne City (BQMA, 2015). The bacteriological and physicochemical quality index (2012-2014), which includes several measurement parameters, is considered good. This means the river can be used for all purposes, including swimming (MDDELCC, 2016b). The metal analyzes also generated results below the quality criteria for surface water (MDDELCC, 2016c). The average values are 13 mg/l for hardness, 521.7 µg/l for extractable aluminum, and 473.3 µg/l for extractable iron. The temperature of the water ranges from 4.4 to 16.8 °C while pH is neutral at a substantially constant value of 7.2. Suspended solids are relatively low and show an average concentration of 3 mg/l. No exceedance of the current criteria was noted, which shows the quality of the water at that location is good.

4.2.4.2 Watercourses and Drainage Ditches

There are several watercourses and bodies across the study area (AECOM and IBI/DAA, 2011). Characterization studies were conducted by Genivar (2012 and 2013), Groupe Hémisphères (2012) and Environnement illimité (2011) in watercourses located near the project site and covering approximately 2.4 km^2. These studies showed the presence of several small permanent and intermittent streams, as well as drainage ditches. The rivers subject to a field visit[3] are numbered from 1 to 10 on Map 4.2 and recent protographs (2015-2016) of the

[3] Field visits, including a characterization of water courses, were conducted during the preliminary design phases of separate projects for other private developers. Data collection focused on physical aspects and a fishing activity was conducted to determine the presence of fish (Envill 2011). No physicochemical measurement (temperature, pH, O_2, hardness, conductivity/salinity, etc.) was made during these field campaigns

watercourses located near the project site (no. 5, 6, 7 and 8) are presented in the detailed description document, inserted in Apendix E.1.

The watercourses closest to the plant project site are mainly small size head watercourses (1st order, Strahler 1964) located in agricultural or forest environments (Envill, 2011). Some are affected by beaver dams and most contain obstacles that are impassable by fish. Away from the center of the study area, the watercourses generally become 2nd order watercourses (Envill, 2011). Their depth may range between 2 and 20 cm while their width ranges between 10 and 210 cm depending on the watercourses visited at times when they have not dried up.

A small watercourse network (# 6, Map 4.2) associated with a wetland (MH3) is located south of the Quai-Marcel-Dionne Road and flows alongside it. A section of this watercourse was apparently straightened for the construction of the road. A second watercourse network (watercourses # 5, # 8 and # 9) is found south of the project area and is interspersed with several beaver dams (Groupe Hémisphères 2012) while watercourses # 1, # 2 and # 3 flow across agricultural areas (Envill 2011).

Watercourses # 7 and # 10 are intermittent and become permanent further away east of the project site. Watercourse # 7 seems to be supplied by the impassable culvert installed at the end of the adjacent area. Finally, the presence of a waterfall is reported in watercourse # 4. This waterfall, which is considered impassable by fish, is caused by the culvert built for the crossing of the Anse à Benjamin Road (Groupe Hémisphères 2012).

In accordance with the Guide to Physicochemical Characterization of the initial state of the aquatic environment before the construction of an industrial project (MDDELCC, 2015a), sampling campaigns on water quality in the receiving environment will be conducted as soon as the weather conditions made it possible to conduct sampling activities, on June 6th 2016. Additional sampling is planned in June, July and August 2016. The results from these activities will be presented in addenda to this study.

Both sampling stations selected (#1 and #2) are located on Map 4.3, one is located near the effluent's discharge point in watercourse # 5 and the second one at the confluence of watercourses #5 and #8. The results of initial water sample analyses, carried out in a accredited laboratory, on water samples show higher concentration values compared to the aquatic life protection criterion (chronic effect) – CVAC – for total phosphorus. The measured aluminum concentration was close to ten times higher than the CVAC, and was also higher that the aquatic life protection criterion (acute effect) – CVAA. However, according to the cited reference, the CVAC was defined for water showing low hardness values (<10mg/L), and hence, this criterion cannot be used for watercourse #5, which hardness is around 56.5 mg/L. For the CVAA, the high measured aluminum concentration should not have toxic effects if the pH remains between 6.5 and 9.0.

Gross figures are presented in Appendix E.2.

4.2.5 Geology and Soil Quality

The study area is located in the Grenville geologic province dominated by gneiss, anorthosite and granite. The soil is mainly rocky north of the access road and in the southwest of

boundaries of the intermodal station where there are rocky type surface deposits. Marine-type surface deposits with deep water facies form the majority of the terrain on the south side of the access path, except on the southeast side of the boundaries of the intermodal station where there is an undifferentiated till surface deposit (Genivar, 2013). The project area is entirely located on rocky outcrops with differences in height of up to 40 m (Laboratoires S. L., 2002).

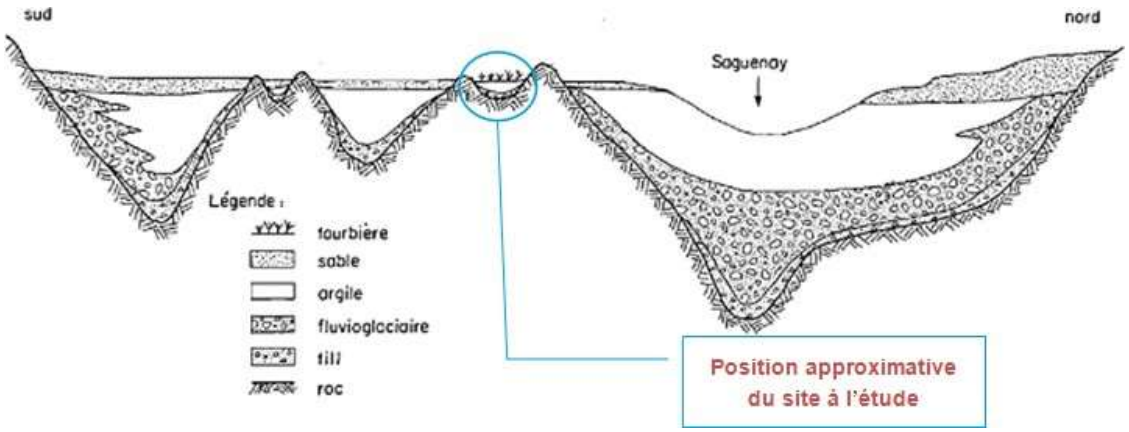
The project area is located on the south bank of the Saguenay River which is a fjord enclosed in a metamorphic and igneous rock complex that is part of the Grenville geological sub-province of the Canadian Shield. The fjord itself is located in the heart of a Grabben bordered in the north and south by the faults of the north and south walls. Figure 4.2 shows a diagram of a section of the Saguenay Grabben and the approximate location of the project area.

The fjord, as it appears today, was shaped by the passage and recession of glaciers of the last ice age which ended more than 10,000 years ago. During their recession, the glaciers left behind a trail of sediment: tills as well as sands and gravels. The region was subsequently covered by an inland sea which has facilitated the deposition of thick clay wedges.

The area south of the access path has a generally flat terrain with terraces encased between rocky hills. This sector consists of wildlands (alders and small trees). These terraces predominantly have clay soils and present the signs of previous agricultural activities. In particular, a clearing is present further south in the form of farm. A 10 to 30 m deep ravine is also present east of the farm. This ravine has inclinations of up to> 30° where the vegetation is abundant and consists mostly of mature trees. The terrain is less rugged north of the access path and consists mainly of a rocky outcrop. A terraced agricultural field is also present east of the path (Laboratoires S. L., 2002).

Traces of landslides near the ravine show the presence of past agricultural activities. In places, these traces present a retrogressive landslide (Laboratoires S. L., 2002). The local study area, however, is characterized by stress areas caused by low or non-retrogressive landslides. These areas have been marked on the map of the stress areas related to the landslides of the Grande-Anse area (Ville de Saguenay, 2011). The slopes surrounding the rivers of the study area also have stress areas related to risks of landslide (Ville de Saguenay, 2012a).

Figure 4.2 Schematic View of a Section of the Saguenay Graben



Stratigraphy

The stratigraphy of the site located near the plant site is limited to a canopy overlying a natural deposit of clayey silt whose depth varies from 0.4 to 10.0 m (SNC-Lavalin 2016). Overall, it includes a surface layer of organic material covering a deposit of silt and clay. A deposit of silty sand covering a silt and clay unit, and a deposit of till resting on bedrock are also present in places. The bedrock is composed of granitic gneiss with garnet with alternating felsic and mafic layers (Laboratoires S. L., 2002).

Specifically, the organic material is 5 to 30 cm thick and becomes thicker in places, i.e. from 0.6 m to 1 m. There is virtually no embankment in this section of the study area where only one stratigraphic unit has a backfill of 0.7 m composed of clayey silt with blocks, stones and organic matter. This embankment is believed to have been formed as a result of the excavation of a drainage ditch south of the clearing. A thin layer of silty sand (<1 m) is also present in places. This layer lies on silt and clay deposits over almost the entire surface of the recessed terraces. These deposits were formed by the sediments of the Laflamme Sea and have a variable thickness of up to 20 m, depending on the thickness of the underlying bedrock. The presence of the till seems limited in this area, but could be present some 0.6 m away (Laboratories S. L., 2002).

The bedrock is reportedly found locally at about 2.3 m (Laboratoires S. L., 2002). It is outcropping mainly in the northern part of the site and reaches depths of about 10 m in the middle. The quality of the rock encountered is described as very poor to excellent depending on the area and consists mainly of gneiss and dark gray paragneiss as well as pink granite (Bay granite) with sub-vertical, horizontal and sub-horizontal fractures (SNC-Lavalin 2016).

Soils

A Phase 1 environmental assessment was completed in 2010 by Dessau. This assessment shows the project site presents no sign of actual or potential contamination (Dessau, 2010).

A new Phase 1 environmental assessment followed by a Phase 2 characterization study was conducted in the winter of 2016 (SNC-Lavalin 2016). It confirmed the findings of the 2010 study and did not reveal the presence of significant environmental risks, with the exception of a bulk de-icing salt storage building standing on a platform whose run off water is uncontrolled. However, this storage building is located downstream of the proposed plant site.

Based on the results of the environmental characterization analyses - Phase 2, the results of the chemical analyses of soil samples taken from the site are all below or close to the detection limit or very close to the MDDELCC Criterion A (background levels). In fact, small exceedances of Criterion A were observed for some metals (barium, chromium, cobalt and nickel). The results tables, the map showing the location of the drill hole, as well as a table summarizing the site stratigraphy are available in Appendix F.1.

4.2.6 Hydrogeology and Groundwater

A study by Laboratoires S.L. (2002) presents water levels near the surface (0 to 0.5 m), increasing in depth eastward and reaching 2 m in the southwest part of Quai-Marcel-Dionne Road. Variations in water levels in the soil may occur depending on the seasons and precipitation levels (Laboratoires S.L., 2002).

A 2016 SNC-Lavalin study also shows the values of similar water levels. The groundwater in the monitoring wells installed in the clay soil deposits is at a depth of about 0.6 m from the ground level. However, some monitoring wells installed in the clay soil deposits or on the blasted rock embankment are dry. This shows that the water circulating in the rock mass has a low hydraulic connection with the overlying water table. The stabilized water levels were measured inside the observation wells and the piezometric elevations calculated from these measurements are shown in Appendix F.2.

Based on the drilling reports (SNC Lavalin, 2016), precipitation in the study area mainly drain away by runoff on the surface of the ground, especially in areas characterized by intact surface soil deposits that are fairly permeable and with relatively high proportions of silt or silty particulates. In areas characterized by rocky outcrops, precipitation water drains either by runoff or by underground seepage through rock fracture networks.

In the project area, groundwater generally flows from the southwest to the northeast, towards Intermittent Streams # 7 and # 8 east of the site and into the Saguenay River located about 2 km away from the site. The average groundwater horizontal hydraulic gradient assessed for the site is about 2.2% (SNC-Lavalin 2016). However, the groundwater flow direction can be affected by topographic depressions in the area. These depressions include the following:

- Near the southeastern boundary of the site: towards the southeast and near a complex of intermittent streams (# 5, 8, 9 and 10) that flow into the Saguenay River (2 km east of the site);
- In the northwest sector: towards the northwest and near Intermittent Stream # 6 that flows westward along the Quai-Marcel-Dionne Road and into the Saguenay River (1.4 km north) through farmlands;

› Near the southwestern boundary of the site: towards the southwest and near Intermittent Stream # 1 which flows into the Anse-à-Benjamin or the Baie des Ha! Ha! (4 km south of the site);

› Finally, near the western boundary in a topographic depression between two rock straps.

Groundwater is moderately vulnerable to contamination by anthropogenic activities in areas occupied by surface deposits of fairly permeable soils. By contrast, their vulnerability is higher outside these low permeability areas, including in areas with topographic crests where there is a hydrostratigraphic unit characterized by bedrock that is fractured and more permeable at a shallow depth or on the surface of the ground.

Depending on site conditions, the MDDELCC's DRASTIC vulnerability index for rock aquifers ranges from 125 (clay area) to 180 (area located directly on the bedrock). Therefore, the degree of vulnerability of the groundwater table is thus moderate, but it increases when the rock is exposed or covered by a fine soil layer (less than 2 m). The calculations of this index with relevant explanations are presented in Appendix F.3.

Based on the Quebec groundwater classification system defined in the MDDELCC Policy, the groundwater is classified as class IIB, and can potentially become a drinking water supply source. However, this is considered unlikely due to the lack of groundwater catchment facilities within a radius of 1 km from the site (based on the MDDELCC's hydrogeological information system) and that the area is served by the municipal water supply system.

Chemical analyses of groundwater samples taken in a borehole for HP C_{10}-C_{50}, PAHs and phenols are all below or very close to the detection limits (SNC Lavalin, 2016). However, the results for manganese concentration and total sulphides analyses slightly exceed the criterion for water intended "for consumption". In contrast, the results of the sodium and chlorides analyses are below the same criterion. Only one borehole could be sampled because of the winter 2016 meteorological conditions (January 26th). An additional sampling campaign was planned after the spring thaw and samples were taken in five wells and were analyzed by an accredited laboratory. The last results available (May 18th 2016) show slight exceedances of potable water criteria for dissolved manganese, total sulfides and toluene. The results are presented in Appendix F.2. An additional sample from the borehole where the toluene was detected (MW-10A) was planned on June 29th and the preliminary results confirm the presence of toluene but in a smaller concentration (12 µg/L). Additional sampling is planned on July 28th to confirm the previous observed concentrations. These last results will be presented in an addendum to the EIA report.

4.3 Biological Environment

This section presents an overview of the vegetation and fauna species found in the local study area described in section 4.1, including the project site which is located in the industrial park of the Saguenay Port Authority.

4.3.1 Vegetation

The general characteristics of vegetation in the study area were established by using information from various studies conducted in the region and the consultation of various

databases (Ducks Unlimited, 2009, CDPNQ 2016a, MERN 2015) and summaries of knowledge on the biological communities of the area. In fact, preliminary biological inventories were conducted in the study area for development projects unrelated to this project, including a characterization of the vegetation and wetlands (Groupe Hémisphères, 2012) and an Environmental Assessment (Genivar, 2013).

The study area is located in the landscape unit of Chicoutimi and Jonquière (Robitaille et Saucier, 1998). It corresponds to the northern temperate vegetation zone and the mixed forest subzone, and belongs to the bioclimatic field of the balsam fir-yellow birch. The climate is a continental subpolar and sub-humid climate with a moderately long growth season. The terrain is very rugged and consists of mountains and high hills that are interspersed with faults showing steep slopes. Mixed stands of yellow birch and softwood such as the balsam fir, the white spruce and the cedar, are the species that colonize mesic sites. The sugar maple is also growing at the northern limit of its range (MRNF, 2010).

There is no indication of the presence of invasive plant species in the local study area. A search on the MDDELCC SENTINEL site (2014) made it possible to establish that no such mention has been reported in the project study area.

4.3.1.1 Vegetation Cover of the Study Area

The vegetation profile of the study area was determined by means of the Ecoforest map (4th decadal, ENR, 2015). The study area consists of various types of environments, i.e. productive forest, unproductive forest and non-forest environment.

The productive forest environments cover an area of 1,283.5 ha, i.e. 55.5% of the study area. They include hardwood stands, mixed conifer, cups, regenerating stands and disturbances such as cuts and disturbed areas.

The unproductive forest environments occupy a surface area of 121.0 ha (5.2%) and are characterized by the presence of forest stands whose growing and harvesting conditions are major limiting factors. These correspond to wetlands and to humid bare and semi-bare areas. Finally, non-forest environments cover a surface area of 909.5 ha, i.e. 39.3% of the study area. They are mostly bodies of water, gravel pits, wildlands, built environment and farmlands.

Table 4.9 shows the various elements of the forest and non-forest environment of the study area which are also shown on Map 4.2.

Table 4.9 Study Area Vegetation Profile

Component	Surface Area (ha)	Proportion of the Total Surface Area (%)
Productive forest environment	**1,283.5**	**55.5**
Hardwoods	51.3	2.2
Under 30 years	32.0	1.4
30 to 70 years	19.3	0.8
Mixed woods	511.1	22.1
Under 30 years	159.9	6.9
30 to 70 years	351.2	15.2
Softwood	414.2	17.8

Component	Surface Area (ha)	Proportion of the Total Surface Area (%)
Under 30 years	109.8	4.7
30 to 70 years	304.4	13.1
Regeneration	194.4	8.4
Disturbances	112.4	4.8
Wood harvesting	44.1	1.9
Disturbed environment	68.3	2.9
Unproductive forest environment	**121.0**	**5.2**
Barren and dry semi-barren	30.0	1.3
Wetland	92.0	3.9
Non-forest environment	**909.5**	**39.3**
Wasteland	5.1	0.2
Gravel pit	1.7	>0.1
Water, island	498.7	21.6
Agricultural land	404.0	17.5
Built environment	>0.1	>0.1
Total	**2,314.0**	**100.0**

4.3.1.2 Wetlands

A wetland is an area of land that is flooded or saturated over a period of time long enough to influence the nature of the soil and the composition of the vegetation and thus sustains various kinds of biological activities adapted to wet conditions (Ducks Unlimited, 2009b). Wetlands include organic wetlands or “peatlands” and mineral wetlands (mineral soil areas that are influenced by excess water but produce little or no peat) such as marshes and swamps. Wetlands are recognized for their biodiversity and high productivity.

Some of the wetlands are identified in the ecoforestry data of the 4th decadal and the Quebec Topographic Database (BDTQ). In addition, some organizations working in conservation such as Ducks Unlimited Canada (DUC) have a wetland identification system that can be applied to hydrographic and ecoforestry data to help identify other wetlands that are not listed in ecoforestry data. The various types of wetlands covered by this analysis are presented in Table 4.10.

Table 4.10 Distribution of Wetland Types Present in the Study Area

Component	Total (ha)	% of the Study Area
Shallow water (beaver pond)	1.3	0.1
Herbaceous meadow	6.3	0.3
Shrubby swamp (including alder groves)	7.3	0.3
Treed swamp	17.1	0.7
Flooded swamp	13.1	0.5
Rich mixed swamp	10.6	0.5
Rich softwood swamp	15.4	0.7
Very poor softwood swamp	3.0	0.1
Unspecified wetland[1]	12.7	0.5
Peatlands	5.2	0.2
Total	***92.0***	***3.9***

[1] Bounded by photointerpretation, but not characterized in the field

Wetlands in the study area consist mainly of swamps and, to a lesser extent herbaceous meadows and peatlands. As demonstrated in the study carried out by Groupe Hémisphère (2012), wetlands often form large complexes that consist of several types of wetlands adjacent to each other.

Regarding wetlands in the study area, Genivar (2013) conducted a summary study in the project area without delineating the wetlands identified. These wetlands were not identified in the SIEF data or by photointerpretation. A characterization study was conducted in 2012 by Groupe Hémisphère (2012) on a section of the industrial park around the project area, but mainly in a 2.4 km^2 area located south of the Quai-Marcel-Dionne Road. This study identified and delineated the wetlands closest to the project area within the local study area. The data of this field survey were validated against the current situation of the project area by photointerpretation and added to the cartographic data of Ducks Unlimited (2009) and the data of the Ecoforest Information System (SIEF) (MERN 2015). The result of the merging of these data is shown in Map 4.2 and shows that the study area comprises approximately 92.0 ha of wetlands.

Characterization conducted south of the project area (Groupe Hémisphères 2012)

Field surveys made it possible to delineate some of these wetlands more accurately (Groupe Hémisphères, 2012). The wetlands characterized and located closest to the plant site are the MH4 and MH13 wetlands. The surface areas of all wetlands characterized in this survey and now present in the area are presented in Table 4.11. These wetlands are also mapped (Map 4.2) in addition to wetlands whose presence was established by the ecoforestry data and by photointerpretation.

Several wetlands (or complexes) have hydrological linkages, increasing their ecological value. These wetlands are: MH3, MH4, MH6, MH7, MH10, MH14 and MH16. In addition to filtering the water entering streams associated with them, these eight wetlands (or complexes) regulate the

water flow, limiting risks of flooding and thereby increasing the quality of the water. The MH4, and MH6, MH9 and MH10 wetlands (or complexes) are considered as peatlands.

Five wetlands are present in natural depressions. These wetlands (MH2, MH5, MH8, MH13, and MH15) have no hydrological connectivity and cover a small area (<1 ha). These wetlands have no role of particular importance.

Table 4.11 Wetlands Charactérized[1] in the Study Area

Number	Type	Hydrological Connectivity	Surface Area 2015[2] (ha)	Function
MH1	Treed swamp	No	1.62	—
MH2	Shrubby swamp	No	0.50	—
MH3	Treed swamp	Yes	2.27	› Water flow control › Improved water quality
MH4	Treed swamp, peatland	Yes	4.42	› Water flow control › Improved water quality
MH5	Treed swamp	No	0.70	—
MH6	Shrubby and treed swamp, peatland	Yes	4.13	› Water flow control › Improved water quality
MH7	Shrubby swamp	Yes	3.64	› Water flow control › Improved water quality
MH8	Shrubby swamp	No	0.25	—
MH9	Treed swamp, peatland	No	5.01	—
MH10	Treed swamp, peatland	Yes	1.60	› Water flow control › Improved water quality
MH13	Treed swamp	No	0.1	—
MH14	Treed swamp	Yes	0.22	› Water flow control › Improved water quality
MH15	Treed swamp	No	0.72	—
MH16	Shallow water	Yes	1.16	Water flow control

Note 1: Groupe Hémisphères, 2012

Note 2: The surface areas were re-evaluated by photointerpretation in order to represent changes in the area since the field trip. Source: 2015 photographs of the City of Saguenay (20 cm resolution).

4.3.2 Wildlife

4.3.2.1 Mammals

The environment characterizing the project area is not favorable to the presence of mammals. However, the surrounding environment, which is part of the study area, is favorable to several mammal species because of the large diversity of habitats present there: hardwood, mixed, softwood species of various age groups, wildland plantations, agricultural lands, peatlands, swamps, watercourses, etc. The northern part of the study area also includes a major water body, the Saguenay River, which hosts marine mammals during part of the year.

Terrestrial Mammals and Bats

Based on the Quebec mammals distribution map (Prescott and Richard, 2004), recent field inventories as well as other databases, 46 species of mammals are potentially using the study

area (Table 1, Appendix G). Nine of them are special status species, i.e. two vole species, a weasel species and six bat species.

Three wildlife species are present in the study area: moose, deer and black bear. However, the White-tailed Deer is present in very low density in Hunting Zone 28 (Huot and Lebel, 2012). Besides, no deer was observed in the study area during an inventory conducted in 2014 in the project area (CDPNQ, 2016b). As for the Moose, its presence has been confirmed in the study area (GENIVAR 2013). The presence of the Black Bear has also been confirmed (CDPNQ, 2016B). However, the collection of these two species in the vicinity of the study area is limited. No moose was hunted there from 2009 to 2014 and only one black bear was trapped there during that period (MFFP 2015), which seems to indicate low population densities. In Hunting Area 28, the density of the Black Bear was estimated at 0.73 bear/10 km^2 in 2001 (Lamontagne et al. 2006) while the density of the Moose was 0.9 moose/10 km^2 2006 (Dussault, 2015). It should be noted that the study area is located outside the distribution area of the Woodland Caribou (Quebec Woodland Caribou Recovery Team, 2013).

The study area straddles Fur-Bearing Animal Management Unit (UGAF) 44. In the 2012-2013 season the main fur-bearing animals trapped in this UGAF were the Canadian Beaver, the Muskrat, the Red Fox and the Pine Marten (MFFP 2015). The presence of beavers in the study area was confirmed after observing dams nearby (Groupe Hémisphères 2012). Although the Gray Wolf's range overlaps the study area, its presence in the project area is probably only occasional because this predator is sensitive to human activities.

As for the mammals, they are represented by five vole species, five shrew species, four mice species and the Star-Nosed Mole. Two of these species, i.e. the Rock Vole and the Southern Bog Lemming, are likely to be designated as threatened or vulnerable in Quebec. The Rock Vole prefers rocky environments while the Southern Bog Lemming uses grassy wetlands such as peatlands (Desrosiers et al. 2002).

Genivar (2010) conducted an inventory targeting small mammals in the study area, near the project site. This inventory confirmed the presence of three species, i.e. the Northern Short-tailed Shrew (*Blarina brevicauda*), the Masked Shrew (*Sorex cinereus*) and the Deer Mouse. The Rock Vole (whose preferred habitat consists of sugar maple, yellow birch and spruce stands) and the Southern Bog Lemming (whose preferred habitat consists of sphagnum peatlands and outlying areas) are species likely to be designated as threatened or vulnerable by the MRNF and are likely to be present in the limited study area. However, they were caught during the field inventory.

As far as bats are concerned, the range of seven species straddles the study area. Six of these species, including the Red Bat and the Hoary Bat, are special status species. The presence of these two species was also confirmed near the study area, i.e. the Saint-Fulgence Wildlife Preserve area (CDPNQ, 2016b). The habitats of interest for the six special-status species vary from one species to another and include rivers, wetlands, wooded areas or semi-wooded areas, glades and nearby buildings.

Marine Mammals

Two species of marine mammals are more likely to frequent the study area, i.e. the Common Minke Whale (*Balaenoptera acutorostrata*) and the Harbor Seal (*Phoca vitulina vitulina*). A third specie, the Beluga Whale (*Delphinapterus leucas*), which inhabits the St. Lawrence estuary, is designated “threatened” in Quebec and under the Species at Risk Act (SARA). However, the sighting of these species is rather exceptional in this section of the Saguenay River (Robert Michaud, Group for Research and Education on Marine Mammals, personal communication; Nadia Ménard, the Saguenay-Saint Lawrence Marine Park, personal communication). No seal haul-out is known in the study area.

4.3.2.2 Avifauna

The avifauna profile was prepared using data collected by the Regroupement Quebec Oiseaux (RQO) in the Studies of Bird Populations in Quebec (ÉPOQ) (cited in Genivar 2013). Adding to these observations are those mentioned in the Southern Quebec Breeding Bird Atlas (2012) that deserve attention because the breeding species use the area for breeding.

According to the ÉPOQ data bank, 258 species of birds belonging to 49 separate families were found in the vicinity of the study area (EPOQ 2010 Genivar cited in 2013). A large number of these species use the study area for nesting purposes. According to the Southern Quebec Breeding Bird Atlas (2012), 134 species nest in the administrative region of Saguenay-Lac-Saint-Jean, 88 species potentially use the reference territory, which consists of a 100 km^2 plot around the study area. They include 32 potential breeders, 28 probable breeders and 28 confirmed breeders. Table 2 of Appendix G provides a full list of these species.

Wetlands located near the study area, including along the Saguenay River, are habitats suitable for the feeding and resting of waterfowl during the spring and fall migrations. Besides, there are three waterfowl staging areas near the study area that are mentioned in the Wildlife Habitats Regulation (MERN, 2015). These waterfowl staging areas are located near the study area and are described in Section 4.3.4.

4.3.2.3 Ichthyological Fauna and Fish Habitat

Saguenay River

The Saguenay River is the second largest branch of the St. Lawrence River. It is over 167 km long, and has a maximum width of 6 km and three distinct ecosystems. The study area is located at the upstream end of the Bas-Saguenay area. This area starts at the Saint-Fulgence Spit where the Saguenay River becomes a marine ecosystem and becomes the Saguenay Fjord (Mousseau and Armellin 1995).

The ichthyological community found in the Saguenay River is relatively well documented because of the numerous surveys that produced data taken, among other sources, from the FHMIS (Fish Habitat Management Information System), and provided by Parks Canada as part of this study. It includes 68 species (Table 3, Appendix G) that are likely to be found in the section of the Saguenay River in the study area and are mostly common Quebec species.

The Saguenay River is also an important migration route for several fish species. It is frequented by four anadromous species and one catadromous species. The Rainbow Smelt, the

Anadromous Brook Trout, the Atlantic Salmon, and the Atlantic Tomcod are anadromous species and the American Eel is the only catadromous species (CRRNT, 2011). Some sectors of the Saguenay River, which are identified as spawning areas for the Capelin and the Smelt, are shown in Map 4.2 (section 4.3.4).

Other Streams and Drainage in the Study Area

The small watercourses (streams and drainage canals) crossing the study area could represent potential fish habitats. According to CRRNT (2011), the sector could be used by species of interest to sport such as the Brook Trout. However, the presence of a steep slope downstream of the watercourses flowing into the Saguenay is a strong indication that the water bodies of this subwatershed are naturally without fish (CDPNQ, 2016b).

An inventory of a section of the territory (2.4 km^2) covered by this study area and corresponding to the project site, was conducted by Environment Unlimited in 2011. The watercourses covered by the study are presented in Map 4.2. The watercourses were surveyed and characterized in order to determine the quality of the fish habitat. The results showed the absence of fish in the surveyed watercourses and the presence of insurmountable obstacles was noted for six of them, significantly limiting access to fish in the study area.

4.3.2.4 Amphibians and Reptiles

In total 13 species of amphibians and 4 reptile species could frequent the study area (Table 4, Appendix G; AARQ 2016a, b; Desroches and Rodrigue 2004; GENIVAR 2013). Three of these are special status species (Section 4.3.3.2). Water streams are habitats of interest for the Northern Two-Lined Salamander while ponds and lakes are favorable to aquatic frogs (Pickerel Frog, the Leopard Frog, the Mink Frog, the Green Frog, and the Bullfrog), other species of anurans (tree frogs, American toads), the Green Newt and the Snapping Turtle. As for the Wood Frog, the Spotted Salamander and the Blue-spotted Salamander, they use temporary spring ponds and adjacent terrestrial environments in the other stages of their life cycle. The Garter Snake and the Red-bellied Snake use a variety of habitats, including open areas, while the Backed Salamander and the Grass Snake are associated with woodlands.

4.3.3 Threatened, Vulnerable or Endangered Species

This section presents at-risk flora and fauna species found in the study area.

In Quebec, the list of wildlife species designated as threatened or vulnerable, published by the MFFP (2016) under the *Act respecting threatened or vulnerable species* (LEMV) (L.R.Q., Chapter E-12.1), includes 38 species, 20 of which are classified as endangered and 18 as vulnerable. Adding to this is the list of wildlife species likely to be designated as threatened or vulnerable, which includes 115 species. To date, the LEVM has also identified 78 threatened or vulnerable wild flora species and 332 species of vascular plants and 226 nonvascular plants (bryophytes) are also likely to be designated as threatened or vulnerable.

At the federal level, the *Species at Risk Act* (SARA) protects at-risk wildlife species in Canada. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies and distinct populations in Canada and produces the official list of endangered species. This list includes 726 extirpated, endangered, threatened, or

special concern species of the following taxonomic groups: mammals (77 species), birds (89 species), reptiles (45 species), amphibians (27 species), fish (158 species), arthropods (61 species) and mollusks (36 species), vascular plants (198 species), mosses (18 species) and lichens (17 species) (COSEWIC 2015).

4.3.3.1 Special Status Plant Species

The CDPNQ and studies specifically addressing the study area have identified 29 special status plant species. These are listed in Table 4.12. Map 4.2 shows where the ostrich fern is observed (Groupe Hémisphère, 2012).

During field visits (Hemispheres Group 2012) to the project site and the majority of the area south of the Quai-Marcel-Dionne Road, the potential presence of special status plant species had been assessed and verified. Three species showed a potential of occurrence based on the habitat type: the Dragon's Mouth[4] (*Arethusa bulbosa*), the Striated Corallorhize (*Corallorhiza striata*) and the Ostrich Fern (*Matteucia struthiopteris*). However, only the latter species was identified (Table 4.12). No other threatened or vulnerable plant species or species likely to be designated as such was observed. The area was considered as having a low or even no potential for the occurrence of other special status plant species.

Table 4.12 Special Status Plant Species in or Near the Study Area

Species		Status			Presence	
Common Name	**Scientific Name**	**Provincial**	**Federal**	**COSEPAC**	**Potential[1]**	**Confirmed[2]**
Eastern Fairy Slipper	*Calypso bulbosa* var. *americana*	Sensitive	-	-	Low	
Short-headed Bracted Sedge	*Carex cephalophora*	Sensitive	-	-	Unknown	
Hooked Threadwot	*Cephaloziella uncinata*	Sensitive	-	-	To be characterized	
Striped Coralroot	*Corallorhiza striata* var. *striata*	Sensitive	-	-	Fair	No
Hairy Dogtooth Moss	*Cynodontium schisti*	Sensitive	-	-	Historical	
Ostrich Fern	*Matteuccia struthiopteris*	Vulnerable to collection	-	-		Yes
Showy Lady's-slipper	*Cypripedium reginae*	Sensitive	-	-	Fair	
Beaked Bow Moss	*Dicranodontium denudatum*	Sensitive	-	-	To be characterized	
Blunted Earwort	*Diplophyllum obtusatum*	Sensitive	-	-	Good	
Slenderleaf Sundew	*Drosera linearis*	Sensitive	-	-	Excellent	
Small Round-leaved Orchid	*Galearis rotundifolia*	Sensitive	-	-	Low	
Asian Oak Fern	*Gymnocarpium continentale*	Sensitive	-	-	Good	
Robinson's Hawkweed	*Hieracium robinsonii*	Sensitive	-	-	Fair	

[4] No longer has special status (MDDELCC, 2016d)

Species		Status			Presence	
Common Name	**Scientific Name**	**Provincial**	**Federal**	**COSEPAC**	**Potential[1]**	**Confirmed[2]**
Woolly Beachheather	*Hudsonia tomentosa*	Sensitive	-	-	Excellent	
Tuckerman's Quillwort	*Isoetes tuckermanii*	Sensitive	-	-	Historical	
Greene's Rush	*Juncus greenei*	Sensitive	-	-	Extinct	
Large White-flowered Ground-Cherry	*Leucophysalis grandiflora*	Sensitive	-	-	Historical	
Pale-spike Lobelia	*Lobelia spicata*	Sensitive	-	-	Historical	
Two-Lobed Flapwort	*Nardia insecta*	Sensitive	-	-	To be characterized	
Southern Twayblade	*Neottia bifolia*	Sensitive	-	-	Low	
Obedient Plant	*Physostegia virginiana subsp. virginiana*	Sensitive	-	-	Historical	
Black-toothed Nodding Moss	*Pohlia melanodon*	Sensitive	-	-	To be characterized	
Sesquehana Sandcherry	*Prunus pumila* var. *susquehanae*	Sensitive	-	-	Good	
Diverse-leaved Bristle Moss	*Seligeria diversifolia*	Sensitive	-	-	To be characterized	
Variegated Peat Moss	*Sphagnum rubiginosum*	Sensitive	-	-	To be characterized	
Anticosti Aster	*Symphyotrichum anticostense*	Threatened	Threatened	Threatened	Good	
Ovate Four-Toothed Moss	*Tetrodontium ovatum*	Sensitive	-	-	To be characterized	
Clinton's Bulrush	*Trichophorum clintonii*	Sensitive	-	-	Low	

Note 1: Source: CDPNQ 2016a, if more than one mention of a species is recorded, the best occurrence quality is indicated.
Note 2: Source: Groupe Hémisphère 2012
In bold: nonvascular plants

Based on data taken from the CDPNQ data bank (2106), which was updated in January 2016, mentions of special status plant species present on the project site are unlikely. Two Ostrich Fern populations (50 m^2 and 300 m^2; Map 4.2) have been located in the study area (Groupe Hémisphères, 2012). These populations are located respectively 172 m and 140 m away from the project site. This species was also observed during earlier plant inventories (Genivar, 2010). Although designated as vulnerable to commercial harvesting, the Ostrich Fern is a common species and, therefore, is not considered a rare plant in Quebec.

4.3.3.1 Special Status Wildlife Species

The CDPNQ was consulted regarding mentions of special status wildlife species and the SOS-POP database (RQO, 2016). This section also describes the other mentions of interest in studies conducted in the study area and its surroundings. The CDPNQ and the SOS-POP database contain no mention of special status wildlife species in the study area. However,

certain species of interest are mentioned near the boundaries of the study area and deserve special attention. In addition, field inventories conducted in relation to separate projects show occurrences of wildlife species of concern in or nearby the study area (Table 4.13).

Three mammal species likely to be designated as threatened or vulnerable in Quebec could be present in the study area. These are the Least Weasel, the Rock Vole, and the Southern Bog Lemming. A specific field inventory conducted in 2010 (Genivar, 2010) was not conclusive as to the presence of these species near the project area. The Hoary Bat and the Red Bat are the only special status bat species recorded in the area of the Saint-Fulgence Wildlife Preserve, near the study area.

No avian species nesting sites were identified in the study area (SOS-POP 2016 and CDPNQ 2016b). However, there are confirmed nesting sites of special status bird species near the study area, or a site they could potentially use within the study area. Four special status species are mentioned: the Peregrine Falcon, the Barrow's Goldeneye, the Least Bittern and the Yellow Rail. Only the potential Peregrine Falcon habitats are located in the local study area (Map 4.2). In addition the SOS-POP database (Genivar 2013) mentions the possible presence of the Short-eared Owl and the Breeding Bird Atlas mentions the Barn Swallow as a "confirmed breeding species", and the Canada Warbler and Eastern Wood-Pewee as "possible breeding species" in the inventory site around the study area.

Table 4.13 Special Status Species Possibly Present in or Nearby the Local Study Area[1]

Species		Status		
Common Name	**Scientific Name**	**Provincial**	**Federal List of Species at Risk Act**	**COSEPAC**
Mammals				
Least Weasel	*Mustela nivalis*	SLDTV	-	-
Rock Vole	*Microtus chrotorrhinus*	SLDTV	-	-
Southern Bog Lemming	*Synaptomys cooperi*	SLDTV	-	-
Silver-Haired Bat	*Lasionycteris noctivagans*	SLDTV	-	-
Hoary Bat	*Lasiurus cinereus*	SLDTV	-	-
Northern Long-Eared Bat	*Myotis septentrionalis*	-		Endangered
Red Bat	*Lasiurus borealis*	SLDTV	-	-
Big Brown Bat	*Eptesicus fuscus*	-		
Little Brown Bat	*Myotis lucifugus*	-		Endangered
Eastern Pipistrelle	*Perimyotis subflavus*	SLDTV		
Birds				
Peregrine Falcon	*Falco peregrinus anatum*	Vulnerable	Special concern	Special concern
(Barrow's Goldeneye)	*Bucephala islandica*	Vulnerable	Special concern	Special concern
Short-eared Owl	*Asio flammeus*	SLDTV	Special concern	Special concern
Barn swallow	*Hirunda rustica*	-	-	Threatened
Canada Warbler	*Wilsonia canadensis*	SLDTV	Threatened	Threatened
(Least Bittern)	*Ixobrychus exilis*	Vulnerable	Threatened	Threatened
Eastern Wood-Pewee	*Contopus virens*	-	-	Special concern
(Yellow Rail)	*Coturnicops noveboracensis*	Threatened	Special concern	Special concern

Species		Status		
Common Name	**Scientific Name**	**Provincial**	**Federal List of Species at Risk Act**	**COSEPAC**
Fish				
American Shad	*Alosa sapidissima*	Vulnerable	-	-
American Eel	*Anguilla rostrata*	SLDTV	-	Threatened
Striped Bass	*Morone saxatilis*	-	Extinct	Endangered
Atlantic Sturgeon	*Acipenser oxyrinchus*	SLDTV	-	Threatened
Northern Wolffish	*Anarhichas denticulatus*	SLDTV	-	-
Spotted Wolffish	*Anarhichas minor*	SLDTV	-	-
Northern Cod	*Gadus morhua*	SLDTV	-	Endangered
Thorny Skate	*Amblyraja radiata*	-	-	Special concern
Atlantic Salmon	*Salmo salar*	-	-	Special concern
Deepwater Redfish	*Sebastes mentella*	-	-	Endangered
Amphibians and Reptiles				
Ring-Necked Snake	*Diadophis punctatus*	SLDTV	-	-
Pickerel Frog	*Lithobates palustris*	SLDTV	-	-
(Wood Turtle)	*Clemmys insculpta*	Vulnerable	Special concern	Threatened
Snapping Turtle	*Chelydra serpentina*	-	Special concern	Special concern

SLDTV: On the list of species likely to be designated threatened or vulnerable (*Act Respecting Threatened or Vulnerable Species*).

IN BOLD: Species listed within the study area or whose possibility of occurrence is high.

(Between brackets): Species whose potential presence was mentioned, but whose presence was considered very unlikely in the local study area.

[1]**Sources:** CDPNQ 2016b; Genivar 2010; Groupe Hémisphères, 2012; Quebec Breeding Birds Atlas (2012), Parks Canada (2016)

Two recognized Peregrine Falcon nesting sites were observed near the study area, on the north bank of the Saguenay River and north of the Baie des Ha! Ha! This medium-sized bird of prey usually nests on cliffs located near water bodies. It goes hunting in large open areas such as rivers, marshes, beaches, mudflats and fields, which offer good visibility and facilitate the pursuit and capture of prey. Therefore, this species could possibly nest in the steep cliffs of the study area (Map 4.2) and use the study area as a hunting ground.

The CDPNQ (2016b) indicates that the Barrow's Goldeneye could be present in the immediate vicinity of or even inside the study area. This species usually nests around lakes, and often around high-altitude, fishless lakes. The absence of fish populations in these lakes usually allows them to have a greater biodiversity and increased abundance of benthic invertebrates and amphibians. These lakes are, therefore, prime habitats for the Barrow's Goldeneye, a species designated as vulnerable at the provincial level and as a species of concern at the federal level. Obstacles to free passage of fish were noted (Envill, 2011 and CDPNQ, 2016b) and fishless lakes with a surface area smaller than 15 ha located in mountainous areas, at an altitude of over 500 m can be potential nesting habitats for this species (Environment Canada, 2013) in the study area. There is no lake matching this definition in the study area (altitude <500 m).

The bird species mentioned by the CDPNQ (2016b) include the Least Bittern, a secretive bird that nests mainly in the large cattail marshes of Southern Quebec. This bird breeds in the most urbanized regions of Southern Quebec, i.e. where habitat losses were the most significant. Large marshes with dense vegetation are likely to host broods of this species, but it is unlikely to be found on the project site. The places where the species is mentioned are located on the north bank of the Saguenay River, which is outside the study area.

Similarly, the CDPNQ data show the Yellow Rail was identified in the same area as the Least Bittern, i.e. on the north bank of the Saguenay River, outside the study area. The Yellow Rail prefers the surface of freshwater marshes and large expanses of brackish water where the vegetation is dense and short. Dense sedge marshes or other low-growing plants are the Yellow Rail's preferred environments (MFFP, 2010). It is unlikely to be found in the study area.

The presence of a couple of Short-eared Owls was also mentioned in 1997 (SOS-POP bank cited in Genivar 2013). The Short-eared Owl has long been associated with marshes where the herbaceous vegetation reaches 50 cm to 1 m in height. However, it frequents several other types of open habitats such as wet meadows and some agricultural lands. Since the habitat of this species could be found in the study area, a specific inventory was conducted to confirm its presence in 2012 (Genivar, 2012). These works did not make it possible to validate the presence of this species in the area. No sign of its presence has been noted.

The Barn Swallow is a breeding species whose presence in this area has been confirmed. This species has only been assigned a status by COSEWIC. As yet, little is known about the causes of its decline. This species is capable of nesting in a variety of artificial structures (barns, bridges, etc.) and take advantage of the feeding opportunities offered by rural landscapes that have been opened and altered by humans.

The Canada Warbler is the only special status bird species recently spotted within the boundaries of the study area (Groupe Hémisphère, 2012 and Genivar, 2010). This species breeds in hardwood and coniferous forests that are usually humid and have a well-developed dense shrub layer. Dense shrub and understory vegetation helps conceal nests usually located on the ground or near mossy logs or roots. Its breeding status is "Possible" according to the Southern Quebec Breeding Birds Atlas (2012). The species could therefore use the project area.

The Eastern Wood-Pewee was only assigned a status by the COSEWIC. It is known to nest in a wide range of habitats, from the large mature forest to mature orchards, small woodlots, roadsides and even urban trees. It is usually associated with clearings, canopy gaps and forest edges (McCarty, 1996).

Some of the fish species listed in the section of Saguenay River located in the study have a status under Quebec's Act Respecting Threatened or Vulnerable Species and only one of them has a status under the SARA (Table 4.13). No specific mention has been identified within the study area.

None of the three species of amphibians and reptiles identified to have a range overlapping the study area has a high potential of occurrence in the study. These species are the Pickerel Frog, the Ring-necked Snake and the Snapping Turtle. The Wood Turtle (*Glyptemys insculpta*), a

species designated as “vulnerable” in Quebec and “threatened” under the federal Species at Risk Act (SARA) was seen in 1997 in Saint-Félix-D’Otis (AARQ 2016b), i.e. outside the study area. This species is usually associated with meandering rivers with a sand and gravel substrate. It is also associated with nearby terrestrial environments (Desroches and Rodrigue, 2004). This turtle’s preferred habitat is missing from the local study area.

4.3.4 Protected Areas, Conservation Areas and Sensitive Areas

The Saguenay River has three known waterfowl staging areas (WSAs) recognized under the *Regulation respecting wildlife habitats*. However, these WSAs are located outside the study area, near the Saguenay River. The Rang Saint-Martin WSA is the closest to the study area as it is located 320 m away from there (Map 4.2). The WSAs of the Anse-aux-Foins and Cap à la Loutre are located further north of the study area, on the opposite bank of the Saguenay River.

Some areas that are more sensitive for the fish fauna are known to exist in the Saguenay River, near the study area (Map 4.2). This information, which was provided by Parks Canada, concerns the spawning areas of the Smelt and the Capelin. The first smelt breeding area is located within the study area and the second one is located 250 m north of the study area, on the north bank of the river. A capelin spawning area is also identified north of the study area, at a distance of 275 m.

4.4 Human Environment

To describe the human environment for the purpose of this project, the local study area will be analyzed in terms of the direct impacts to be potentially felt there. Considering the regional nature of the majority of the project’s socio-economic benefits, an extended study area is also considered in order to analyze these components. This extended study area stretches up to the boundaries of the City of Saguenay. Where relevant, the Saguenay-Lac-Saint-Jean region was also considered. The various study areas are defined in Section 4.1.

4.4.1 Administrative Framework

The proposed site of the pig iron plant is located in the City of Saguenay, within the boundaries of the Grande-Anse Intermodal Marine Industrial Park (Map 4.1). The City of Saguenay does not belong to any Regional County Municipality (RCM)[5]. It is part of the administrative region of Saguenay-Lac-Saint-Jean (No.2). The territory of the Saguenay-Lac-Saint-Jean also includes the RCMs of Fjord-du-Saguenay, Domaine-du-Roy, Maria-Chapdelaine, Lac-Saint-Jean-Est and the territory of the Innu community of Mashteuiatsh (MAMOT, 2015).

The City of Saguenay, which was founded in 2002 following the merger of four cities (Chicoutimi, Jonquière, La Baie, and Laterrière) and three municipalities (Canton Tremblay, Lac-Kénogami and Shipshaw), now has three districts: Jonquière, Chicoutimi and La Baie. The proposed plant is located in the District of La Baie (Ville de Saguenay, 2016a).

The City of Saguenay covers an area of 1,137 km^2, i.e. just over 1% of the total area of the Saguenay-Lac-Saint-Jean region. It is enclosed in the RCM of Fjord-du-Saguenay and is

5 The municipalities outside RCMs are local municipalities vested with certain powers of an RCM.

bordered on the west by the RCM of Lac-Saint-Jean-Est (Affaires municipales et occupation du territoire, 2015).

Since its creation Saguenay has become a major urban agglomeration in the Saguenay-Lac-Saint-Jean region. Considered as the region's metropolis, it is the 7th largest city in Quebec and has a population of over 146,000 inhabitants.

The Intermodal Maritime Industrial Park was created in order to develop an industrial zone near the Grande-Anse Terminal which is believed to be accessible by sea and by road and is connected to the railway network (Port of Saguenay, 2015a). This park, which is located outside the region's urban concentrations, lies in an industrial development zone. This zone is defined in the development plan and covers an area of over 150 ha.

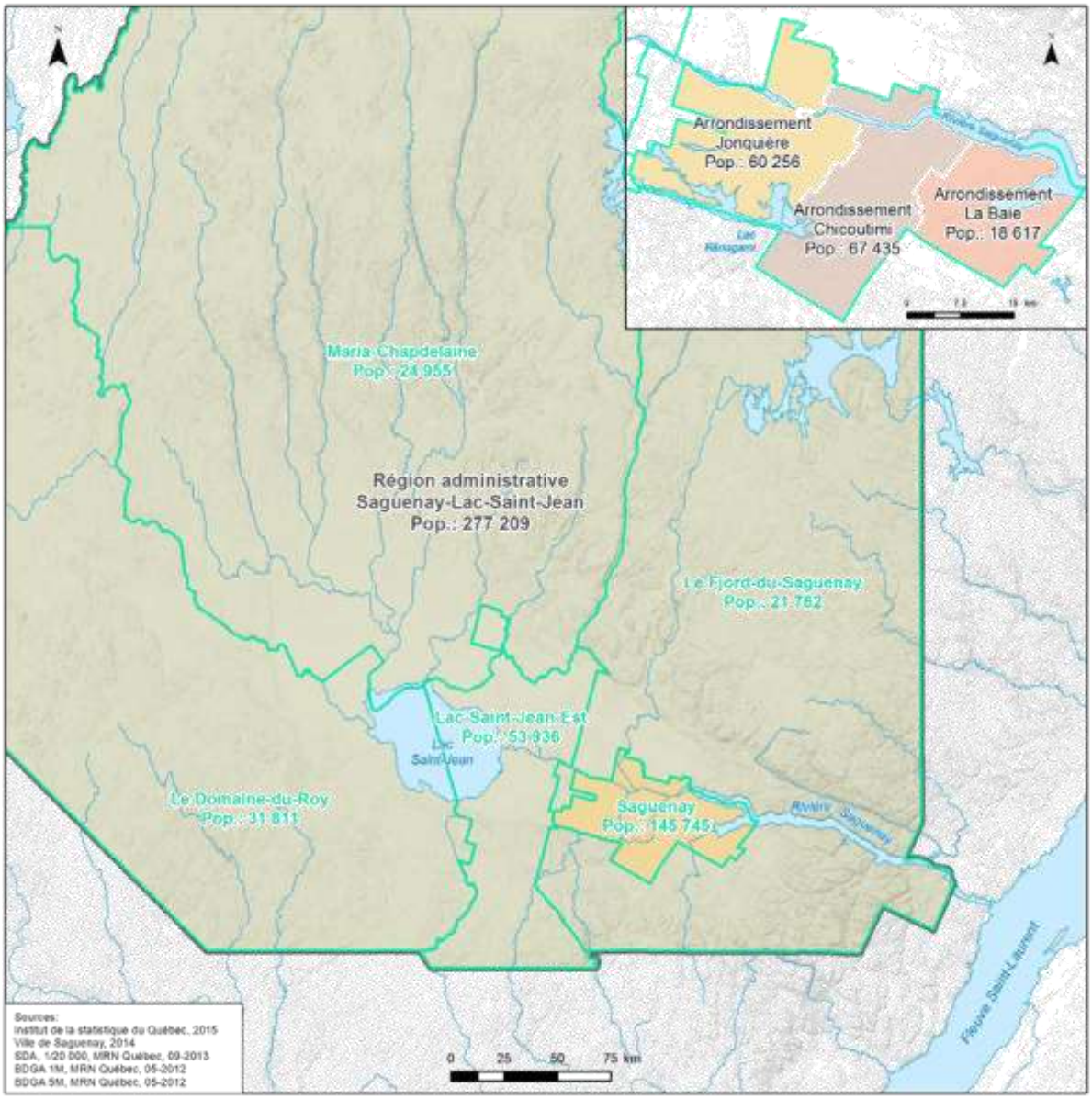
Map 4.1 shows the location of the project site, the Districts of the City of Saguenay and the boundaries of the local study area.

4.4.2 Socioeconomic Profile

This section provides a general overview of the socio-economic profile of the extended study area, which corresponds to the boundaries of the City of Saguenay. For a more complete picture, the data are compared with those of the Le Saguenay-et-son-Fjord[6] census division and the Province of Quebec. In addition, some data are compared to those of the Saguenay-Lac-Saint-Jean region. Figure 4.3 indicates the location of the RCMs of the administrative region of Saguenay-Lac-Saint-Jean and the Districts that form the City of Saguenay.

6 Since the territory of the City of Saguenay is landlocked in the RCM of Fjord-du-Saguenay, the census division of Le Saguenay-et-son-Fjord, which includes both territories, was chosen for population data comparison purposes.

Figure 4.3 Territories of Saguenay-Lac-Saint-Jean and their Population



The data assembled in this study include information on the population and the socioeconomic aspects of the study area. They come mainly from the following documentary sources:

- The Revised Land Use and Development Plan of the City of Saguenay (2011);
- Various profiles of the Saguenay-Lac-Saint-Jean region (Ministère de l'Économie, de l'Innovation et des Exportations, 2015 ; Desjardins, 2015 ; Ministère de l'Agriculture, des Pêcheries et de l'Alimentation, 2016);
- Studies, compilations and census information from the 2011 Population Census and the 2011 National Household Survey from Statistics Canada.

The data presented in this section are the most recent publically available data. Organizations and local representatives were also consulted as part of this study and helped validate certain trends and statistics.

4.4.2.1 Population

Based on Statistics Canada data, the City of Saguenay had a population of 144,746 inhabitants in 2011, i.e. 52.7% of the population of the Saguenay-Lac-Saint-Jean region, which totaled 27,480 inhabitants (Statistics Canada, 2012a and b). Contrary to the trend prevailing in all manufacturing areas experiencing considerable population growth, the Saguenay-Lac-Saint-Jean region has seen a small increase in its population in recent years (MEIE, 2015). From 2006 to 2011, the population of the Saguenay-Lac-Saint-Jean increased by 0.8% compared to the Province of Quebec's 4.7%. The population of the City of Saguenay has increased by 0.7% since 2006. A similar demographic growth was recorded across its administrative area, but is well below that of the entire province (Statistics Canada, 2012a and b). The long-term demographic outlook points to a slowdown in population growth. From 2011 to 2016, the expected increase across the region was 0.6%, compared to 4.4% in the Province of Quebec while the projected increase between 2021 and 2026 is 0.1% (MEIE, 2015).

According to the Statistics Canada data presented in Table 4.14, the population of the Saguenay-et-son-Fjord as recorded by the census division totaled 165,211 inhabitants in 2011. The City of Saguenay then accounted for 87.6% of the entire territory. Between 2006 and 2011, the population variation of the City of Saguenay, i.e. 0.7%, was similar to that Saguenay-et-son-Fjord, which was 0.9% for the same period (Statistics Canada, 2012b and 2012C).

Table 4.14 provides population data for the City of Saguenay, and data from the Saguenay-et-son-Fjord census division and the Province of Quebec.

Table 4.14 Population Data for the Regional Study Area

Population and Housing Figures	City of Saguenay	Saguenay-et-son-Fjord	Province of Quebec
Population in 2011	144,746	165,211	7,903,001
Population in 2006	143,692	163,717	7,546,131
Population variation between 2006 and 2011	0.7%	0.9%	4.7%
Total private homes	66,798	77,817	3,685 926
Private homes occupied by habitual residents	64,228	72,599	3,395 343
Population density per square kilometer	128.5	4.0	5.8
Land surface area (in square kilometer)	1,126.5	41,358.9	1,356,547.0

Source: Statistics Canada, 2012a, 2012b and 2012c

Just under 70% of the population of the City of Saguenay is of working age (15 to 64). This percentage is similar to those recorded in the Saguenay-et-son-Fjord area and across Quebec. According to the Statistics Canada data (2012a, b and c) in Table 4.15, the median age of the population of the City of Saguenay was 45.6 years in 2011. This is similar to the census division's median age (45.4 years), but slightly higher than the median age for the entire province (41.9 years).

Table 4.15 Distribution of the Population of the Regional Study Area by Age

Age	City of Saguenay	Saguenay-et-son-Fjord	Quebec
0 to 14 years	14.06%	14.32%	15.93%
15 to 24 years	12.34%	12.19%	12.41%
25 to 44 years	22.81%	22.88%	25.83%
45 to 64 years	33.01%	33.23%	29.92%
65+ years	17.78%	17.38%	15.91%
Median age of the population	45.6	45.4	41.9
% of the population aged 15 or older	85.9%	85.7%	84.1%

Source: Statistics Canada, 2012a, 2012b and 2012c

In 2011, the majority of the population of the City of Saguenay spoke French at home (98.8%), while 0.5% spoke English, 0.2% spoke English and French, and 0.3% spoke a non-official language. French is the predominant language in the study area, which is similar to the situation in the entire Province of Quebec where 80.0% of the population speak French most often at home, while 9.8% use English and 7.1% speak a non-official language (Statistics Canada, 2012a).

4.4.2.2 Education

The City of Saguenay is served by the school boards of the Rives-du-Saguenay (Chicoutimi and La Baie Districts) and Jonquière (Jonquière District) that provide primary and secondary school education services, vocation training services, adult education services, and vocational services tailored to businesses.

The education centers located in the District of La Baie - where the proposed project site is located – are as follows:

- Primary schools (3): Sainte-Thérése, Médéric-Gravel, Saint-Joseph;
- Secondary schools (1): Grandes-Marées;
- Adult education (1): Durocher Adult Education Center;
- Vocational training (2): Vocational Training Center of the Fjord (Pavillon La Baie), Rural Family House.

Vocational training centers offer programs leading to a Vocational Studies Diploma (VSD) or an Attestation of Vocational Specialization (AVS). The Vocational Training Center of the Fjord in La Baie provides a series of training courses in tinplate and sheet metal work, foundry, welding-assembly and high pressure welding. Custom-made refresher courses are offered based on specific needs expressed by businesses.

La Baie students also have access to other post-secondary institutions (colleges and universities) in the City of Saguenay. These include General and Vocational Education Colleges (CÉGEP) in Chicoutimi and Jonquière that provide pre-university and technical education programs. These colleges provide services to companies and have specialized research centers (Industrial Health and Safety Training Center, Quebec Aviation Training Center, Bureau of Metallurgical Research Bureau (Chicoutimi); Automated Production Center (Jonquière)). Other research centers and training programs focused on the metal industry are present in Saguenay (Quebec Aluminum Research and Development Center (CQRDA), Aluminum Technology Center (CTA)).

The University of Quebec in Chicoutimi (UQAC) was founded in 1969. It has three cycles of higher education in addition to being active in research. In 2014, UQAC hosted some 7,500 students enrolled in a hundred programs. Since it is affiliated to the University of Quebec network, its research activities are structured into five areas of excellence in connection with the region's economic activities: Boreal Forest, Population Studies, Aluminum, Atmospheric Icing and Mineral Resources. Since 2006 UQAC, in collaboration with the Chicoutimi Health and Social Services Center (CSSSC) and the University of Sherbrooke, has also been offering a comprehensive medical education program: Family Medicine, Basic Specialties and Pharmacy (Ville de Saguenay, 2011).

The City of Saguenay has a low proportion of people aged 15 years or older with university education (Table 4.16). Like with other equivalent Quebec regions, this is due, firstly, to the predominance of technical jobs, especially those related to the industrial and agricultural sectors which attract youth to specialized vocational training. As mentioned during exploratory consultations, the low proportion of university students is also due to young people's exile to large urban centers. In fact, the retention of youth in the region – and also in skilled jobs - has been identified as a major challenge by the stakeholders met.

There are more women than men with no certificate, diploma or degree. However, among those with post-secondary education, women reach a higher level of education. This trend is also observed in the census division data and across the entire Quebec territory.

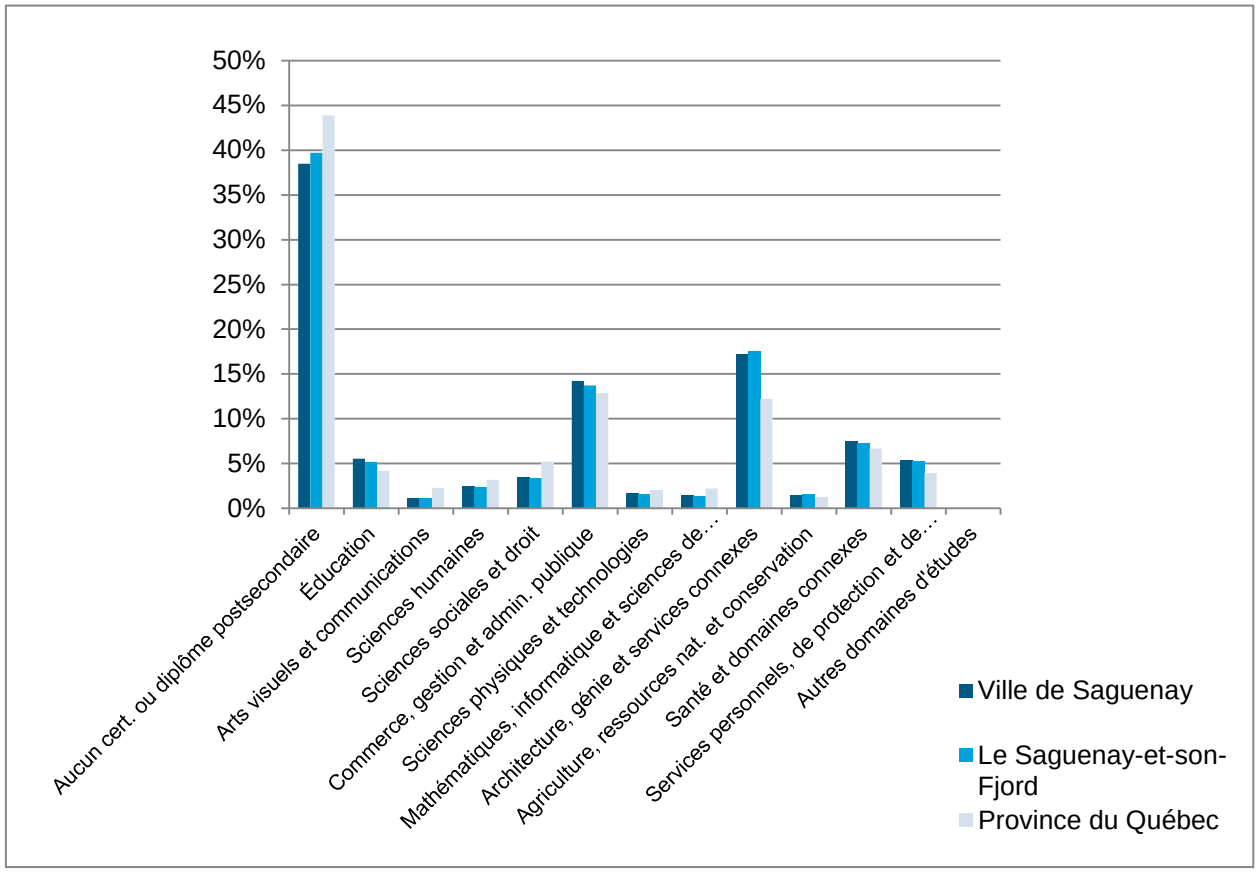
Table 4.16 Educational Attainment (Population Aged 15 and Over)

Educational Attainment	City of Saguenay			Saguenay-et-son-Fjord			Quebec		
	Tot.	Male	Female	Tot.	Male	Female	Tot.	Male	Female
No certificate, diploma or degree	20%	43%	57%	21%	44%	56%	22%	50%	50%
High school diploma or equivalent	19%	46%	54%	19%	46%	54%	22%	46%	54%
Post-secondary certificate, diploma or degree	62%	52%	48%	60%	53%	47%	56%	50%	50%
• Apprenticeship or trade school certificate or diploma*	37%	61%	39%	39%	62%	38%	29%	61%	39%
• Certificate or diploma from a college, a CEGEP or other non-university educational institution*	32%	47%	53%	32%	47%	53%	30%	44%	56%
• Certificate or university diploma below bachelor level*	7%	41%	60%	7%	41%	59%	8%	41%	59%
• Certificate, diploma or degree equivalent to the bachelor or higher*	23%	49%	51%	22%	49%	51%	33%	48%	52%

Source: Statistics Canada 2011; *Data from the *Post-secondary certificate, diploma or degree category*.

As shown in Figure 4.4, the major fields of study mostly pursued by the inhabitants of the City of Saguenay are architecture, engineering and related services (17% of people aged 15 and older) and trade, management and public administration (14% of people aged 15 and older). The fields of health, education and personal, protection and transportation services also attract more students from the area (7%, 6% and 5% respectively). Of these subjects architecture, engineering and related services are the ones that attract men the most. Women tend to prefer subjects relating to health, education and trade. It should be noted that the City of Saguenay has a higher proportion of residents with a postsecondary certificate or diploma than the rest of the region or the province of Quebec, (Statistics Canada, 2013).

Figure 4.4 Post-secondary Education Subjects Studied by the Population of the Study Area



Source: Statistics Canada, 2013.

4.4.2.3 Economy and Employment

Saguenay–Lac-Saint-Jean Region

Based on the 2015 Regional Profile of Saguenay-Lac-St-Jean established by the Ministry of Economy, Innovation and Exports (MEIE), the structure of the region's economy is similar to that of the province although the primary and secondary sectors are more significant. In 2014, the number of primary sector jobs was twice as high (4.5%) as in the province (2.2%), while the number of jobs in the secondary sector was slightly higher (19.1%) than in the province (18.4%). As for the tertiary sector, it accounted for the majority of all jobs in the region (76.4%) even though this rate was lower than the province's rate (79.4%) (MEIE, 2015).

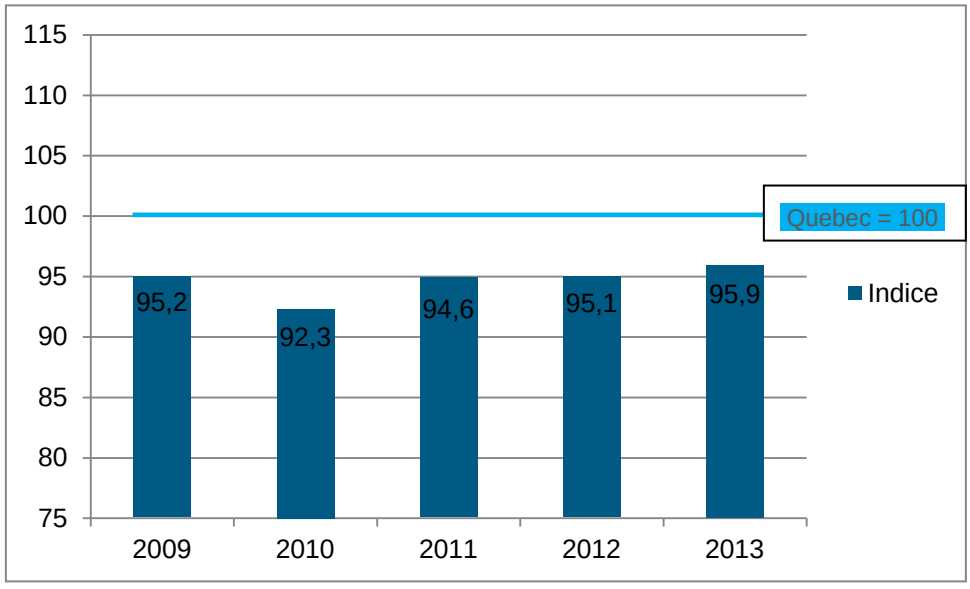
The region's economic structure has remained unchanged over the past 25 years, during which the manufacturing sector has grown in importance (Desjardins, 2015). The primary sector continues to play a key role vis-à-vis the province and the implementation of the major projects under consideration - including mining projects - would give new impetus to the local economy. Several economic diversification initiatives connected with the agricultural and tourism sectors have been undertaken in recent years in order to boost the regional economy.

Regarding the labor market of the administrative region of Saguenay-Lac-St-Jean, a thousand (1,000) jobs were lost in 2014. The employment rate in the region (54.6%) posted a slight decline of 0.4% in 2014 compared to 2013 (same variation in Quebec -59.7%). Since 2012, the region's unemployment rate has increased and remains higher than the province's rate (9.9% vs 7.7%). The region's unemployment rate is among the highest in Quebec (MEIE, 2015). In 2015, the labor market focused on consolidation rather than job creation and it is forecast that 2016 should be a period of gains (Desjardins 2015).

The Gross Domestic Product (GDP) measures the value of goods and services produced within the borders of a given economy. It is used to measure size, whereas its evolution is an indicator of the performance of the economy. The Quebec Institute of Statistics estimated that the GDP of the Saguenay-Lac-St-Jean region stood at $10.5 billion in 2014, with a positive variation of 2.7% compared to 2013. This change is equivalent to that recorded in the entire province (ISQ, 2015). Desjardins estimated that, in 2015 GDP, growth in the region would reach 3% and remain at the same level in 2016. This rate is lower than the province's rate which is estimated at 3.5% for 2016 (Desjardins, 2015).

More generally, the economic situation of the Saguenay-Lac-St-Jean region can be characterized by the economic development index. Since 2010, the region's index has increased and totaled 95.9 in 2013. Despite this positive result, the index remains below the Quebec average of 100 (Figure 4.5). These good results are largely due to the improvement of the education-related data in recent years (MEIE, 2015).

Figure 4.5 Economic Development Index for the Saguenay-Lac-St-Jean Region



Source: MEIE, 2015.

City of Saguenay

Economic activities in the City of Saguenay are distributed in the same way as in its administrative region. The only difference is that the primary and secondary sectors have more weight at the regional level (Table 4.17). The main providers of jobs are the aluminum, food, wood, energy, trade, tourism or biomedicine sectors.

The primary sector for workers aged 15 and older (73,730 people) accounts for 2% of jobs. These jobs are equally distributed between the agricultural, forestry, fishing and hunting, and mining and quarrying activities. The secondary sector accounts for 21% of jobs. These jobs are mostly manufacturing and construction jobs. Most jobs are tertiary sector jobs (77%), mainly in retail trade, health care and social care, and educational services (Statistics Canada, 2013).

Table 4.17 Comparative Employment Data by Sector

Industry	City of Saguenay	Saguenay-et-son-Fjord	Province of Quebec
Primary sector	**2%**	**3%**	**3%**
Agriculture, forestry, fishing and hunting	1%	2%	2%
Mining, quarrying, and oil and gas extraction	1%	1%	1%
Secondary sector	**21%**	**22%**	**22%**
Construction	7%	7%	6%
Manufacturing	11%	12%	12%
Transportation and warehousing	3%	3%	4%
Tertiary sector	**77%**	**75%**	**75%**
Retail trade*	14%	14%	12%
Health and social care*	13%	13%	12%
Education services*	9%	8%	7%
Government agencies*	8%	8%	7%
Lodging and catering services*	7%	7%	6%
Professional, scientific, and technical services*	6%	6%	7%

Source: Statistics Canada, 2013; *Main sub-sectors of the tertiary sector.

As the region's main urban center, the City of Saguenay stands out by the presence of large industries and commercial businesses. It has three industrial parks (Jonquière, Chicoutimi and La Baie) which cover an area of 8,496,138 m^2. Its parks are served by a full transportation network (sea, road, air and rail). As far as business is concerned, the city has five central business districts and trade points with a concentration of various services to the population.

Table 4.18 presents the main employers in the City of Saguenay, deployed at various locations of the city. These include Rio Tinto Alcan (3,319 employees) in the private sector and the Integrated University Health and Social Services Centers (CIUSSS) of Saguenay-Lac-Saint-Jean (6,074 employees) in the public sector. The public and administrative sectors (23,415 jobs provided by 847 companies); the construction and manufacturing sectors (13,934 jobs in 622 companies) and the wholesale and retail trade sectors (13,022 jobs in 988 companies) provide the majority of jobs (Ville de Saguenay, 2012b).

Table 4.18 Main Employers in the City of Saguenay

Company	Area of Activity	Number of Employees
Private sector		
Rio Tinto Alcan	Primary production of alumina and aluminum	3,319
Groupe Ceger	Construction of buildings and industrial structures	773
CGI	Design of computer systems and related services	540
Group Fernand Gilbert ltée	Site preparation contractors	485
Groupe CANMEC	Repair and maintenance of commercial and industrial machines and equipment	460
Acier MYK Inc.	Contractors in steel structure installation and precast concrete	350
Garda	Safe-keeping and patrolling services	300
Reboitech inc.	Forestry support services	300
Entrepôts Costco	Hypermarkets	280
Groupe Alfred	Residential construction	275
Public sector		
Integrated University Health and Social Services Centres (CIUSSS) SLSJ	Health and social services	6,074
Canadian Forces Base of Bagotville	National security and defense	1,800
City of Saguenay	Public administration	1,600
Rives-du-Saguenay School Board	Education	1,474

Source Promotion Saguenay (2016) – Personal communication

The Statistics Canada 2011 data show that the employment rate of the City of Saguenay was slightly higher than the census division rate. This is partly due to the concentration of economic activities. However, it is lower than the province's rate (Table 4.19). Regarding unemployment, the City of Saguenay's rate (6.7%) was lower than the province's unemployment rate (7.2%). Men had a higher unemployment rate (7.5%) than women (5.8%).

Table 4.19 Employment and Unemployment Rate in 2011

Parameters	City	Saguenay-	Province
Working population	73 730		
Employment rate	56.9%	56.6%	59.90%
Male	62.4%	62.0%	63.5%
Female	51.5%	51.3%	56.5%
Unemployment rate	6.7%	7.1%	7.2%
Male	7.5%	7.9%	7.9%
Female	5.8%	6.2%	6.5%

Source: Statistics Canada, 2013

Table 4.20 presents the 2011 income of households in the study area. The average individual income was higher in Saguenay ($35,669) in its census division ($35,309), but was lower than the provincial average ($36,352). The male population of Saguenay ($44,279) earned more than the male population in the province ($42,343), which can be partly due to the presence of large manufacturing firms that tend to offer better salaries. Besides, these higher salaries lead

to some disparities in the local area, which are mainly perceptible in the difference between the median and average income rates.

Table 4.20 Individual and Household Income (CAD)

Income	City of Saguenay	Saguenay-et-son-Fjord	Province of Quebec
Average individual income *	35,669	35,309	36,352
Men	44,279	43,920	42,343
Women	27,039	26,534	30,523
Number of private households	64,230	72,600	3,395,220
Total median household income	52,534	52,676	51,842
Total average household income	64,083	63,905	66,205
Net median household income	46,416	46,631	45,968
Net average household income	53,555	53,527	55,121

Source: Statics Canada, 2013; *for the income-earning population.

4.4.2.4 Other Regional Particularities

› Aluminum Valley

Since the commissioning of the Arvida plant in 1926, the aluminum sector has been associated with evolution of the City of Saguenay. Today, the city hosts major companies including Rio Tinto Alcan. On a larger scale, the region has 4 aluminum smelters and produces about one million metric tons annually (Ville de Saguenay, 2012b).

The region has recently been recognized by the Government of Quebec as the Aluminum Valley. A project development assistance agency linked to the aluminum sector has also been created (the *Société de la Vallée de l'aluminium*) in order to support new initiatives, offering various services to developers and grouping together resources available in the region.

The region has more than 7,500 jobs directly or indirectly related to the aluminum industry. Various research centers have been established in order to support this industry. These include the Aluminum Research and Development Center of Quebec (CQRDA), the Aluminum Technology Centre (CTA) or the University Research Center on Aluminum (CURAL). In fact the region has qualified workers who are familiar with this industry (Ville de Saguenay, 2011).

› Agriculture Industry

The Saguenay-Lac-St-Jean region has a very dynamic agricultural sector. It is one of Quebec's main producers of oats, canola and seed potatoes, and has several certified organic farms. The large majority of the region's companies specialize in dairy, beef and sheep production. In fact, the *Ferme des Quatre Vents* is located near the project site, in south where about 1,500 liters of milk are produced every day. The area is also known for its blueberry producers (400 companies) and, more recently for its camerise producers.

The food processing industry is considered as a sector with a strong development potential. For example, in 2013, some 1,225 agricultural companies operating in the region generated $271 million in income, and 15,300 people were working in the bio-food sector (MAPAQ, 2016).

› Forest Industry

Historically the forest, sawmill and pulp and paper industry has always been present in the region. Every year, nine million cubic meters are harvested, which represents about 20% of timber from Quebec. Forty companies employing about 1,350 persons are operating in Saguenay. As with aluminum, the region has set up research centers that support the development of forestry activities. These centers include the Research Group on Renewable Resources in the Boreal Forest (GR3MB) and the Commercial Boreal Forest Research Consortium (Ville de Saguenay, 2011).

The forest industry has been struggling to stabilize in recent years and is facing several challenges. Among other challenges companies must face a new forest regime limiting their supply quotas and thereby reducing their production capacity. In addition, this sector has to face an aging workforce and a large number of people will be retiring in the coming years. Despite these difficulties, the timber industry remains one of the region's main economic sectors.

› Military Base

The City of Saguenay hosts the Bagotville military base which was founded in 1942. Initially, the purpose of this base was to protect the dams of the Alcan aluminum company and train pilots. Today, the base hosts the 3 Wing Bagotville and is one of only two fighter plane bases of the Canadian Air Forces. It carries out air defense, combat support and search and rescue missions (Ville de Saguenay, 2011).

The military base is currently one of the largest employers in the region. The airport, which is used for both military and civilian purposes, has two perpendicular runways that can accommodate all types of aircraft.

› Tourism Industry

In recent years the region has developed several initiatives in order to fulfill its tourism potential. The tourism industry benefits from the presence of three national parks (Monts-Valin, Fjord-du-Saguenay, Saguenay-St-Laurent Marine Park) and its fjord, around which various tourist services are organized. In fact, adventure tourism and ecotourism are also niches of excellence in the region. At the international cruise market, major investments were made to create a first level tourist stopover, in particular with the construction of a dock, a welcome center and a harbor village. Thanks to these facilities the Saguenay has won the "Best Port Welcome" three times (2009, 2012 and 2013). In 2015, 32 ships docked at the Saguenay and 39 are expected in 2016.

› Energy

The Saguenay-Lac-St-Jean has various hydroelectric facilities that have enabled many companies in the region to specialize in the field of hydro-electricity and access international markets. For example, in the private sector, Rio Tinto Alcan has six plants in the region: three on the Péribonka River and three on the Saguenay River, totaling an installed capacity of 2,900 MW. The *Produits forestiers Résolu* company, for its part, has seven plants in the region: one on the Chicoutimi River, two on the Rivière aux Sables and four on the Shipshaw River, i.e. an installed capacity of 170 MW (Constas, 2012). Adding to these plants are the Elkem Metal Canada inc. of the City of Saguenay power plants as well as the Hydro-Quebec network.

4.4.3 Land Use

4.4.3.1 Land Allocations

Land allocations represent the proposed use of lands based on planning instruments such as the land use and urban plans of the City of Saguenay. The City of Saguenay has the power of an MRC, which is why an urban plan and a land-use development plan were adopted. These allocations are made on the basis of historical and current uses, physical constraints to land planning and potential but also on the basis of social and economic policies that the authorities establish for their territory. They represent the current and foreseen allocations for each part of the territory.

The public lands planning and development tools used in the study area are as follows:

› The Revised Land Use and Development Plan of the City of Saguenay (2011);
› The Urban Plan of the City of Saguenay, 2012d;
› The Urban Plan of the La Baie District, 2012a;
› The Rural Development Plan, 2012c;
› Applicable planning and zoning regulations.

Development Plan

Map 4.4 shows the major land allocations in the study area. The latter belongs to four categories of major land use types represented in the development plan of the City of Saguenay: industrial, port, forest and agricultural. As shown in Table 4.21, the majority of the territory of the study area is covered by agricultural zones (51%) as well as by industrial and port operation zones (45%) purposes.

Table 4.21 Land Allocation in the Study Area

Allocation	Surface Area (ha)	Proportion of the Study Area (%)
Industrial purposes	522	29
Port operations	286	16
Forest activities	77	4
Agricultural purposes	931	51
TOTAL	**1,816**	**100**

NOTE: The areas covered by the Saguenay River in the study area were excluded. The industrial lands within Planning Unit 119 cover an area of 1340 hectares since Planning Unit 119 extends beyond the study area.

Land allocation for industrial purposes: This includes lands dedicated to industrial activities. These lands are confined in a specific sector within Planning Unit 119 as defined in the Town Planning Program of the City of Saguenay, and are located far away from residential areas. Incidently, the remoteness of the Grande-Anse sector from the La Baie agglomeration and inhabited zones represent an advantage in industrial terms. Unit 119 is an industry-dominated area whose purposes are related to the Grande-Anse port activities. All industrial activities related to manufacturing, processing or production, are allowed with this type of land allocation. The section of the study area corresponding to lands allocated for industrial purposes includes an industrial development zone as well as an industrial reserve zone (Ville de Saguenay, 2011).

The Industrial Development Zone concerns planned sectors intended for new industrial developments, including the Intermodal Maritime Industrial Park where the pig iron plant will be located. The types of uses authorized are the same as those intended for industrial parks (commercial, services, industrial and public).

As for the industrial reserve zone, it corresponds to areas intended for medium and long term development projects. This zone includes lands available around the Intermodal Maritime Industrial Park and corresponds to the Comprehensive Development Plan (PAE) identified in Planning Unit 119, which defines the allocation of public spaces located around the industrial zone. It should be noted that farming and forestry activities are allowed in the PAE and may be scaled up to an industrial level.

Multipurpose allocation: This type of allocation applies to lands intended for the construction of community amenities and infrastructure. Based on the development plan of the City of Saguenay, this type of land allocation includes uses for institutional, airport and port operation purposes. The marine facilities of Grande-Anse are intended for the latter type of allocation. Allocation for port operations primarily includes major people and goods transportation equipment as well as industrial activities, trade and services linked to port activities (Ville de Saguenay, 2011).

Allocation for forestry activities: Three small sections of the study area are located inside the area allocated for forestry operations and, more specifically, in the areas used for forestry, recreational, and production activities. In the study area, the forest production area includes intra-municipal public lands whereas the forestry and recreational area corresponds to private land plots. The main purposes authorized with this type of land allocation are as follows: agriculture, livestock farming, forestry, parks, playgrounds and natural areas, as well as single-family and two-family dwelling units. Other uses are permitted under certain conditions.

Allocation for agricultural purposes: This covers the section of the territory designated as a permanent agricultural zone by the Commission for the Protection of Agricultural Land in Quebec (CPTAQ). The agricultural zone of the study area, which covers most of the latter, includes dynamic agricultural lands as well as lands intended for viable agricultural purposes. In addition to agriculture and forestry activities, several types of land use are authorized on these permanent agricultural lands, including conservation, interpretation, extensive recreation as well as single-family or two-family dwelling units. Other types of uses are also permitted under certain conditions.

Based on data from the Commission for the Protection of Agricultural Land in Quebec (CPTAQ), APS lands, which will host the project, are partly located inside the protected agricultural land. However, wWithin the framework of the expansion of the industrial site, various requests for the exclusion of the territory associated with these land plots were submitted to the CPTAQ by APS or the City of Saguenay. The decisions issued could either authorize these activities on the land plots being the object of the requests or be excluded from the permanent agricultural zone of the City of Saguenay. In this particular case, the industrial site of the APS is now wholly dedicated to industrial use.

4.4.3.2 Urban Plan

The Revised Land Use and Development Plan of the City of Saguenay proposes major development and planning guidelines for each of the major functions of the territory. These guidelines are then incorporated into the guidelines of the city's Town Planning Program. The intended uses and functions specified by the planning units identified by the Town Planning Program therefore reflect the intended purpose indicated by the development plan for each major land use allocation (Map 4.4). Based on the urban plan of the La Baie District, the study area overlaps four planning units, i.e. Units 117, 118, 119 and 121. Planning Units 117 and 118 are mainly used for agricultural purposes; Planning Unit 119 is mainly industrial and lies around the facilities of the marine terminal of Grande-Anse while Unit 121 is mainly used for forestry activities (Ville de Saguenay, 2012a and 2012c).

As mentioned in the description of the orientations and allocations of Unit 119, the Saguenay Port Authority is developing an industrial area near its Grande-Anse maritime terminal. This area, called "Intermodal Maritime Industrial Park" is designed to meet the region's current and future industrial development needs, will be deployed in various phases. The medium and large exporting or importing companies that will settle there will have at their disposal a complete intermodal network transport (see, road, rail).

Four main purposes were defined for Planning Unit 119 (Ville de Saguenay, 2012a and 2012c):

› Protect the port and maritime vocation of the facilities and facilitate their accessibility
› Recognize the Grande-Anse site for the installation of large size industries
› Support the development of an intermodal maritime industrial park
› Preserve the site's isolation characteristics and its industrial potential.

The construction of the Intermodal Maritime Industrial Park will thus reinforce the strategic role of the Grande-Anse terminal for the region's economic development which is already identified in the main territorial planning tools (land use plan, development plan, and designated areas by the APS for industrial use).

4.4.3.3 Site Zoning

The proposed plant site is located in Zone 71770, as defined by the City of Saguenay. According to the zoning regulation for this area, the land use for industrial purposes is the main type of occupation allowed there and this is associated with port activities in the Grande-Anse area.

In the specifications grid for the management of municipal lands, the following land use types are authorized in Zone 71770 depending on the area code:

› C4f: Construction or building contractor without goods or products sales activities;
› C4g: Transportation, trucking and warehouse;
› I2: Light industries;
› I3: Heavy industries;
› P1a: Parks, playgrounds and natural areas;

› P3b: Products of utilities and related activities.

In addition, their specifically permitted uses are as follows:

› 4111: Railway (except tourist trains, referral and yard);
› 4112: Switching and marshalling yards;
› 4113: Railway station;
› 4116: Maintenance and railway equipment;
› 4119: Other activities related to rail transportation.

Otherwise, below is a type of use that is specifically excluded:

› 4812: Wind power.

4.4.3.4 Land Use

The local study area mainly covers the area around the Grande-Anse Intermodal Maritime Industrial Park where the site proposed for the construction of the pig iron plant, a few buildings, a rail service, and the marine terminal of Grande-Anse is located. It also includes several residential buildings, some agricultural lands, an operating quarry, part of the south bank of the Saguenay River and an aquatic portion. The project's proposed site is located in the southern part of the Industrial Park.

Map 4.4 shows the main types of land use in the study area and Table 4.22 presents the propotion of its surface area compared to the study area.

Woodlands cover a large area of the study area, i.e. 48.0%. Wetlands, which are mainly located south of the Intermodal Maritime Industrial Park, cover 4.0% of the study area. The area's non-productive parts correspond to the rocky banks of the Saguenay River (0.2%).

The Saguenay River is the main water body in the local study area and accounts for over 99% of the water system present there. The rivers and creeks present in the territory taken into account, hydrography occupies 21.4% of the local study area.

Table 4.22 Land Use in the Study Area

Land Use	Surface Area (ha)	Proportion of the study area occupied (%)
Developed area		
Built environment	19	0.8
Industrial	47	2.0
Extractive industry	1	0.1
Amenities	13	0.5
Exploited agricultural land	335	14.5
Vacant and wildlands	197	8.5
Natural environment		
Woodland	1110	48.0
Wetland	92	4.0
Non-productive land	4	0.2
Hydrography	496	21.4
TOTAL	**2,314**	**100**

The built environment is limited to the presence of some homes and farm buildings on the Saint-Martin Road and Anse-à-Benjamin Road. The homes nearest to the proposed site are located approximately 800 m along the Saint-Martin Road.

In the area occupied by the Intermodal Maritime Industrial Park, land use reflects the industrial use of the land and occupies 2% of the study area. The Grande-Anse maritime terminal is used for “public utility” purposes and occupies 0.6% of the study area. A quarry operated along the Grande-Anse Road, west of the Intermodal Maritime Industrial Park, occupies a very small portion of the study area, (0.1%).

Vacant lands and wildlands cover 8.6% of the study area and are mainly located around the Intermodal Maritime Industrial Park. These are abandoned agricultural lands, unused urban space, gully areas and infrastructure and railway right-of-ways.

Farmlands are relatively abundant (14.5%), in particular in the area west of the study area. These lands are mainly used for grain and hay production purposes, but a dairy farm (Ferme des Quatre Vents) is present along the road to the Anse-à-Benjamin, south of the proposed site. Some residents down the Saint-Martin Road practiced subsistence agriculture.

4.4.3.5 History of Land Use on the Project Site

An Environmental Site Assessment - Phase 1 (SNC-Lavalin 2016) was performed on various plots selected for the construction of the plant. These plots, which make up the study area, have been used for the purpose of the following activities:

Plots 4 012 436 and 4 012 439

- In 1969, the plot was partially cultivated or used for logging purposes. Aerial photos from 1964 and 1980 show a small building in the middle of a cultivated field in the center-west, probably a tool shed or shelter for the farmer;
- In 1983, part of the land was transferred to the Ministry of Public Works of Canada for the construction of the Quai-Marcel-Dionne Road which gives access to the Port of Grande-Anse. It was inaugurated in 1985;
- In 1997, the entire area of the remaining plot was sold to the city of La Baie. Agricultural lands are then left in fallow, but logging activities took place in the field between 2002 and 2005, as shown by satellite photos on the Google Earth website;
- In 2010, APS became the owner of the plot.

Plot 4 012 437

- In 1968, the plot belonged to a private owner. A cultivated field juxtaposed three of the plots under study and has a small building visible on aerial photographs from 1964 and 1980;
- In 1983, the Société Canadienne des Ports purchased part of the plot for the construction of the Quai-Marcel-Dionne Road to serve the port of Grande-Anse opened in 1985;
- In 2011, APS became the owner of the plot.

Plot 5 210 880

- In 1928, the land belonged to a private owner. Based on the information available, this was a forest land where no special activities were conducted;
- In 2013, APS became the owner of the plot.

Current Condition

Since 2013, all the plots have been excluded from the permanent agricultural area after requests for their exclusion from the agricultural zone were submitted to the CPTAQ.

From 2010 to 2014, the construction of an irregularly shaped 350 m X 450 m platform for potential businesses was conducted. The platform consists of a blasted rock embankment that is 2 to 5 m thick depending on the sector. The materials come from blasted rocks from the same land and the land located immediately north of Quai-Marcel-Dionne Road. The work was carried out by APS.

During this period, a rental office building was built in the area located north-east of the study site, near the gatehouse. In addition, a road salt distribution company installed a bulk storage platform in the northeast section of the proposed, on plot 4 012 439.

In July 2015, the first convoy of trains carrying aluminum ingots traveled on the railway, north of the project area.

4.4.4 Infrastructure and Public Services

The planning and economic and social development of the area are largely based on the presence of transportation routes which are vital for the trade of goods and services. They consist of road, rail, energy transportation and port infrastructure. This section presents the key infrastructure and equipment present in the extended study area. Facilities located within the local study area are shown in Map 4.5.

4.4.4.1 Road Network

The study area is accessible by National Road 170 which passes across the District of La Baie. It is also accessible by Regional Road 372, also known as Grande-Baie Nord Boulevard. The study area is mainly crossed by the Grande Anse Road, which is also a regional road. The Grande Anse Road, which is considered as an industrial road, links National Road 170, the future Intermodal Marine Industrial Park and the Grande Anse marine terminal. The regional network crossing the local study area also includes the following roads: the Anse-à-Benjamin Road and the Quai-Marcel-Dionne Road. Although it is part of the regional network, it falls under federal jurisdiction.

Based on 2014 data from the MTQ, the Average Annual Daily Traffic (AADT) for the Grande Anse path was 1,470 vehicles between Highways 170 and 372 and 1,040 vehicles between Highway 372 and Rang Saint Joseph. On the stretch of road to Grande-Anse between Rang Saint Joseph and the Quai-Marcel-Dionne Road, the AADT totaled 820 vehicles (MTQ, 2014). For the Grande-Baie Nord Boulevard, the section of Highway 372 connects the District of La

Baie to the Grande-Anse Road, the data provided by the City of Saguenay show an average AADT of 8,655 vehicles in 2013 (Personal communication, Ville de Saguenay, 2016). The roads of the regional network are primarily used by residents as well as agricultural companies operating in the area. Highway 170, the Grande-Anse Road and the Quai-Marcel-Dionne Road accommodate the entire industrial trucking transit to the Grande-Anse maritime terminal. In 2014, the equivalent of more than 10,000 trucks transited through the marine terminal (Personal communication, Port de Saguenay, 2016). The Grande-Anse Road, which is the only road managed by the MTQ in the local study area, is accessible to truck transportation, albeit with certain restrictions. Other roads in the local study area and under municipal management are prohibited to truck traffic (MTQ, 2016). The road to Anse-à-Benjamin has a recreational tourism vocation as it is part of the tourist road circuit of the Fjord Road (Ville de Saguenay, 2016a).

4.4.4.2 Railway Network

The network of two railway companies crosses the Saguenay-Lac-Saint-Jean region: the Internal Short Line Railroad of Northern Quebec (NQISL), a subsidiary of the National Railways of Canada (Canadian National) and the Roberval and Saguenay Railway Company (CFRS), a subsidiary of Rio Tinto Alcan. CFRS operates 11 locomotives over a 142 km railway network linking the Laterrière, Arvida, Grande-Baie and Alma plants to the Canadian National (CN) Railway network (Ville de Saguenay, 2016b). It is used to transport goods over short distances, mainly bauxite unloaded at Port-Alfred, as well as alumina, coke, chemicals, paper, forest products and aluminum (AECOM and IBI/DAA, 2011). Since 2015, a 12.5 km railway section links the Grande-Anse marine terminal to the Quebec railway network via the CFRS network. Shipping services aimed at developing the Intermodal Marine Industrial Park around the Grande Anse port facilities. In 2015, aluminum was the only product transported across the railway service (Personal communication, Port de Saguenay, 2016).

The industrial area south of the Quai-Marcel-Dionne Road is not yet served by the rail network. During the construction of the railway section to connect the marine terminal, the foundation of a railway line along the area south of the Quai-Marcel-Dionne Road was laid in order to serve this area.

4.4.4.3 Port Infrastructure

The facilities of the Grande-Anse marine terminal located in the District of La Baie, which are owned by the Government of Canada, are managed, for commercial purposes, by the Saguenay Port Authority, also known as Port of Saguenay. This deep water port (14 m at low tide) is operational throughout the year and has a 290 m long dock (two berths). The port's facilities are used for the transshipment of various goods. They include a tipping platform, two transit sheds, an open-air storage area, liquid storage tanks and an office building (Port of Saguenay, 2016). The Intermodal Marine Industrial Park, which is located near the marine terminal, provides storage space and is connected to the road network and the railway network. The Industrial Park currently includes an industrial and storage area, a storage building, and well as an administrative building (Port de Saguenay, 2015a).

As the only public port in the Saguenay-Lac-Saint-Jean region, the Grande-Anse terminal is recognized for its strategic importance for trade and for the country's economy. It serves as a maritime port of entry to some world markets, is part of the critical infrastructure of the City of

Saguenay and generates hundreds of jobs. Originally, the Grande-Anse marine terminal was built in order to handle forest products. Following a recent diversification program, the terminal has turned into a transit port for general cargo. These days the terminal is used for the transshipment of goods and a variety of raw materials that are imported or exported outside of Canada (Port of Saguenay, 2016).

In recent years, the total quantity of loaded and unloaded goods increased from 270,000 tons in 2012 to 267,000 tons in 2013 and to 280,000 tonnes in 2014 (Port de Saguenay, 2014b). The main products handled are de-icing salt, coal, fluorspath, anodes, aluminum, liquid pitch, industrial or large-size parts, forest products (pulp, paper, wood pellets, etc.), kaolinite, aggregate, refractory brick as well as general cargo (Personal communication, Port de Saguenay, 2016). The larger volumes of goods handled in 2013 and 2014 corresponded to cargoes of road salt from Canada with, respectively, 35% and 29% of the total volume of goods received (Port de Saguenay, 2014, 2015b).

Table 4.23 shows the type of main goods transiting through the marine terminal as well as their origin or destination.

Table 4.23 Type, Origin and Destination of the Main Goods Handled at the Grande-Anse Terminal

Goods	Origin	Destination
Deicing salt	Canada	Saguenay-Lac-Saint-Jean and Chibougamau regions
Pulp and paper	Produits forestiers Résolu	Guatemala, China, Turkey
Liquid pitch and bricks	Belgium	Rio Tinto Alcan Alma smelter
Coal	United States	Elkem Métal Chicoutimi
Aluminum	Rio Tinto Alcan smelters in Grande-Baie and Laterrière	England, USA, France, Netherlands, Switzerland, and Germany
Wood pellets	Granules LG	Italy
Anodes	Netherlands, Switzerland	Rio Tinto Alcan (Arvida) AP-60 technology center

Source: Port of Saguenay, 2014; 2015a; 2015b

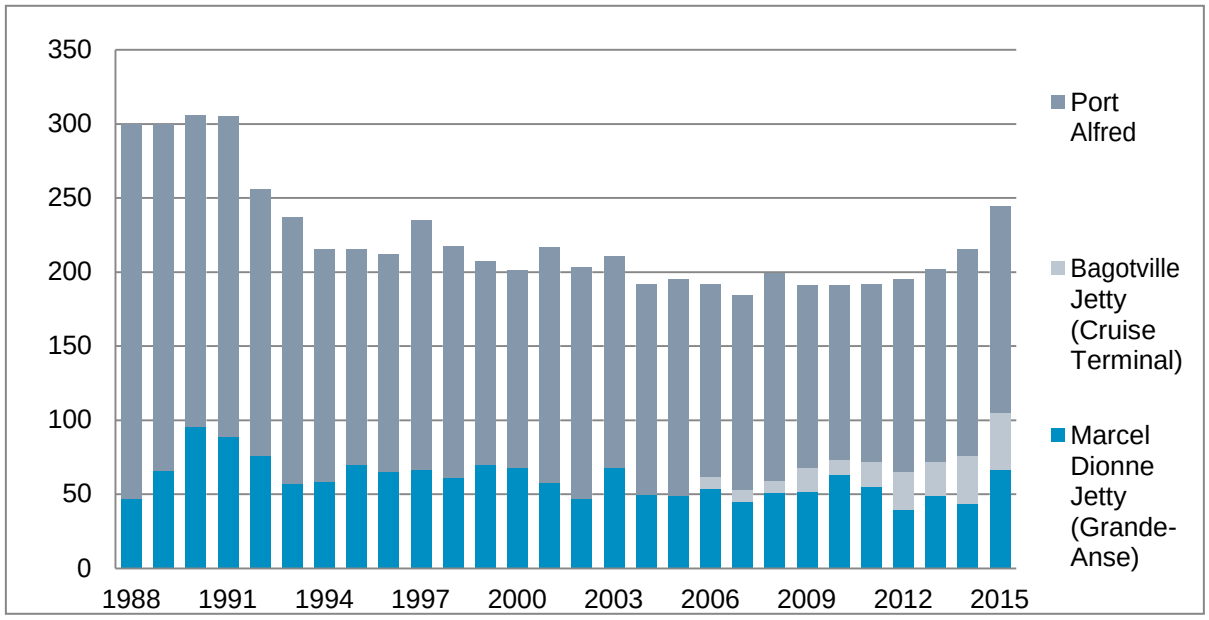
The main target markets are Germany, the USA, England, France, Italy, Switzerland, the Netherlands, but also Canada and Asia. In 2013 and 2014, about 70% of goods handled were related to international ship loading or unloading operations (Port de Saguenay, 2014, 2015b).

4.4.4.4 Maritime Transport Network

Based on information from the Port of Saguenay, an average of 222 ships visited the port facilities of Grande-Anse, Bagotville and Port Alfred per year between 1988 and 2015. The busiest year was 1990, with a total of 306 ships. In recent decades, there has been a decrease in marine traffic on the Saguenay River since the beginning of the 1990s to stabilize at around 200 ships per year since 1994. In 2015, however, the number of ships increased to 244, the highest quantity since 1992. Figure 4.6 provides a summary of the number of ships that visited the various docks.

As for the Grande-Anse maritime terminal, it was visited by an average of 60 ships every year between 1988 and 2015. The busiest year in terms of traffic at the port was 1990 as 96 ships docked there. The average number of ships visiting the Grande-Anse terminal in a decade has followed a downward trend since the early 1990s, decreasing from 71 between 1990 and 1999 to 54 between 2000 and 2009, and to 53 between 2010 and 2015.

Figure 4.6 Number of Ships Docked on the Saguenay River between 1990 and 2015



Source: Port of Saguenay, 2016

Note 1 The Bagotville dock has been in operation since 2008. The data for 2006 and 2007 relate to ships at anchor only.

Note 2 Data for Port Alfred include the Maltais dock (increased activity since 1993), Powell docks 1 and 2 (increased activity since 2004) and the Duncan and Powell 4 docks.

Maritime traffic at the docks of Port-Alfred (Powell docks) involves merchant ships carrying mostly solid materials such as caustic soda and bulk aluminum and tankers.

In addition to commercial ships, other types of ships sailed across the Saguenay River. International cruise ships as well as local cruise ships sail across the Saguenay Fjord. The Bagotville dock, located in the Baie des Ha! Ha!, can accommodate large international cruise ships. In 2013, 23 cruise ships carrying 20,380 passengers used the facilities of this platform while in 2014, 32 ships carrying in total 29,000 passengers used the platform (Port de Saguenay, 2014; 2015b). As for local boat cruises, nine companies now offer tours in the fjord as well as whale-watching cruises (Ville de Saguenay, 2016a). In winter, an ice-breaker sails across the Saguenay River to maintain the waterway open up to the Grande-Anse terminal and Port Alfred (Le Groupe Leblond Bouchard, Alliance Environnement inc. and CJB Environnement inc., 2005).

4.4.4.5 Electric Power Network

There is no major power transmission line crossing the study area. The closest transmission line is a 161-kV line single-circuit (circuit 1641) of the Hydro-Quebec power grid that connects the Saguenay post in the District of Jonquière to the Port Alfred post in the District of La Baie (Ville de Saguenay, 2011). It is planned that Hydro-Québec will connect the project site to its network over a distance of around 8 km.

4.4.4.6 Telecommunication and Cable Network

Much of the urban perimeters of Saguenay are served by a fiber optic network. Several companies, including DERYtelecomm, Cogeco, Bell and Videotron offer telephone, internet, and cable services. The project site is served by the fiber network.

The entire territory of the City of Saguenay is served by a wireless communication network with cutting edge technology. The main companies providing these services are Rogers, Bell, Telus and Videotron. They each operate their own telecommunications network for wireless telephony.

The closest telecom tower is located more than 5 km away from the project site in the District of La Baie. It is owned by various companies (Rogers, Vidéotron, and Telus). No telecommunication tower is present in the local study area.

4.4.4.7 Gas Network

The Gaz-Métro transmission system serves several municipalities in the Saguenay-Lac-Saint-Jean region, including the City of Saguenay. It crosses the City, from the District of Jonquière to the District of La Baie. The natural gas distribution network is mainly limited to the urbanized areas of the Districts of Jonquière, Chicoutimi and La Baie (Ville de Saguenay, 2011). However, Fromagerie Boivin, which is located along the St. Joseph Road, near the center of the District of La Baie, is served by Gaz-Métro, in particular in order to fuel its boilers. Within the framework of the project, Gaz-Métro is expected to provide a connection of about 15 km to its network.

4.4.4.8 Air Network

The Saguenay-Bagotville Airport, which is located in the District of La Baie, in the City of Saguenay, has civilian and military facilities. This airport offers several regular regional and international flights during the autumn and the winter (Ville de Saguenay, 2016b).

4.4.4.9 Drinking Water and Wastewater

The urbanized areas of the City of Saguenay are supplied with drinking water through the water system. Drinking water is supplied via 12 outlets spread across the territory of the city. The water system is present along the Saint-Martin Road, the Ligne Bagot Road, the Anse-à-Benjamin Road, the Quai-Marcel-Dionne Road and a section of the Grande-Anse Road. Residents living outside these areas are supplied with drinking water through surface or artesian wells (Ville de Saguenay, 2011; 2012c). At present the potential project site is served with a water system along the Chemin de la Grande-Anse. The City of Saguenay could build an additional conduit of approximately 15 km to link up the St-Anicet reservoir to the treatment plant site. Its route would follow the existing railway corridor. According to the hydrogeological

information system (HIS), a drinking water intake belonging to a private owner is present in the industrial park (MDDELCC, 2015b). However, a validation on this land, which currently belongs to the APS, has confirmed that this water intake does not exist.

As for the city's wastewater, it is treated in four treatment plants (Arvida, Jonquière, Chicoutimi and La Baie sectors) and by an aerated oxidation system (Shipshaw sewage). These facilities are located outside the local study area (Ville de Saguenay, 2011). The houses present in the local study area are not connected to the sewer system of the City of Saguenay (Ville de Saguenay, 2012c). The industrial park is not connected to the municipal sewer system.

4.4.4.10 Residual Materials Management

In December 1997, the former RCM of Fjord-du-Saguenay and 14 of its member municipalities signed an agreement on the sharing of the residual materials disposal service for a period of 20 years. The area covered by this agreement includes the current City of Saguenay and seven municipalities that are still part of the current RCM. The municipalities that signed the agreement delegated their waste management responsibilities to the RCM. Following the 2002 municipal mergers, the City of Saguenay became responsible for implementing the agreement and the RCM's facilities and responsibilities were transferred to the city. The city also inherited the powers of the RCM in the collection, transportation and processing of recyclable materials. In 2013, the City of Saguenay and the RCM of Fjord-du-Saguenay started jointly developing a new Waste Management Plan (RMMP). A draft RMMP was adopted in June 2014 and a revised version was prepared in January 2016. The revised RMMP was presented during public consultations held in March 2016 and its implementation will be effective once a compliance notice has been issued by the MDDELCC (Ville de Saguenay and MRC du Fjord-du-Saguenay, 2016).

Waste materials are collected by Services Matrec Inc., which takes them to an engineered landfill located in the District of Chicoutimi. This site, which is known as the AES Technological Center, is owned by Matrec Services inc. which also operates it. This engineered landfill is due to be closed in November 2017. The Lac-Saint-Jean Residual Materials Board, which manages and operates the engineered landfill of Herbertville-Station, is currently awaiting a decision on a decree amendment application for the enlargement of the site and the increase in the tonnage authorized for the site. This decree amendment would allow the engineered landfill to receive waste from the City of Saguenay and the RCM of Fjord-du-Saguenay from December 2017.

Recyclable materials are collected by Services sanitaires Rodrigue Bonneau which takes them to the regional sorting center located in the District of Chicoutimi (Ville de Saguenay and MRC du Fjord-du-Saguenay, 2016).

In addition to the engineered landfill site, the territory of the City of Saguenay includes 11 old waste disposal sites spread across the three districts. These districts have various levels of contamination (Ville de Saguenay, 2011). There are four ecocentres within the territory of the City of Saguenay, including two in the District of Chicoutimi, one in Jonquière and one in the District of La Baie. These ecocentres accept residual materials excluded from the household collection system as well as recyclable materials such as construction, renovation and demolition waste, house appliances, hazardous household waste, garden waste, tires, and information and communication technology devices (Ville de Saguenay and MRC du Fjord-du-

Saguenay, 2016). The city also hosts five waste snow disposal sites as well as a septic tank sludge processing center in the District of Jonquière (Ville de Saguenay, 2011). In addition, the Gazon Savard Saguenay Inc. company operates two composting sites in the Districts of Chicoutimi and La Baie which receive municipal waste as well as paper mill sludge (Ville de Saguenay and RCM Fjord-du-Saguenay, 2016). These residual materials management facilities are all located outside the local study area.

4.4.4.11 Public Safety

Regarding public safety, the Sûreté du Quebec division of the City of Saguenay, whose offices are located in the District of Chicoutimi, is responsible for the protection of citizens in Saguenay. In addition, the city has two fire stations and five brigades one of which is located in the District of La Baie, about 13 km by road southwest of the project site (Ville de Saguenay, 2016c). These facilities are located outside the boundaries of the local study area.

4.4.4.12 Health

In the City of Saguenay, health services are provided by the Cleophas-Claveau Hospital (District of La Baie), Chicoutimi Hospital and the administrative and hospital center of Jonquière, which are located in the same districts. Three local community service centers (CLSC) also serve the districts of the City of Saguenay: the CLSC of Chicoutimi, Jonquière and Fjord (La Baie service point). The city also hosts several long-term accommodation centers in its three districts. The health and social services centers (CSSS) serving the City of Saguenay also include several independent community organizations that offer services in various sectors, including mental health, women and youth, and drug treatment services (CSSS de Chicoutimi, 2016; CSSS de Jonquière, 2016; CSSS de Cléophas-Claveau, 2016). All these facilities are located outside the boundaries of the local study area.

4.4.4.13 Recreotourism

The District of La Baie features various tourist sites, including the Centre Plein Air Bec-Scie. This center, which is located south of the Saguenay-Bagotville airport, offers more than 120 km of pathways that make it possible to practice various activities including snowshoeing, cross country skiing, mountain biking and hiking (Centre Plein Air Bec-Scie, 2016). The Eucherius footpath, which starts at the Marina of La Baie, goes along the fjord and ends on a site where it offers a view of the Ha! Ha! (BaliseQc, 2016). This pathway is considered as being part of the waterfront heritage by the City of Saguenay (2011). Various federated snowmobile and quad trails, which are under the responsibility of the *Club de Motoneige de Saguenay* (Snowmobilers Club of Saguenay) and the Club Quad du Fjord cross the District of La Baie. During the winter season, ice fishing can be practiced in two areas: the Anse-à-Benjamin and Grande-Baie. About 1,200 huts are set up there for people wishing to catch smelts, redfish and cods. In addition, cruises organized in the fjord are also available from the District of La Baie. Fromagerie Boivin, which is located on the Rang St. Joseph near the Anse-à-Benjamin Road intersection, is a must for agro-tourism enthusiasts. The Saint-Martin Gardens offer visitors the opportunity to pick their own fruits and vegetables, including strawberries, raspberries, blueberries, blackberries, beans, fava beans, and several varieties of tomatoes. This farm is located on Saint-Martin Road, near the intersection with the Ligne Bagot Road, outside the local study area (Ville de Saguenay, 2016a)

Within the local study area there are some circuits and tourist trails (Map 4.4), including the following:

- The *Route Verte* cycle path which follows the Grande-Anse Road, the Anse-à-Benjamin Road and National Highway 372 (Ville de Saguenay, 2011);
- The Fjord Road, a marked tourist road follows the Anse-à-Benjamin Road and then continues along the Saguenay River and along the Saint-Martin Road, in the District of La Baie (Ville de Saguenay, 2016a). This road is known as a scenic road in the development plan of the City of Saguenay (2011);
- The Notre-Dame Kapatakan footpath which goes along the road to Anse-à-Benjamin and Saint-Martin Road. This is a 215 km pilgrimage trail linking Rivière-Éternité to Lac-Bouchette. It is nicknamed the small regional "Compostelle" of Saguenay-Lac-Saint-Jean (Sentier Notre-Dame Kapatakan, 2016);
- A small section of a local quad trail crossing the District of La Baie in a northwest-south-east direction (FQCQ, 2016).

Besides, based on the development plan of the City of Saguenay (2011), the banks of the Saguenay River, which are located in the District of La Baie, were identified as a territory of aesthetic interest, i.e. an element of the waterfront heritage (Map 4.5). The Saguenay River is also recognized in the development plan as an area of aesthetic interest.

4.4.4.14 Mining Title and Mining Site

The study area includes no active mining title. However, a surface mineral substances (SMS) mining site, used for the mining of crushed stone and covering a surface area of 29.3 hectares, is located on the site of the Grande-Anse port facilities (Map 4.5). The title associated with the SMS mining site belonged to the Saguenay Port Authority, but has expired since 2011 (GESTIM, 2016).

A crushed stone quarry is located within the boundaries of the study area, along the Grande-Anse Road, near the intersection with the Anse-à-Benjamin Road (Map 4.4). A second crushed and architectural stone quarry is located nearby, but outside the local study area, near the southern boundary (MERN, 2016)

4.4.4.15 Land Use by the Innu

The study area is located in the territory called "Southwestern Part" of Nitassinan which covers an area of 21,106 km^2 (Map 4.5). The Southwestern Part is shared by the Nitassinan First Nations of Mashteuiatsh, Essipit and Pessamit and is to be discussed before the signing of the treaty with the various parties. This territory, part of which is located on the southern portion of the Saguenay-Lac-Saint-Jean region, also covers part of the North Bank of the Quebec region and also part of the Charlevoix region. The Nitassinan is currently subject to comprehensive land-related negotiations. It is the territory where the general agreement in principle is being implemented. This agreement was ratified in 2004 by the First Nations of Mamuitun (Mashteuiatsh, Essipit and Pessamit) and Nutashkuan and the governments of Quebec and Canada. Although it is subject to claims by the Innu, the latter have limited rights on the

Nitassinan (SAA, 2010). The three communities concerned by the Southwestern Part should receive a model treaty in March 2016.

The Mashteuiatsh Innu reserve, which covers an area of 14 km^2, is enclosed in the RCM of Domaine-du-Roy. The Essipit Innu reserve (0.82 km^2) is located in the administrative region of Côte-Nord, near the municipality of Escoumins. The Pessamit Reserve is also located in Côte-Nord and covers an area of 252 km^2. These reserves, which are governed by federal law, are all located outside RCM territories (MAMOT, 2016). The reserves of Mashteuiatsh, Essipit and Pessamit are located respectively about 102 km, 108 km and 173 km in a direct line from the project site.

Based on the maps drawn up as part of the above-mentioned agreement in principle, there is no heritage, burial or archaeological site or Innu park within the boundaries of the study area (SAA, 2010).

A meeting held with the Innu community during exploratory consultations made it possible to confirm that no traditional activities are currently taking place on the project site. However, migratory bird hunting and sea urchin fishing activities are conducted near the site, along the Saguenay River. These activities also take place at various locations along the river, up to its mouth in the St. Lawrence River.

4.4.5 Historical and Archaeological Heritage

The City of Saguenay has numerous sites, buildings or architectural structures considered as of historic and cultural interest in the development plan. The cultural heritage of the city stands out for its residential, commercial, industrial and institutional architecture. This sets the city apart as a remarkable modern heritage site (Ville de Saguenay, 2011). According to the Directory of the cultural heritage of Quebec consulted on February 16, 2016, five properties listed as heritage buildings are located within the boundaries of the local study area. Three buildings, including the Charles-Gobeil house, an old elite schoolhouse and a wayside cross are located on Saint-Martin Road (MCC, 2016, Ville de Saguenay, 2011) (Map 4.5).

A study of the area's archaeological potential was conducted by the Subarctique Enr. firm in order to establish the presence of archaeological sites and evaluate the archaeological potential of the study area. The main findings of this study are summarized below.

The archaeological potential study took into consideration all current knowledge on Native American occupation of the territory in prehistoric and historic times as well as the Euro-Canadian occupation. The ancestors of the Iroquois and the Iroquoian groups themselves frequented the mouths of the tributaries of the Saguenay River during the prehistoric period (450-9000 A.A.). As for the Algonquian groups, they occupied the entire territory of Côte-Nord, Saguenay and its hinterland during the historical period (0-450 A.A.). The Euro-Canadian are believed to have frequented the study area in order to exploit its natural resources.

Although several archaeological interventions have been conducted in the region in recent years, there is no known archaeological site located within 5 km of the project site. It should be noted that two archaeological sites have been identified within a radius of 10 km from the project site. The first site (code Borden DcEr-a) is located near the Valin River in the

municipality of Saint-Fulgence, a little more than 5 km northwest of the project site. The site is located just over 10 km south-east of the project site, in the municipality of Saint-Félix-d'Otis and includes the archaeological sites of the Anse-à-la-Croix (Borden codes DcEP-1, 2, 3, 4, 5). These archaeological sites testify to prehistoric and historic occupations by Native American and are located outside the local study area.

Following the analyses and direct observations conducted, no archaeological potential zone was identified within the local study area[7]. It does not seem necessary to conduct archaeological surveys in the project area, on the lands where works would be conducted.

4.5 Noise Environment

4.5.1 Initial Condition

The sound environment (ambient or total noise at a place and at a given moment) is the result of accumulated sounds usually from a multitude of sources (near or far) that each has distinct characteristics of stability, duration and content. This section addresses the initial condition of the sound environment, i.e. the environment prevailing in the study area prior to any modification that could result from the construction of the proposed plant.

The initial condition of the project area was characterized using sound readings taken in November 2010, December 2012 and April 2013 as part of studies related to the Grande-Anse maritime terminal rail service project (AECOM, Groupe IBI/DAA, 2011; Yockell, 2013a) and to the marshaling yard in the La Baie area (Yockell, 2013b). The sound readings were taken in order to determine the initial noise level during the day and at night before the implementation of the projects.

The position of the measurement points is identified in Map 4.5. Three of the measurement points are located in the 2.5-km study area around the project site. A summary of the results for these three points is presented in Table 4.25. To simplify their presentation, the sound levels are rounded to the unit. The detailed results of the measurement are presented in Appendix H.1.

Based on the studies mentioned, the following observations can be made on the initial noise environment of the study area, based on the studies cited:

- At 4893 St-Martin Road, the high noise levels recorded day and night are related to Bagotville Airport's air traffic activities. The noise generated by a farming machine between 9:30 and 10:30 is not considered representative of the area and has been removed from the analysis. Hourly noise levels ($L_{Aeq\ 1h}$) have varied from 26 to 53 dBA during the day and from 22 to 60 dBA at night, with instant sound levels above 85 dBA recorded when aircrafts fly over. The 24h noise level is 49 dBA.
- At 4583 St-Martin Road, the sound environment is less influenced by Bagotville Airport's air traffic activities and is quieter. The hourly noise levels ($L_{Aeq\ 1h}$) measured in 2012 varied from 29 to 56 dBA during the day and from 28 to 33 dBA at night and the 24h noise level 24 is 43

[7] It should be noted that the archeological potential study area area is different from the impact study area. It is more or less rectangular in shape and is located along the Chemin du Quai-Marcel-Dionne and includes the entire project site and the route of the future multi-user conveyor.

dBA. In 2013, the hourly sound levels ($L_{Aeq\ 1h}$) measured varied from 33 to 53 dBA during the day and from 31 to 38 dBA at night and the 24h noise level is 44 dBA.

› At 4413 Anse-à-Benjamin Road, the sound environement is related to traffic on that road. Hourly noise levels ($L_{Aeq\ 1h}$) ranged from 50 to 70 dBA during the day and from 35 to 52 dBA at night. The 24h sound level is 60 dBA.

Table 4.24 Results of Initial Noise Level Measurements in Sensitive Areas

Measurement Point	Time		Results[1]		
	Date	Period [2] (MDDELCC)	L_{Aeq1h}, dBA	L_{Aeq24h}, dBA	L_{dn}, dBA
Nº 1 4893, Chemin St-Martin, La Baie	December 12-13, 2012	Day	26 to 53	49	57
		Night	22 to 60		
Nº 2 4583, Chemin St-Martin, La Baie	December 12-13, 2012	Day	29 to 56	43	43
		Night	28 to 33		
	April 22-23, 2013	Day	33 to 53	44	45
		Night	31 to 38		
Nº 3 4413, Anse-à-Benjamin Road, La Baie	April 22-23, 2013	Day	50 to 70	59	60
		Night	35 to 52		

Notes:
L_{AeqT} Equivalent-continuous A-weighted sound pressure level corresponds to the average noise level recorded during the sampling period T).
L_{dn} Day-night average sound level with a penalty (+10 dBA) added to sound levels occurring between 10 pm and 7 am
(1) Exclusion of sound levels recorded when weather conditions were beyond the prescribed limits, and sound levels recorded during sound events considered unrepresentative of the usual soundscape.
(2) Day, from 7 am to 19 pm and night from 19 pm to 7 am (MDDEP, 2006)

4.5.2 Noise Limits

The City of Saguenay has a noise regulation which prohibits the generation of noise considered as nuisance (Appendix H-2): “When a person provokes or incites (in any way) noise which would disturb the peace, tranquility, comfort, rest or well-being of one or more citizens or hamper the peaceful use of neighboring property, this constitutes a nuisance and is prohibited” (Ville de Saguenay, 2007). Noise generated by construction works between 10 pm and 7 am within 200 meters of a residence is prohibited and the sound of a device such as a heat pump or a pool pump must not exceed 50 dBA within 1 m of the boundary of the land where the disturbing device is located.

The MDDELCC’s noise limits will be used to assess the project’s sound emissions during the construction and operation phases since they contain quantitative limits that could be compared with the project’s anticipated noise levels. The noise limits for stationary sources during the operational phase (MDDEP, 2006) are presented in Table 4.26 while the noise limits for the construction phase (MDDELCC, 2015c) are presented in Table 4.28, in combination with the

results of the surveys of the initial sound level. These documents are reproduced in Appendix H-3 and H-4.

Table 4.25. Summary of Noise Limits for the Project's Stationary Sources

Noise Reception Point	Zone	Period (1)	MDDELCC Noise Limits $L_{Ar\ 1h}$ (dBA) (2)	Initial Sound Level L_{Aeq1h} (dBA)
Nº 1 4893, Chemin St-Martin, La Baie	Agricultural (3) 2218	Day	45	26 to 53
		Night	40	22 to 60
Nº 2 4583, Chemin St-Martin, La Baie	Industrial (4) 71774	Day	55	29 to 56 (2012) 33 to 53 (2013)
		Night	50	28 to 33 (2012) 31 to 38 (2013)
Nº 3 4413, Route de l'Anse-à-Benjamin, La Baie	Agricultural (3) 2236	Day	50 (5)	50 to 70
		Night	40	35 to 52
Boundary of the project area	Industrial 71770	Day and Night	70	Not available

Notes

1. Day: from 7 am to 7 pm during the day and night: from 7 pm to 7am [MDDEP 2006]
2. L_{Ar}: Reference noise level, which includes corrective terms for impact noise, tonal noise and special situations, according to Instructions Note 98-01 (MDDEP 2006)
3. On the ground of an existing residence in an agricultural zone.
4. On the ground of an existing residence in an industrial zone.
5. The louder of the residual noise or the maximum level permitted depending on the zoning. The residual noise is supposed to be equal to the original noise since the plant has not been built yet.

Table 4.26 Summary of Noise Limits for the Construction of the Project

Noise Reception Point	Zone	Period [1]	MDDELCC[2] Noise Limit (dBA)	Initial Sound Level Measured (dBA)
Nº 1 4893, Chemin St-Martin, La Baie	Agricultural 2218	Day	$L_{Ar\ 12h} = 55$	$L_{Aeq12h} = 41$
		Evening	$L_{Ar\ 1h} = 50$	$L_{Aeq1h} = 36$ to 57
		Night	$L_{Ar\ 1h} = 45$	$L_{Aeq1h} = 22$ to 60
Nº 2 4583, Chemin St-Martin, La Baie	Industrial 71744	Day	$L_{Ar\ 12h} = 55$	$L_{Aeq12h} = 46$ (2012) $L_{Aeq12h} = 47$ (2013)
		Evening	$L_{Ar\ 1h} = 45$	$L_{Aeq1h} = 29$ to 32 (2012) $L_{Aeq1h} = 31$ to 38 (2013)
		Night	$L_{Ar\ 1h} = 45$	$L_{Aeq1h} = 28$ to 33 (2012) $L_{Aeq1h} = 31$ to 34 (2013)
Nº 3 4413, Route de l'Anse-à-Benjamin, La Baie	Agricultural 2236	Day	$L_{Ar\ 12h} = 62$ [3]	$L_{Aeq12h} = 62$
		Evening	$L_{Ar\ 1h} = 45$	$L_{Aeq1h} = 44$ to 52
		Night	$L_{Ar\ 1h} = 45$	$L_{Aeq1h} = 35$ to 52

Notes:

1. Day : between 7 am and 7pm ; evening : between 7 pm and 10 pm; night: from 10 pm and 7 am (MDDELCC, 2015c)
2. At any reception point used as a residence or equivalent (hospital, institution, school). In the evening when justified, the sound level can reach $L_{Aeq3h} = 55$ dBA.
3. The higher of the initial noise level or the allowed maximum level

4.6 Visual Environment

The information in this section comes mainly from the following documentary sources:

- The environmental impact study for the Grande-Anse marine terminal rail service project (AECOM - IBI/DAA Group, 2011);
- The Revised Land Use and Development Plan of the City of Saguenay (Ville de Saguenay, 2012c);
- The Urban Plan of the City of Saguenay (Ville de Saguenay, 2011);
- The Urban Plan of the District of La Baie (Ville de Saguenay, 2012a).

These data were supplemented by field observations. The landscape analysis was performed in accordance with the *Environmental Assessment Method for Lines and Substations, Landscape Study Method* (Hydro-Québec 1992).

4.6.1 Regional Landscape

The study area is located in the Saguenay-Lac-Saint-Jean region in the boroughs of Chicoutimi and La Baie, in the City of Saguenay, and in a portion of the municipality of Saint-Fulgence, on the north bank of the Saguenay River. The regional landscape in the tourist region of Saguenay-Lac-Saint-Jean is generally mild and takes the form of an undulating plain. Some topographic features, including the Kénogami Horst, marking the boundary between the Saguenay and Lac Saint-Jean regions, characterize this plain. The lowlands are generally occupied by agricultural and urban development activities, while forests occupy areas that are

less favorable for such activities. In the north, the landscape is dominated by the Saguenay River which forms a fjord from St-Fulgence and Cap-à-l'Ouest. The terrain around the fjord is very hilly and presents rocky outcrops with an average height of 150 meters.

The landscape of the city of Saguenay has three urban cores that correspond to the urbanized areas of the Districts of Jonquière, Chicoutimi and La Baie. These districts are connected to each other by Highway 70 and National Highway 170. Highway 175 connects the City of Saguenay to the Capitale-Nationale region, Highway 172 connects it to the Côte-Nord region, and Highway 170 to the region of Charlevoix. The City of Saguenay somehow fits in a large natural park, thanks to its rich natural heritage enhanced by the Saguenay River and Fjord. In fact, the city's configuration allows numerous views of the river. Due to the unique features of the fjord, the area, with its landscapes, is a popular tourist destination.

On the north bank, the west area of Municipality of Saint-Fulgence has a lower agroforestry plateau. The geography of the area changes markedly at the beginning of the fjord where the banks become very steep and the landscape consists mainly of large forest areas. In the north, the terrain gradually rises near the Valin Mountains area.

4.6.2 Landscape of the Local Study Area

The visual analysis is limited to the local study area and discusses the visibility of the proposed facilities to be built on a portion of the territory that could be affected by the project. The study area is bounded in the north by Highway 172 (Tadoussac Road), in the east by Cap-à-l'Est, in the south by the Boulevard of Grande-Baie Nord and South and in the west by a residential area in the east sector of Chicoutimi and by a marked change in the course of the river.

The area's landscape is mainly composed of vast undulating forest lands, of a large plateau which is the cornerstone of agricultural activities, and of wetlands. The Saguenay River, which is part and parcel of the landscape of the local study area, is a fjord recognized in the development plan as an area of aesthetic interest.

4.6.3 Identification of Landscape Units

The components of the natural environment (hydrography, topography, and vegetation) and the human environment (land use, sites of interest, and infrastructure) which are detailed in the previous sections of this chapter, help identify landmarks and visual attractions as well characterize the types of view possible in the study area. This characterization of the local environment made it possible to identify six landscape units. A landscape unit is a portion of a landscape that is characterized by its high degree of visual accessibility and/or by its distinctiveness. Each of these units is described below. Map 4.6 shows the location of the various landscape units present in the local study area. As well, Appendix I presents pictures from various viewpoints (in addition to those presented below) and a map to localize them.

4.6.3.1 Landscape Unit #1: Urban Landscape; Chicoutimi East

This landscape unit forms the western boundary of the study area. It is bounded in the west by the Rivière au Moulin, in the east by the Saint-Martin Road and the Golf Road and in the north by the Saguenay River. This sector is mainly composed of single-family house with one to two floors distributed on either side of Saguenay Est Boulevard. The houses located in the eastern

boundary of the neighborhood are likely to offer a view to the study site with agricultural lands in the background.

Figure 4.7 Intersection of *Rang* Saint-Mathieu and *Rue* des Cormiers

Source : Google Earth

4.6.3.2 Landscape Unit #2: Agricultural Landscape; the plateau

This landscape unit covers all the agricultural lands located between the Grande Baie Nord Boulevard, the Saint-Martin Road and the Cap-à-l'Ouest forest. This sector is characterized by its gently undulating topography and the prevalence of agricultural activities. The farmlands are interspersed with some forests and numerous rivers form wooded ravines at the boundary of the plateau. The built environment is composed of isolated residences, along with farm buildings.

Figure 4.8 *Chemin* St-Joseph

Source: Google Earth

4.6.3.3 Landscape Unit #3: La Baie

This landscape unit, which is located at an elevation of 10 to 50 meters, is characterized mainly by its location in a low-lying area near the project site and includes the urban area of La Baie, the Ha! Ha! aquatic area and Highway 170 (Grande-Baie Sud Boulevard). With a population of almost 20,000, the La Baie urban area consists of a set of various types of businesses, industries and dwellings. Highway 170 runs along the banks, west and south of the bay. There

are also commercial port facilities of Rio Tinto and the facilities of the Quai des Croisières, which is a major tourist destination in the region. The landscape is dominated by the La Baie des Ha! Ha! and the Cap-à-l'Ouest rock formation.

Figure 4.9 Quai des Croisières, La Baie

Source: P-L. Grenon (courtesy of BC2)

4.6.3.4 Landscape Unit #4: Cap-à-l'Ouest

The Cap-à-l'Ouest geological formation marks the beginning of the Saguenay fjord on the south side of the river. The Cap-à-l'Ouest, which is a regional landmark, forms the border between the La Baie des Ha! Ha! and the Saguenay River. Its steep walls of over 150 m in height, abruptly plunge into the Saguenay. Several peaks of 190 to 210 m in height form a ridge from east to west of Cap-à-l'Ouest. The Saguenay River and Fjord strongly mark the landscape. A large forest, which consists primarily of conifers, covers the entire area, which uninhabited for the most part. Cap-à-l'Ouest is part of the territory of aesthetic interest and is identified as part of the riverside heritage in the urban and development plans of the City of Saguenay.

Sub-Unit 4a: Intermodal Sector of the Grande-Anse maritime industrial park

The plant implementation site is located within this landscape sub-unit. This sub-unit stands out in the Cap-à-l'Ouest landscape unit because of its industrial features. It includes facilities bordering the Grande-Anse Road, the marine terminal of the Anse à Benjamin Road, including the overall infrastructure and installations regrouped at the Grande-Anse marine terminal and at the Grande-Anse Intermodal Marine Industrial Park.

Regarding the marine terminal, its facilities include infrastructure for ship berthing (docks), cargo transshipment, some buildings and a storage area. With respect to the industrial park, its facilities include a few buildings and a storage area surrounded by fallow and vacant lands. These are part of the expansion and industrial area reserved for new industrial development projects. The rail service and the Quai-Marcel-Dionne Road cross this area. The presence of a

forest north of the industrial park means there is no visual access to the section of the Saguenay River in the area. The landscape unit also includes a crushed stone quarry located along the Grande-Anse Road.

Figure 4.10 View towards the Grande-Anse Marine Terminal from the Saguenay's North Shore

Source: BC2

Figure 4.11 Vacant land where the future pig iron plant will be constructed

Source: BC2

Figure 4.12 Railway link to the Grande-Anse Intermodal Marine Industrial Park

Source: BC2

Figure 4.13 Forest area forming the buffer zone between the site, Rue Saint-Martin and the Saguenay River

Source: BC2

Sub-Unit 4b: Waterfront Area, St. Martin Road

This landscape unit includes the area between the Saint-Martin Road and the Saguenay River and encompass the only inhabited part of the Cap-à-l'Ouest landscape unit. The landscape is strongly marked by the importance of the River and the Saguenay Fjord. Its surrounding terrain is lined with rocky cliffs whose overhang is occupied by plateaus or agricultural lands interspersed with some built-up areas. The landscape unit offers visual fields that are

sometimes limited by the vegetation that occupies the wooded plateaus, and are sometimes open thanks to the farmlands bordering the Saint-Martin Road which offers a landscape of interest in the north since it offers a clear view of Monts-Valin in the background.

Figure 4.14 View towards the Saguenay from *Chemin* St-Martin

Source: BC2

Figure 4.15 *Chemin* Saint-Martin

Source: BC2

4.6.3.5 Landscape Unit #5: The Saguenay River

The Saguenay River forms a landscape unit whose main features are the presence of a water body itself, located in between major forested escarpments. The unique landscape of the fjord is a major tourist attraction recognized in the development plan as an area of aesthetic interest. The river is used for commercial and recreational shipping and is in itself a landscape attraction.

Figure 4.16 Saguenay river seen from Saint-Fulgence

Source : BC2

4.6.3.6 Landscape Unit #6 Waterfront Landscape Unit, Saint-Fulgence

This landscape unit includes the areas from which the project site is visible, on the north bank of the Saguenay River. The northern boundary of the landscape unit is formed by the road to Tadoussac (Highway 172) and the southern boundary of the river. The east and west ends are formed by major changes in the direction of the river that make the project site more visible. The western portion of the landscape unit (6a) consists of an agroforestry plateau located at almost at river level. This secteur is notably marked by the presence of large flats at the mouth of the Rivière aux Outardes.

Figure 4.17 View of the flats, St-Fulgence

Source: Michel Curcio (Courtesy of BC2)

The landscape changes in Cap-à-l'Ouest at the beginning of the fjord. The topography changes rapidly and forms a number of cliffs with an average height of 100 meters. The agricultural landscape turns into a forest landscape in the eastern part (6b). Highway 172 drifts away from the river and its views disappear. The built environment consists of isolated residences, most of which are located along Highway 172 or along roads perpendicular to it and provide visual access to the river. This landscape is also characterized by numerous leisure places, including several inns, road-houses and the Cap Jaseux adventure park.

Figure 4.18 Terrasse of the Auberge de la Tourelle

Source: Urek Wyder (courtesy of BC2)

Figure 4.19 Beach located south of Cap Jaseax

Source: Denis Beaulieu (courtesy of BC2)

4.6.3.7 Nightlife

The site of the proposed plant is located far away from urban areas and main residential areas, with the exception of the houses located on the edge of the plateau farmlands, north of the site. Since most of the area is currently occupied by farmlands and forests, there is little light there at night. The main sources of light are the port's facilities, lampposts lining the roads of the agricultural area, and light from houses along these roads. Therefore, there is limited lighting, which leads to nightlife dominated by natural lighting (the moon and the stars).

Figure 4.20 View of *Chemin* Saint-Martin from the Auberge de la Tourelle

Source: BC2

265 000 270 000 275 000 280 000 285 000 290 000

5 370 000 5 365 000 5 360 000 5 355 000

SAINT-HONORÉ, M

Arrondissement Chicoutimi Borough

SAINT-FULGENCE, M

Rivière Saguenay

Arrondissement Chicoutimi Borough

SAINTE-ROSE-DU-NORD, P

SAGUENAY, V

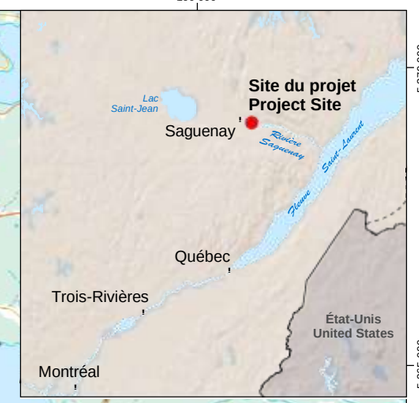
Rivière Saguenay

Arrondissement La Baie Borough

Baie des ha! ha!

Aéroport de Bagotville Airport

SAINT-FÉLIX-D'OTIS, M



Composantes du projet
Project Components

- Empreinte du projet / ProjectFootprint
- Zone d'étude locale (2,5 km) / Local Study Area (2.5 km)

Limites
Limits

- Limite des arrondissements / Borough Boundary
- Limite des municipalités / Municipality Boundary

Stations de mesure
Monitoring Stations

- Station météorologique / Meteorological Stations
- Qualité de l'air / Air Quality

NAIC

SNC·LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Carte 4.1/ Map 4.1

Délimitation des zones d'étude et stations d'échantillonnage /
Study Area Limit and Monitoring Stations

Sources :
Toporama Web Map Service, MRN Canada
Ville de Saguenay, 2016
SDA, 1/20 000, MERN Québec, sept. 2013
BDGA, 1/5 000 000, MRNF Québec, 2012
Worl Shaded Relief, ESRI, 2014
Projet / Project : 634451

Projection MTM, fuseau 7, NAD83

0 1 2 km
1/100 000

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Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified

Format 11x17

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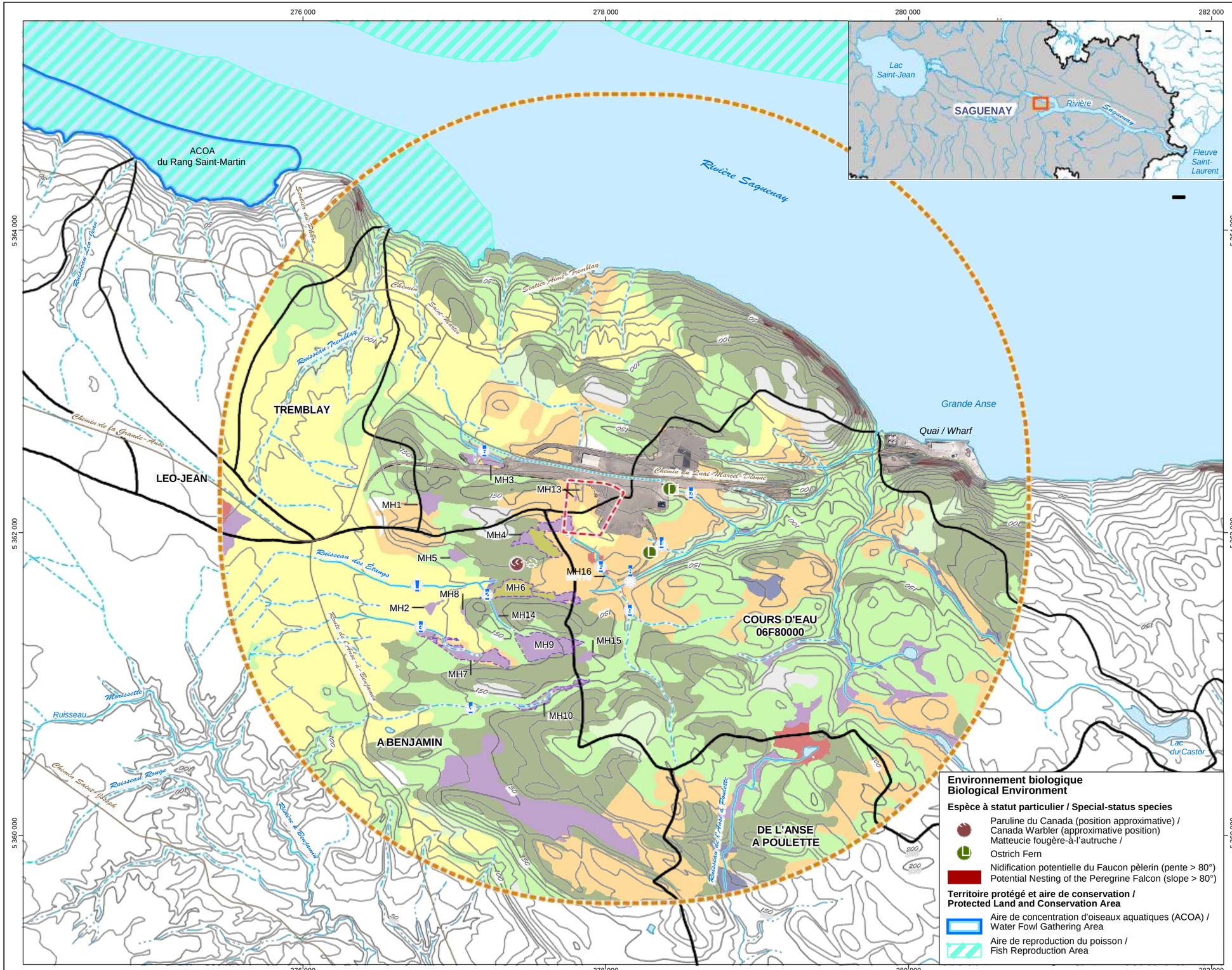

Composantes du projet / Project Components

- Empreinte du projet / Project footprint
- Zone d'étude locale (2,5 km) / Local Study Area (2.5 km)

Environnement physique / Physical Environment

- Identifiant des cours d'eau caractérisés / Characterized Watercourse Identifier
- Cours d'eau permanent / Permanent Watercourse
- Cours d'eau intermittent / Intermittent Watercourse
- Fossé de drainage / Drainage Ditch
- Bassin versant de niveau 1 (voir encadré) / Level 1 Watershed (see top right)
- Bassin versant de niveau 2 / Level 2 Watershed
- Courbe de niveau (équidistance 10 m) / Contour Line (10 m interval)

Environnement biologique / Biological Environment

Milieu forestier / Forested Area

- Peuplement résineux / Conifer Stand
- Peuplement mélangé / Mixted Stand
- Peuplement feuillu / Hardwood Stand
- Dénudé et semi-dénudé / Bare or Semi-Bare soil
- Perturbation et coupe / Partial Clearing

Milieu non forestier / Non-Forested Area

- Terres agricoles / Agricultural Land
- Milieu anthropique / Developed Land

Milieu humide / Wetland

- MH1 Identifiant des milieux humides caractérisés / Caracterized Wetland Identifier
- Herbaçaie et eau peu profonde / Marsh and Shallow Water
- Marécage / Swamp
- Tourbière / Bog
- Non déterminé / Undetermined
- Complexe de milieux humides / Wetland Complex

Environnement biologique / Biological Environment

Espèce à statut particulier / Special-status species

- Paruline du Canada (position approximative) / Canada Warbler (approximative position)
- Matteucie fougère-à-l'autruche / Ostrich Fern
- Nidification potentielle du Faucon pèlerin (pente > 80°) / Potential Nesting of the Peregrine Falcon (slope > 80°)

Territoire protégé et aire de conservation / Protected Land and Conservation Area

- Aire de concentration d'oiseaux aquatiques (ACOA) / Water Fowl Gathering Area
- Aire de reproduction du poisson / Fish Reproduction Area

NAIC

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NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay / Pig Iron Production Plant - Saguenay

Carte 4.2 / Map 4.2

Description du milieu biophysique / Biophysical Environment

Sources :
Faucon: CDPNQ 2016b
Poissons: MDDELCC Québec, février 2016
Paruline du Canada: Groupe Hémisphère 2012, Genivar 2010
Milieux humides: Canards Illimités Canada, 07-2009;
et forestiers Carte écoforestière, 4e inventaire, MERN Québec, 2015;
Groupe Hémisphère 2012, Genivar 2010
Hydrographie: Carte écoforestière, 4e inventaire, MERN Québec, 2015
Habitat Faunique du Québec (HAFA), MERN Québec, juillet 2015
Aires Protégées du Québec, MDDELCC Québec, mars 2014
Adresse Québec, MERN Québec, mars 2015

Projet / Project : 634451

Projection MTM, fuseau 7, NAD83

0 0,25 0,5 km

1/25 000

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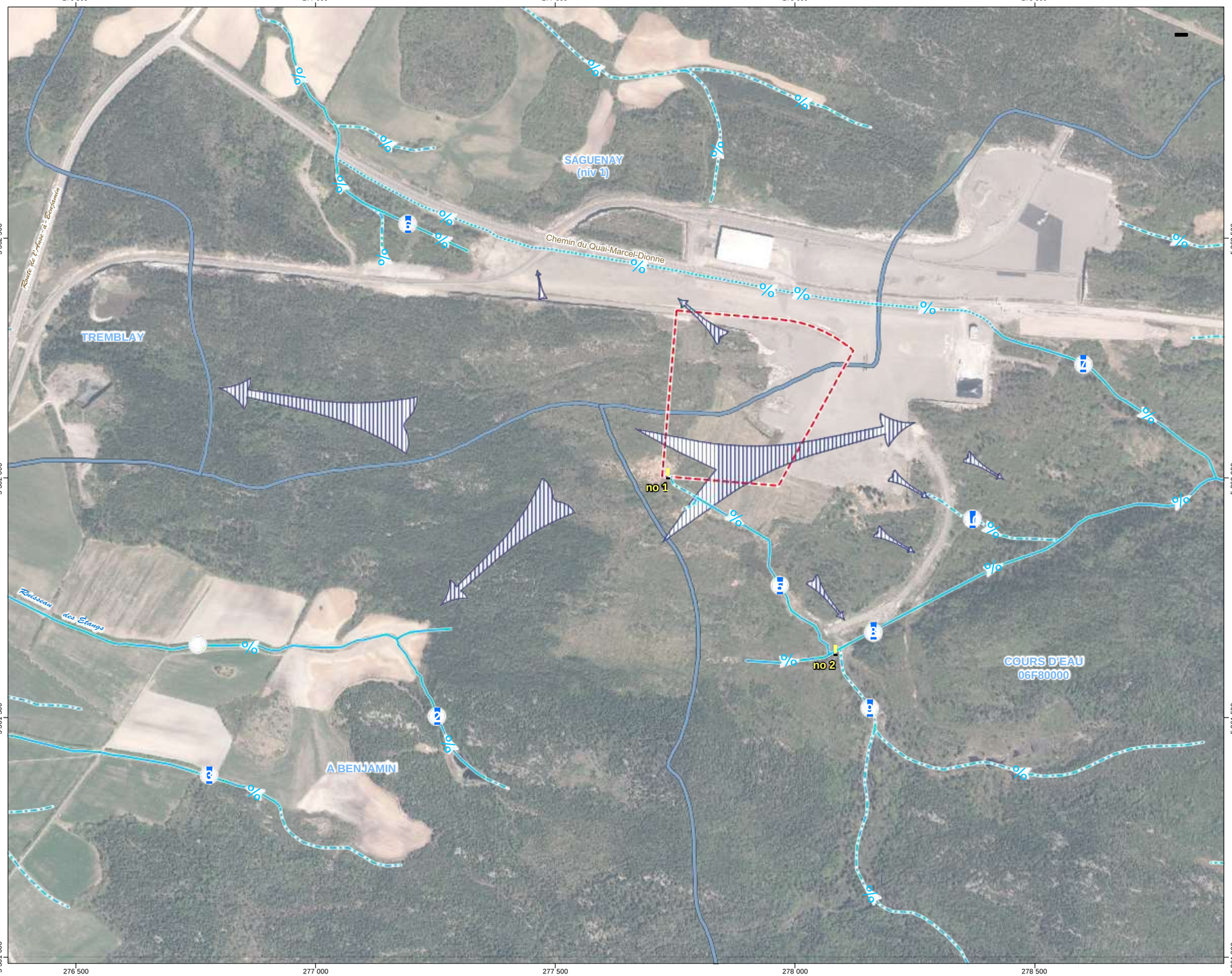

Composantes du projet
Project Components

Empreinte du projet / Project footprint

Station d'échantillonnage
Sampling Station

Station d'échantillonnage de l'eau de surface
Surface water sampling station

Environnement physique
Physical Environment

Identifiant des cours d'eau caractérisés /
Characterized Watercourse Identifier

Sens d'écoulement des cours d'eau /
Water Flow Direction

Cours d'eau permanent / Permanent Watercourse

Cours d'eau intermittent / Intermittent Watercourse

Fossé de drainage / Drainage Ditch

Écoulement des eaux souterraines /
Groundwater Flow Direction

Bassin versant de niveau 2 (sauf indication contraire)
Level 2 Watershed (except if specified otherwise)

NAIC

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NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Carte 4.3 / Map 4.3

Contexte hydrographique
Hydrographic Network

Sources :
Ville de Saguenay, 2016
Bassins hydrographiques du Québec, MDDEP Québec, 2011

Projet / Project : 634451

Projection MTM, fuseau 7, NAD83

0 80 160 m
1/8 000

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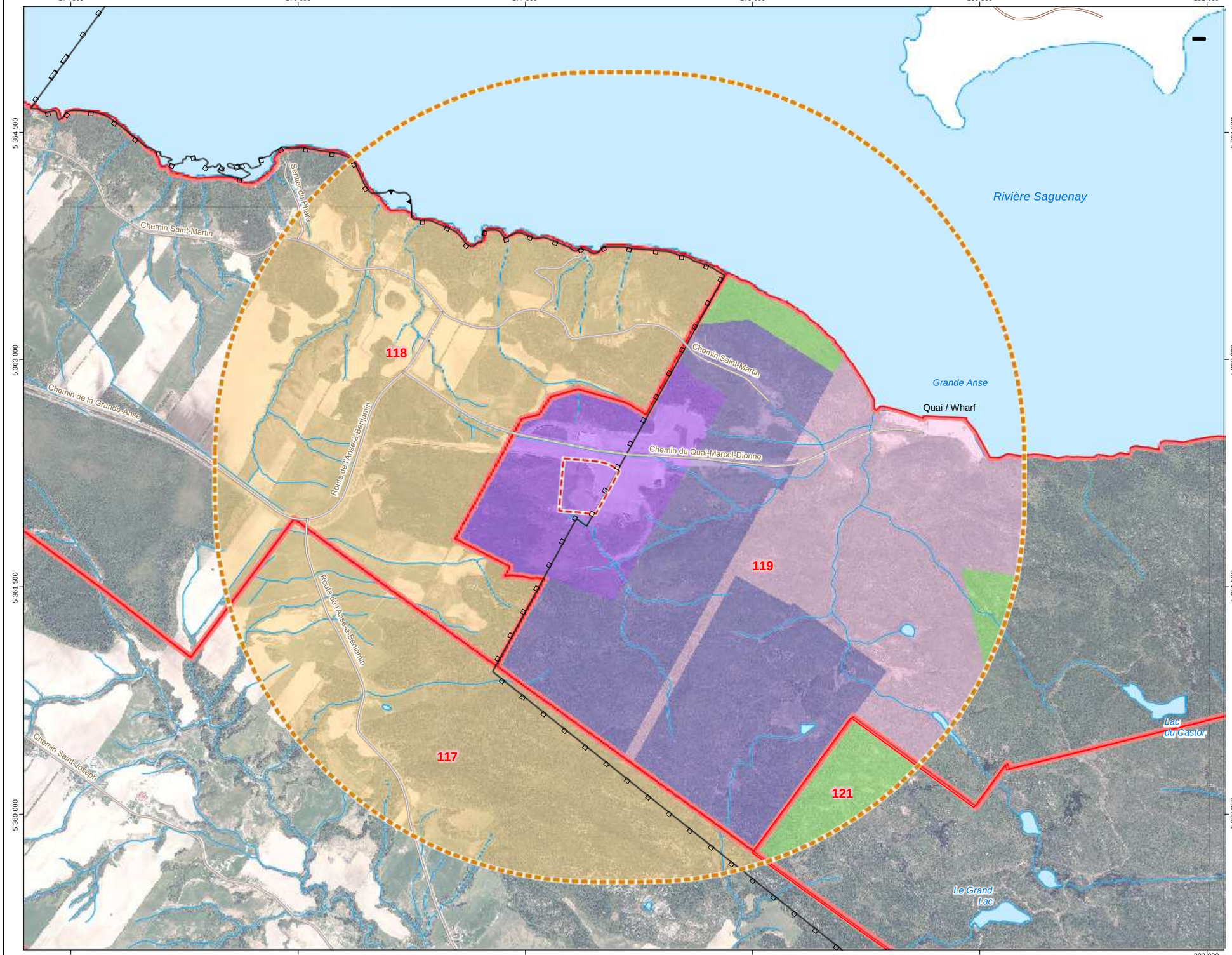

Composantes du projet
Project Components

- Empreinte du projet / Project footprint
- Zone d'étude locale (2,5 km) / Local Study Area (2.5 km)

Limites
Limits

- Territoire agricole protégé / Protected AgriculturalArea
- Unité de planification / Planning Unit
  - 119 Identifiant des unités / Unit Identifier

Affectation
Land Allocation

- Expansion industrielle / Industrial Expansion
- Réserve industrielle / Industrial Reserve
- Portuaire / Port Use
- Forestière / Forest
- Agricole / Agricultural

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NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Carte 4.4 / Map 4.4

Affectation du territoire et unité de planification
Landuse Designation and Planning

Sources :
Ville de Saguenay, 2016
Adresse Québec, 2015
CanVec, 1/50 000, 2016
CPTAQ, 03-2014

Projet / Project : 634451

Projection MTM, fuseau 7, NAD83

0 0,25 0,5 km
1/25 000

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274 500 276 000 277 500 279 000 280 500 282 000

5 364 500 5 363 000 5 361 500 5 360 000

Rivière Saguenay

Chemin Saint-Martin

Sentier du Phare

7,7 km du noyau urbain de Chicoutimi / 7.7 km to Chicoutimi Urban Center

no.1

no.2

no.3

Chemin de la Grande-Anse

Route de l'Anse-à-Benjamin

Chemin du Quai-Marcel-Dionne

Chemin Saint-Joseph

2,8 km du noyau urbain de La Baie / 2.8 km to La Baie Urban Center

Lac du Castor

Le Grand Lac

Lac Saint-Jean

Site du projet
Project Site

Rivière Saguenay

Partie Sud-Ouest du Nitassinan

Fleuve Saint-Laurent

Composantes du projet
Project Components

- Empreinte du projet / Project footprint
- Zone d'étude locale (2,5 km) / Local Study Area (2.5 km)

Éléments du milieu humain
Human Environment Elements

- Bâtiment résidentiel / Residence
- Immeuble patrimonial / Heritage Property
- Carrière exploitée / Mined Quarry
- Route du Fjord
- Réseau cyclable / Bicycle Route - La Route verte
- Sentier quad / Quad Track
- Sentier pédestre / Hiking Path - Kapatakan
- Titre minier (expiré) / Expired Mining Title
- Patrimoine riverain / Waterfront heritage

Utilisation du sol
Landuse

Milieu naturel / Natural Environment

- Forestier / Forest
- Milieu humide / Wetland

Espace aménagé / Developed Land

- Terre agricole exploitée / Exploited Agricultural Land
- Terrain vacant et friche / Fallow Vacant Land
- Industrielle / Industrial
- Milieu bâti / Developed Area
- Utilité publique / Public Utility
- Terrain improductif / Unused Land
- Industrie extractive / Extractive Industry

Infrastructures
Infrastructure

- Chemin de fer / Railway

Environnement sonore / Ambient Noise

- < no.1 Station de mesure / Noise Monitoring Station Identifiant / Identifier

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NORTH ATLANTIC IRON CORPORATION

Usine de production de fonte en gueuse - Saguenay / Pig Iron Production Plant - Saguenay

Carte 4.5 / Map4.5

Description du milieu humain /
Description of the Human Environment

Sources :
Ville de Saguenay, février 2016
Adresse Québec, mars 2015
CanVec, 1/50 000, 2016
Répertoire du patrimoine culturel du Québec,
Ministère de la Culture et Communications, Québec. 2016

Projet / Project : 634451

0 0,25 0,5 km

Projection MTM, fuseau 7, NAD83

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Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified

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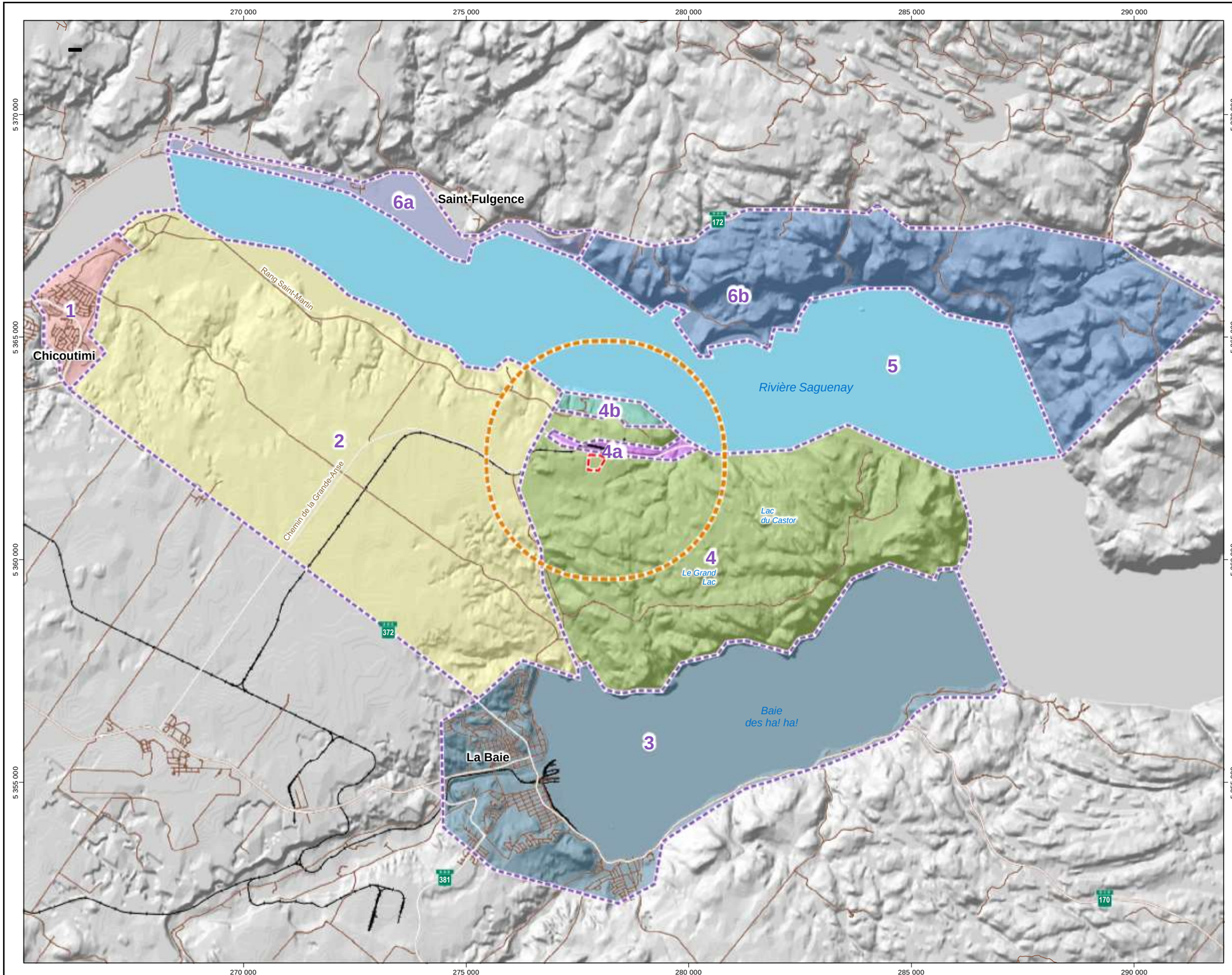

Composantes du projet / Project Components

- Empreinte du projet / Project footprint
- Zone d'étude locale (2,5 km)

Unités de paysage / Landscape Units

- Limite d'unité de paysage / Landscape Unit Limit
- 1 Paysage urbain / Urban Landscape
- 2 Paysage agricole / Agricultural Lanscape
- 3 La Baie
- 4 Le Cap-à-l'Ouest
- 4a Parc industriel maritime intermodal de Grande-Anse
- 4b Secteur riverain / Waterfront Lanscape
- 5 La rivière Saguenay / Saguenay River
- 6a Secteur riverain / Waterfront Lanscape
- 6b Secteur riverain / Waterfront Lanscape

NAIC

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NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay / Pig Iron Production Plant - Saguenay

Carte 4.6 / Map 4.6

Description du milieu visuel / Landscape Components Description

Sources :
Adresse Québec, mars 2015
Relief ombré, MNEC, 1/50 000, Ressources Naturelles Canada

Projet / Project : 634451

Projection MTM, fuseau 7, NAD83

0 0.85 1.7 km

1/85 000

Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified
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Format 11x17

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Chapter 5

Public Consultation

Table of Contents

5 Public Consultation 1

5.1 Consultation Approach 1
5.2 Preliminary Consultations 1
5.2.1 Consulted Stakeholders 1
5.2.2 Objectives 1
5.2.3 Methodology 2
5.2.4 Participation Level 2
5.2.5 Principal Problems and Concerns 3
5.2.6 Stakeholders' Recommendations 5
5.3 Consultation on the ESIA results 6

List of Tables

Table 5.1 Issues and Concerns Raised during the Preliminary Consultations 4
Table 5.2 Stakeholders Recommendations – Preliminary Consultations 5

5 Public Consultation

This chapter presents the main results of the consultation process undertaken in the Saguenay conducted within the context of the environmental and social impact assessment (ESIA).

5.1 Consultation Approach

Public consultation is part of the process of assessing a project's social and environmental impacts. Its main purpose is to provide the different stakeholders with objective information to ensure their concerns and expectations are taken into consideration from the project design stage. In addition, consultations help highlight the major socio-economic and environmental issues to be taken into consideration in the ESIA process.

The consultation process for this project has two main components: preliminary consultations followed by a wider range of information and consultation activities that will be held at a further stage.

5.2 Preliminary Consultations

5.2.1 Consulted Stakeholders

Consultation activities targeted stakeholders at the local and regional levels. The majority of stakeholders are from the Saguenay-Lac-Saint-Jean region, and more particularly from the City of Saguenay and the La Baie borough. The table presented in Appendix J.1 provides a list of the stakeholders met.

Taking into account the nature of the project and the specifics of the study area, stakeholders were grouped into five categories:

- Administrations/elected officials;
- Citizens;
- Socioeconomic organizations;
- Environmental organizations;
- Innu communities.

A description of the identified stakeholders is included in Appendix J.2 for reference.

5.2.2 Objectives

The preliminary consultations were an important source of qualitative data that contributed to enhancing the project's potential impact analysis. The main goals of these consultations were the following:

- Disseminate information on the project and on the environmental assessment process to stakeholders;
- Identify issues, concerns and expectations by stakeholders to be taken into account from the conception phase of the project;
- Collect suggestions and expectations on the next consultation phase;

› Open the dialogue and build a trust relationship between the proponent and key stakeholders of the receiving environment.

5.2.3 Methodology

The methodology used for the preliminary consultations was as follows:

› Establishment of a list of key stakeholders, persons, groups and organizations that are representative of the receiving environment and various interest groups;
› Semi-structured meetings with persons, groups and organizations who accepted the invitation. These meetings began with a general presentation of the project followed with open-ended questions, and a discussion on concerns and expectations regarding the project;
› Consolidation of the comments received and integration into the project.

Communication tools were prepared to support the preliminary consultations and are presented in Appendix J.3. These include:

› An interview guide;
› A project's location maps;
› The layout of the pig iron manufacturing process;
› Images of pig iron and of typical plant installations.

The preliminary consultations were conducted by the consultant. Meetings gathered generally two to three individuals: there were conducted as semi-structured interviews, lasting approximately 1h10. In addition, representatives from two organizations (Centre local d'emploi of Chicoutimi and the Commission scolaire des Rives-du-Saguenay) and from the City of Saguenay (Service of territorial planning and urbanism) were contacted by phone to obtain additional information for the purpose of the ESIA, following the recommendations of stakeholders.

At this stage of the consultation process, the stakeholders did not mention the need to express confidential opinions during the meetings. However, the confidentiality of participants' opinions is respected in this study in order to maintain a trust relation with the key stakeholders.

It is important to mention that the cordiality and openness of stakeholders which characterized the whole of the preliminary consultations.

5.2.4 Participation Level

In total, 11 meetings involving 24 participants were carried out between January 25 and 28, 2016 and on February 17, 2016 in Saguenay, in the boroughs of Chicoutimi and La Baie (Appendix J.1). Overall, the following stakeholders were met:

› Ville de Saguenay;
› two environmental organizations;
› four socioeconomic organizations;

› six households; and

› three Innu communities (Essipit, Mashteuiatsh and Pessamit).

It should be noted that the mayor of the Ville de Saguenay was the only elected officials met during the preliminary consultations. Households were identified using a 2.5 km radius around the project site.

Stakeholders interviewed were satisfied with the consultation process and appreciated being consulted at this stage of the project's planning. All participants contacted for the purpose of the preliminary consultation accepted the invitation.

5.2.5 Principal Problems and Concerns

At the time of the preliminary consultations, the project had not been officially announced. Consultations thus allowed providing firsthand information to stakeholders about the project. It should be noted that at the time of the consultations, the project planned on using coal in its production process. As discussed in Chapter 2, NAIC has since reviewed its technology, eliminating the use of coal, and thereby reducing dust and greenhouse gas emissions. In doing so, NAIC has answered to several concerns raised during the preliminary consultations and reported below.

Generally, the project announcement was well-received by stakeholders. One of the reasons is the current economic downturn which characterizes the Saguenay region, with limited employment opportunities in the industrial sector. A project such as NAIC would not only allow creating local job opportunities, but also business opportunities for local service and goods providers. In addition, in terms of job creation, participants insisted on the importance of accessing quality jobs that would allow retaining the local workforce.

However, participants expressed some concerns, particularly regarding the management of dust emissions. Other concerns included noise, waste water generated by the plant, solid waste, as well as the management of raw materials (storage and use of coal and of iron ore). Given that the Grande-Anse sector has had limited industrial activities up until recently, participants have insisted on the importance of preserving the quality of life around the site and more generally in the region. The use of the Saguenay River as a transportation axis was also raised during the meetings, particularly with regards to the protection of native species, recreo-tourism, and maritime traffic.

Representatives of the Innu communities of Essipit, Mashteuiatsh and Pessamit, in addition to reiterating the concerned mentioned above, have stated the importance of recognizing their rights on their Nitassinan, and more particularly on its southwest portion (Map 4.5). Even if the communities do not actively use the project site, participants met expressed the importance of protecting traditional activities that are carried out near the project site, along the Saguenay River, the potential patrimonial sites along the fjord, and to consider that economic benefits should be shared fairly. Participants insisted on the importance of establishing and good collaboration with their respective communities.

Table 5.1 below presents a summary of the main issues and concerns raised during the preliminary consultations, grouped under two large themes: environmental and socioeconomic issues.

Table 5.1 Issues and Concerns Raised during the Preliminary Consultations

Theme	Description
Environmental issues	
Climate	Quantity of greenhouse gas (GHG) emitted by the plant and use of best technologies to minimize GHG.
Emissions and pollutants	Air quality near the plant
	Control of dust emitted by the plant (in relation with the use of coal)
	Temperature and quality of discharged wastewater
	Noise and ambient environment of the plant
	Revaluation and reuse of solid waste
	Storage of raw materials, coal in particular
Navigation	Protection of native species of the Saguenay River and arrival by ship of exotic species
	Increase of maritime traffic on the Saguenay River
	Respect and continuity of recreo-touristic activities on the Saguenay River
	Impacts of transshipment and of handling of raw materials arriving by ship
Road transportation	Circulation of trucks near residential zones
Cumulative impacts	Cumulative effects on species of the Saguenay River related to ships serving other projects
Closing of the plant	Find the project site as it was before the construction of the plant
Socioeconomic issues	
Community relations/ Social engagement	Dissemination of information regarding the project and collaboration with local stakeholders
	Support the development of the receiving community
	Integration to ongoing community relations initiatives between the industrial sector and citizens
Local partners	Respect of engagements and of development orientations with local partners
	Establishment of partnerships allowing the preservation of the plant operation on the long-term
Employment	Sensitivity of the proponent to industrial risks and establishment of a work health and safety policy
	Creation of quality jobs
	Retention of workforce within the company, but also within the region
Port infrastructure	Added value to the Port of Saguenay infrastructure, in particular the conveyor and the railway, by ensuring that they can serve several users.
First Nations	Recognition of rights and collaboration with the Innu communities concerned by their Nitassinan (and more particularly its southwest portion)
	The protection of potential patrimonial sites located in or near the fjord
	Respect for traditional activities carried out near the project site, along the Saguenay River, in particular, fishing of marine mammals and waterfowl hunt
	Impacts that may be felt in the communities such as atmospheric emissions and waste

5.2.6 Stakeholders' Recommendations

Several recommendations were made by the key stakeholders in relation to the project and to the next consultation phase. These recommendations were taken into consideration in the project analysis, particularly for the option analysis, impact assessment, and of the identification of prevention and mitigation measures. The main recommendations made by stakeholders are presented in Table 5.2.

Table 5.2 Stakeholders Recommendations – Preliminary Consultations

Theme	Description
Emissions and pollutants	Implement best production technologies in order to minimize pollution (treatment of atmospheric emission and of other pollutants)
	Sensitize the community to the low risks related to the pig iron plant
	Repurpose solid waste through local projects/partners
Navigation	Consult the riverside communities affected by the impact of maritime traffic related to the project, including municipalities located on the North Shore and along the Saguenay River
Road and maritime transportation	Establish partnerships with other projects/industries wishing to establish themselves in the Saguenay region in order to maximize infrastructure and transportation modes
	Adopt a policy for the safety of maritime transportation, including emergency procedures in case of an incident
Pig iron production	Added-value to the production by favoring the transformation of pig iron production by local enterprises (smelter, for example)
Community relations/ Social engagement	Establish a formal mechanism for community relations
	Establish and social engagement program to support the development priorities of the community
	Vulgarize and present the technical results of the ESIA as well as industrial risks related to the plant, through communication tools accessible to the public
Local partners	Work in partnership with local organizations that support the development of enterprises
Employment	Specify information on economic benefits and more particularly on employment (number, sought-after specialties and types of positions)
	Prioritize local workforce and enterprises
	Support the training of the local workforce with help from teaching institutions present in the region and of research centers
Next consultations	Plan for more time between the invitation to consultations and the actual meeting
First Nations	Ensure economic benefits for the communities (jobs, contracts to enterprises). A collaboration agreement could be established.
Visual effects	Reduce the visual effects of the plant in the Grande-Anse sector

5.3 Consultation on the ESIA results

The main objective of the second consultation phase is to inform stakeholders of the ESIA results in order to:

- Answer to the questions raised during the preliminary consultations;
- Present and validate the avoidance/mitigation measures;
- Clarify, if required, some aspects of the study and ensure that questions raised by stakeholders are well integrated.

Following these consultations, if appropriate, the project could be enhanced by the addition of new mitigation measures.

These consultations will take place at the end of the summer, 2016. A complementary report will be prepared and will include:

- The stakeholders met;
- The method used
- The results obtained in terms of answers to questions raised during the preliminary consultations.

In addition, this report will clarify the foreseen mechanisms to maintain relations with the communities (aboriginal and non-aboriginal) during the project.

Chapter 6

Environmental Impact Assessment Methodology

Table of Contents

6 Environmental Impact Assessment Methodology 1

6.1 Identification of Environmental Impacts 1
6.2 Assessment of Environmental and Social Impacts 3
6.2.1 Intensity of the Impact 5
6.2.2 Extent of the Impact 6
6.2.3 Duration of the Impact 7
6.2.4 Significance of the Impact 7
6.3 Cumulative Environmental and Social Impacts 8

List of Tables

Table 6.1 Grid for Determining the Environmental Value 6
Table 6.2 Grid for Determining the Intensity of an Impact 6
Table 6.3 Grid for Determining the Impact Significance 8

List of Figures

Figure 6.1 Environmental Impact Assessment Process 4

6 Environmental Impact Assessment Methodology

The purpose of the social and environmental impact assessment is to evaluate the consequences and risks related to a specific project in a given social and environmental context.

The objectives of an environmental impact assessment are:

- To identify and evaluate the environmental impacts of a project, whether they are negative or positive;
- To enhance the positive impacts, and if they are negative, to avoid them or if they can't be avoided, to minimize, mitigate or compensate for them;
- To ensure that all of the relevant social and environmental issues are described in sufficient detail to appreciate the extent of their effect;
- To prepare a comprehensive and consistent social and environmental management plan.

The assessment of environmental impacts is carried out in two steps: their identification and their evaluation. Sections 6.1 and 6.2 below describe each of these steps.

6.1 Identification of Environmental Impacts

The identification of positive or negative impacts caused by the project implementation is based on the analysis of effects resulting from interactions between the affected social and environmental components and the various types of equipment used or activities to be carried out. The proposed equipment and activities are thus considered as sources capable of producing changes in one or many of the sensitive social and environmental components.

Social and environmental issues are taken into consideration as early on as during the study of site location or technological alternatives, thus providing input to enhance project design, construction methods and operations of facilities. This allows the project to be tailored according to its technological and economic constraints while safeguarding the environment from potential adverse effects.

Each element of the project is examined according to its potential effects on each of the environmental components for each phase of the project (construction, operations and decommissioning). The possible interactions between the different environmental components (indirect effects) are also considered. Project elements that are related to its various phases including surveys, construction, operation, maintenance, dismantling and decommissioning are all taken into consideration.

During construction, the potential sources of impacts include:

- development of the construction facilities;
- transportation and traffic resulting from the movement of workers, construction machinery and construction materials;
- site deforestation and management of waste;

- earthwork and excavation;
- disposal of excavated material;
- management of wastewater and the surface water drainage network
- construction and development of facilities and related structures;
- contaminated and non-contaminated waste management (e.g. used oils);
- job creation;
- procurement of goods and services.

During the operation and decommissioning phases, the impacts will be related to:

- operation of equipment (noise, atmospheric emission, liquid effluent, waste and dangerous waste management, purchase of goods and services, and job creation);
- equipment maintenance and eventually equipment repair during its lifecycle;
- equipment disassembly at the end of its useful life.

The physical, biological or socioeconomic components which may be affected by the project are the sensitive elements in the study area, that are, those likely to change or be affected significantly because of components or activities linked to the project. They may include:

- air quality;
- noise environment;
- surface water and groundwater quality;
- sediment quality;
- soil and sediment quality;
- terrestrial vegetation and wetlands;
- fauna and habitats;
- special status species;
- land use and zoning;
- infrastructures and public equipment;
- public safety;
- quality of life for residents, including, among others, health, safety and noise;
- cultural and archaeological heritage;
- landscape;
- socioeconomic activities.

Finally, the project's impacts on global issues such as GHG emissions and biodiversity are also taken into account in the analysis.

6.2 Assessment of Environmental and Social Impacts

When all of the potential impacts of a project on an environmental component have been identified, the significance of the predicted changes of this component is then evaluated.

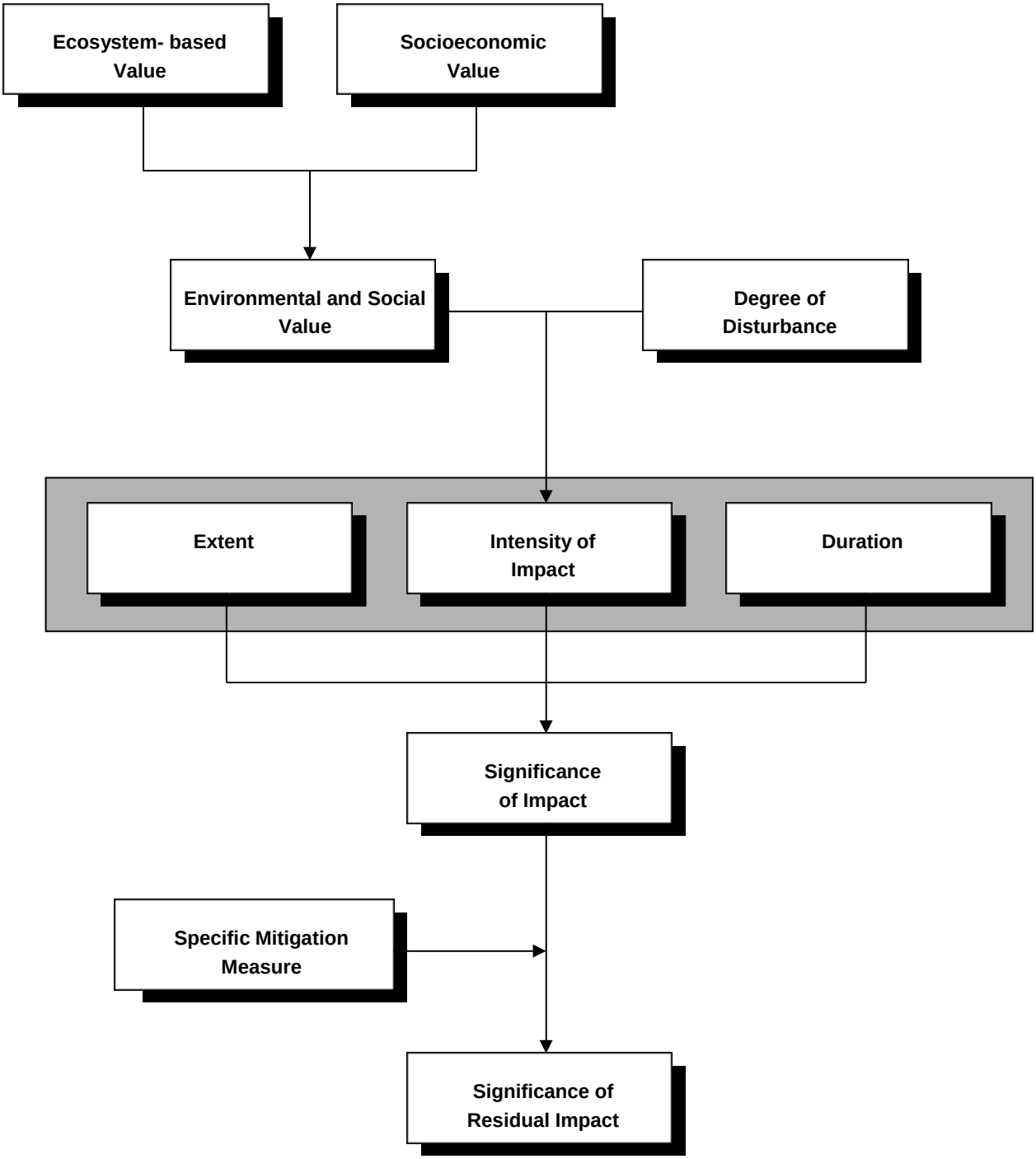
For this second step, the methodology followed was adapted from impact assessment methods recommended by Hydro-Quebec (1990), the Quebec's Ministry of Transport (MTQ, 1990), the MDDELCC (MDDEFP, 2014b), the Canadian Environmental Assessment Agency (2000), as well as by different international organizations including the World Bank and the International Finance Corporation (SFI, 2006).

The approach used to assess environmental impacts of the project determines the social and environmental **value** of the components and the **intensity**, **extent**, and **duration** of the anticipated positive or negative impact. These three qualifiers are grouped under one synthesis indicator, the **significance of the impact**. This indicator provides an overall assessment of the anticipated impacts on a given environmental component.

Figure 6.1 schematically presents the basic process leading to assessment of the impact, as well as the input and output of each step.

Although the impacts on the physical environment are described and quantified as accurately as possible, they cannot be assigned a value in and of themselves. The social or ecosystem-based value of a physical component cannot be defined other than in reference to a specific use or to its importance for flora, fauna or human beings. Consequently, the evaluation of impacts cannot be completed for these components. For instance, a modification to water quality can only be assessed in terms of their resulting impacts on biological and human components, and not through their intrinsic value. However, as changes on the physical environment serve as input to the assessment of impacts on the biological and human environments, they must be analyzed and quantified where possible.

Figure 6.1 Environmental Impact Assessment Process



6.2.1 Intensity of the Impact

The **intensity of an environmental and social impact** expresses the relative importance of consequences attributable to a change in an environmental component. For the majority of environmental components the **intensity** of impact is the integration of the component's **environmental value** with its **degree of disturbance** and can be either positive or negative. For the impact of noise, however, given the nature of this component, the approach to determine the intensity of the impact is different and is described in Appendix H.

The environmental value of a component is the synthesis of its **ecosystem-based value** and its **socioeconomic value**. The **ecosystem-based value** expresses the relative importance of a component to the ecosystems as measured by its function or role. It integrates other notions such as representativeness, patterns of use, diversity, or rare and unique characteristics. This value is the result of the judgment of specialists based on a systematic analysis of the characteristics of the environmental component.

The **ecosystem-based value** of a given component is considered to be:

- **High**, when the component is of major interest in terms of its ecosystem-based function, biodiversity, or exceptional qualities, and there is a consensus in the scientific community that it should be conserved or protected;
- **Medium**, when the component is of strong interest and has recognized qualities, and there is concern, although not consensus, for its conservation or protection; and
- **Low**, when the component holds little interest, has few notable qualities, and there is little concern for its conservation or protection.

The **s**ocioeconomic **v**alue of a component expresses the relative importance attributed to the component by the public, the various levels of government, or any other legislative or regulatory authority. It indicates the popular or political desire or will to conserve the integrity or the original character of a component. This will be expressed through the legal protection that the component is accorded, or by the concern of the local or regional public for the component. The **s**ocioeconomic **v**alue evaluation is based on information gathered during various public consultations in the study area and considers the relative sensitivity of the different stakeholders (disadvantaged or vulnerable groups, targets or directly or indirectly affected groups, etc.).

The **s**ocioeconomic **v**alue of a given component is considered:

- **High,** when the component is the object of legislative or regulatory measures (threatened or endangered species, conservation parks, etc.) or is essential to human activities (e.g., drinking water);
- **Medium,** when the component is valued or used by a significant portion of the concerned population, but is not legally protected; and
- **Low,** when the component is of little concern or is not used by the population.

The **environmental value** integrates the ecosystem-based value and the socioeconomic value and retains the higher of the two values as shown in Table 6.1.

Table 6.1 Grid for Determining the Environmental Value

Socioeconomic Value	Ecosystem-based Value		
	High	Medium	Low
High	High	High	High
Medium	High	Medium	Medium
Low	High	Medium	Low

The **degree of disturbance** for a component defines the scope of the changes that affect the component given its sensitivity to the proposed project. The changes to a given component may be negative or positive and the effect on the environmental component may be direct or indirect. The cumulative, synergistic, or delayed impacts, beyond the simple relation of cause and effect, could amplify the degree of disturbance to an environmental component when the environment is especially fragile. The degree of disturbance is:

- **High,** when an impact affects the continued viability of the environmental component, strongly and irreversibly impairs the component, or restricts its use in a significant way;
- **Medium,** when the impact changes, either by reducing or increasing, the quality or use of the environmental component affected, without, however, compromising its integrity;
- **Low,** when the impact affects the quality, use or integrity of the environmental component in a way that is barely perceptible; and
- **Undetermined,** when it is impossible to assess how and to what extent the component will be affected. When the degree of disturbance is undetermined, the impact assessment cannot be completed for that component. It will thus be necessary to collect more information on this component or implement an environmental monitoring program of to clarify its evolution as a result of the project's implementation.

The intensity of the impact results from the interaction of the three degrees of disturbance (High, Medium and Low) with the three classes of environmental value (High, Medium and Low). Table 6.2 shows the possible combinations of these inputs and the resulting Intensity.

Table 6.2 Grid for Determining the Intensity of an Impact

Degree of Disturbance	Environmental Value		
	High	Medium	Low
High	Very Strong	Strong	Medium
Medium	Strong	Medium	Low
Low	Medium	Low	Low (1)

(1) This intensity should be quantified as "very low" to respect the grid logic, but to limit the number of categories this class has been replaced by low. This leads to an overestimation of the impact intensity of these components, but the overall consequences are negligible.

6.2.2 Extent of the Impact

The **extent** of the environmental impact expresses the spatial influence of the effects produced by an intervention in the environment. This refers either to a distance or an area over which a component will undergo changes. It could also refer to the portion of the population that will be affected by the changes. The three levels of extent are:

› **Regional,** when an impact affects a large geographic area or a number of components located a significant distance from the project, or when it is experienced by a significant portion of the population in the study area;

› **Local,** when the impact affects a relatively restricted area located within, near, or at a limited distance from the project site; or when it is experienced by a limited portion of the population in the study area; and

› **Site-Specific,** when the impact affects only a very restricted area in the proximity of the project site; or is experienced by only a small number of individuals in the study area.

6.2.3 Duration of the Impact

The **duration** of the environmental impact describes the period of time during which a component undergoes changes due to the impact. Duration is not necessarily equivalent to the period of time during which the direct source of impact is active, as it may continue after the phenomenon causing it has ceased. It must also take into consideration the frequency when the impact is intermittent. Duration is characterized as:

› **Long,** when the effects are experienced continuously for the life of the facility, or even beyond if the effect is irreversible**;**

› **Medium,** when the effects are experienced over a relatively prolonged period of time, but less than the duration of the life of the facilities; and

› **Short,** when the effects are experienced over a limited period of time, generally corresponding to the period of construction, the start-up period, a single season, etc.

6.2.4 Significance of the Impact

The interaction between the intensity, extent, and duration defines the **significance** of an impact on a given environmental component. Table 6.3 presents the grid for determining Significance and differentiates between five levels of significance, ranging from very strong to very low.

The relative importance of each impact is assessed, considering the general mitigation measures integrated into the baseline project. For example, if it is anticipated that a silencer should be installed on a chimney, the evaluation of noise impacts will take into account the noise reduction attributable to the silencer. However, if no such equipment was anticipated at the beginning of the project and it is found that the noise level is unacceptable, a mitigation measure will be suggested (ex: installing a silencer on the chimney). When the mitigation measures integrated a priori to project implementation reduce impacts to the point of rendering them negligible, these impacts are excluded from further analysis.

Once the significance of an impact is established as more than negligible, it is described and additional, specific mitigation measures may be proposed to allow optimal integration of the project into the environment. Mitigation measures are implemented to avoid, minimize or compensate adverse social and environmental impacts by prioritizing, first and foremost, the avoidance of impacts. When the impacts are positive, the measures are meant to enhance or optimize the outcomes. The proposed measures naturally consider costs as well as financial,

social and environmental benefits that follow their implementation. The main measures proposed are presented at the end of Chapter 7.

The final assessment phase consists of determining the residual significance of the impact after all mitigation measures are taken into consideration. The issue here, then, is to clarify how the mitigation measure changes one or several of the inputs in the impact assessment process described above.

Table 6.3 Grid for Determining the Impact Significance

Intensity	Extent	Duration	Significance
Very strong	Regional	Long Medium Short	Very strong Very strong Very strong
	Local	Long Medium Short	Very strong Very strong Strong
	Site-specific	Long Medium Short	Very strong Strong Strong
Strong	Regional	Long Medium Short	Very strong Strong Strong
	Local	Long Medium Short	Strong Strong Medium
	Site-specific	Long Medium Short	Strong Medium Medium
Medium	Regional	Long Medium Short	Strong Medium Medium
	Local	Long Medium Short	Medium Medium Low
	Site-specific	Long Medium Short	Medium Low Low
Low	Regional	Long Medium Short	Medium Low Low
	Local	Long Medium Short	Low Low Very low
	Site-specific	Long Medium Short	Low Very low Very low

6.3 Cumulative Environmental and Social Impacts

The consideration of cumulative environmental effects is from now on an essential component of all environmental assessment conducted in virtue of Quebec Environment Quality Act. This

approach consists of examining the magnitude of the effects associated with the proposed project, for which an EIA is conducted, in combination with the effects of implemented projects, ongoing projects or reasonably foreseeable projects, including projects directly related to the main project, whether they are upstream or downstream of the supply chain.

The cumulative environmental effects can be defined as “the effect on the environment which results from effects of a project when combined with those of other past, existing and imminent projects and human activities (Hegmann and al, 1999)”. This definition suggests that any impact related to a given project may interfere, in time or in space, with the impacts of other past, ongoing or future project and thereby generate additional direct or indirect impacts on the either of the components of the environment. This means considering:

› The temporal and geographic boundaries of the assessment; and
› The interactions among the environmental effects of the project, and past and imminent projects and activities.

To facilitate consideration of potential cumulative impacts of the project, one must ensure that:

› The study area is large enough to allow the assessment of the main effects of the project on valued environmental components when combined to effects of other projects and past, existing and imminent activities;
› The description of environmental components include past environmental effects;
› The main development projects that are imminent or foreseen (residential, commercial, industrial or infrastructure) in the area are reviewed to ensure that their potential cumulative incidences are considered.

Future projects susceptible of interacting with the proposed project are identified during consultations or inventories conducted for the environmental impact study. However, the projects positioned upstream and downstream of the main project’s supply chain are identified from the technological analysis of the process. Then, based on available information, the environmental effects likely to combine with the consequences of the main project to create cumulative environmental impacts are identified.

The identification of cumulative environmental effects is made on the basis of available information and foreseen environmental effects of future projects. Unless precise data is available, the project environmental effects other than the main project are estimated on the basis of usual effects resulting from the implementation of similar projects.

The study of cumulative effects is presented in a specific section at the end of Chapter 7 so that the reader can clearly distinguish the cumulative effects from the direct and indirect effects attributed only to the project.

The supervision and monitoring program (Chapter 9) suggests measures to verify the accuracy of the assessment, and the efficiency of the mitigation measures proposed with regards to the principal cumulative environmental effects of the project.

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Chapter 7

Identification and Assessment of Impacts and Mitigation Measures

Table of Contents

7		Identification and Assessment of Impacts and Mitigation Measures	1
7.1		Impacts on the Biophysical Environment during the Construction Period	1
	7.1.1	Air Quality	1
	7.1.2	Surface Water Quality	2
	7.1.3	Soil and Groundwater Quality	5
	7.1.4	Impacts on Vegetation	5
	7.1.5	Impacts on Wildlife	6
7.2		Impacts on the Biophysical Environment during the Operation Period	8
	7.2.1	Air Quality	8
	7.2.2	Surface Water Quality	10
	7.2.3	Soil and Groundwater Quality	11
	7.2.4	Hydrology of the Receiving Watershed	13
	7.2.5	Vegetation	15
	7.2.6	Terrestrial Wildlife	15
	7.2.7	Aquatic Wildlife	15
7.3		Impacts on the Human Environment	22
	7.3.1	Land Use Planning	22
	7.3.2	Public Infrastructure	23
	7.3.3	Human Health and Odors	25
	7.3.4	Greenhouse Gas	26
	7.3.5	Soundscape	27
	7.3.6	Visual Environment	34
	7.3.7	Quality of Life	39
	7.3.8	Archeological Heritage	39
	7.3.9	Economic Spin-offs	40
7.4		Impacts of the Plant’s Closure	44
7.5		Impact Summary	45
7.6		Cumulative Environmental Impacts	50
	7.6.1	Projects Considered	50
	7.6.2	Cumulative Impacts Results Analysis	51

List of Tables

Table 7.1	Summary of the Results of the Atmospheric Dispersion Study for Scenarios 1 and 2	10
Table 7.2	Specific Low-Water Flows at the Stations Considered	14
Table 7.3	Flows Estimated for Watercourse 06f80000 at its Estuary with the Saguenay River	15
Table 7.4	Quality of the Effluent based on MDDELCC Criteria	16
Table 7.5	Assessed Toxicity of the Compounds used for the Conditioning of the Water	17
Table 7.6	Noise Levels and Equipment Use Percentage	29
Table 7.7	Projected Noise Levels – Plant Construction	29
Table 7.8	Intensity of the Noise Level Anticipated during the Construction of the Plant	30
Table 7.9	Plant Equipment Sound Power Level	31
Table 7.10	Projected Noise Levels Generated during the Operation of the Plant	33
Table 7.11	Intensity of the Noise Level Anticipated during the Operation of the Plant	33
Table 7.12	Economic Impact of the $257 Million Capital Expenditures (in thousands of dollars, 2016)	42
Table 7.13	Economic Impacts of $141.3 Operating Expenditure (in thousands of dollars -2016)	43
Table 7.14	Summary of the Residual Impacts of NAIC's Pig Iron Plant Project– Construction Phase	46
Table 7.15	Summary of the Residual Impacts of NAIC's Pig Iron Plant Project– Operation Phase	48
Table 7.16	Annual Emissions due to Materials Handling Activities by the APS	53
Table 7.17	Summary of the Results of the Atmospheric Dispersion Study on the Cumulative Impacts of the Plant's Operation and APS Handling Activities	54

List of Figures

Figure 7.1	Visual Simulation	38

7 Identification and Assessment of Impacts and Mitigation Measures

7.1 Impacts on the Biophysical Environment during the Construction Period

The construction works will be conducted on industrial lands owned by the Saguenay Port Authority (APS), on a site that was previously cleared and stripped in order to accommodate industrial facilities. This location therefore consists of vacant land ready for development. The impacts to be generated during the construction phase are related to the following environmental components:

› Air quality;
› Surface water quality;
› Soil and groundwater quality;
› Vegetation ;
› Wildlife.

Impacts on the human environment such as noise, and economic spin-offs generated during the construction and operation phases, are discussed in Section 7.3.

7.1.1 Air Quality

Based on available MDDELCC records on air quality, only two exceedances of the standard for fine particles ($PM_{2.5}$) were observed in 2012 and 2013, at the La Baie station. For all the other parameters measured, the standards are met.

Construction activities may cause temporary changes in air quality by emitting:

› dust from excavation and trucking on the road;
› gas and dust from combustion engines of heavy vehicles, machinery and equipment.

The use of heavy equipment and trucking activities associated with the construction period will fluctuate depending on the level of activity on the construction site. Mass excavations having been completed, dust emissions will remain much the same throughout the works. In addition to emissions due to traffic on the site, concreting works, detailed excavation works - including blasting – will be sources of air contaminant emissions.

Although these effects are local and could, at most, affect the immediate vicinity of the construction site, control measures will be implemented to reduce nuisances related to dust emissions:

› Speed limitations;
› Application of dust suppressants authorized by the MDDELCC, as appropriate, on bare surfaces in dry and windy conditions and on unpaved construction site roads;
› Use of a tarp covers (or other containment measures) over loads of bulk materials;

› Cleaning of paved roads;
› Repair and adjustment of vehicles, heavy machinery and equipment producing excessive emissions, visible at the exhaust;
› Raising truckers' awareness on idling;

During blasting activities:

› Conduct blasting operations in accordance with a pre-approved blasting plan. Vibrations and blast pressure must be controlled by adjusting dynamite loads and the time between explosions based on the limits imposed by the site's environmental conditions;

› Install protective carpets, if necessary, to prevent rocks from flying outside the site.

7.1.2 Surface Water Quality

Construction activities could affect water quality. During the site preparation works, runoff water can carry along sediment into surface waters. In addition, accidental spills can also contaminate surface waters. These spills could be caused by the following:

› Trucks, equipment or machinery in poor condition or during refueling or maintenance activities;
› Cleaning of concrete mixers;
› Handling or storage of hydrocarbons, other hazardous materials, or hazardous waste;
› Construction site sewage water.

The water quality monitoring parameters that are the most likely to be affected by runoff waters are pH, TSS, turbidity and hydrocarbons C_{10}-C_{50}.

The drainage network of the construction areas will be designed in a way to direct runoff waters towards a holding pond before being discharged into the watercourse. The drainage plan during the construction period will be determined during detailed engineering. Where access to the main basin by some temporary drainage ditches is not possible due to topography, sediment and hydrocarbon control measures will be installed, as a preventive measure, at the exit points and their effectiveness will be closely monitored. If necessary, passive water treatment systems, such as filter berms, a flocculation system or hydrophobic absorbents, will be installed in the basin in order to reach targets for TSS (35 mg/L) and hydrocarbons (2 mg/L).

In addition, a valve mechanism will be installed at the exit of the basin alongside a pumper truck access platform in order to allow recovery operations in the event of a major spill.

Where drainage to the main basin of some temporary drainage ditches is not possible due to topography, control measures for sediments and hydrocarbons will be installed at the exit points and their effectiveness will be monitored.

Periodic inspections of the site's drainage network will be carried out to ensure it is functional and effective. A program will be implemented to monitor drainage waters and, in particular, the places where these waters are discharged into the receiving environment to ensure that water

treatment is carried out effectively and that corrections are made if necessary. For example, some areas subject to erosion and TSS concentrations could be stabilized if needed.

No in-water work will be required for the construction of the plant.

During the pre-start-up phase, some activities may affect the quality of surface waters. To clean up pipes it may be necessary to use additives in the water which could then be contaminated. The water will either be analyzed for metals and hydrocarbons and suspended solids before deciding where the discharge point will be (creek or external disposal).

To prevent spills, specific procedures or methods designed to manage activities that can cause these spills will be included in the *Construction Environmental Management Plan (CEMP[1])* that will be given to the contractor. The CEMP will include the following procedures or plans:

› Cleanliness on the site;
› Management of fuels and petroleum equipment;
› Management of hazardous materials and hazardous waste;
› Management of concrete waste;
› Emergency Prevention and Response Plan;
› Management of sewage water.

7.1.2.1 Cleanliness on the Site

Work areas and other locations will be cleaned on a regular basis in order to remove any waste or rubble generated by the works. Likewise, all temporary installations that are no longer used will be removed.

7.1.2.2 Management of Fuels and Petroleum Equipment

Hydrocarbons used to heat temporary installations and refuel vehicles, equipment and machinery must be managed in accordance with regulatory requirements such as:

› The Building Act.
› Section VIII of the Building Code.
› Chapter VI of the Safety Code.
› The Propane Storage and Handling Code.

Specifications regarding the management of hydrocarbons and equipment spill will be presented in the CEMP. Spill prevention and containment methods will be described in the CEMP, as will the content and location of the emergency equipment kits to be used in the event of a spill. These must be present not only in vehicles, but also in refueling areas and at strategic points on the work site.

[1] The Monitoring and Follow-up Program that includes the CEMP is described in Section 9 of this report.

In addition, the mandatory use of biodegradable hydraulic oil will be included in the mandatory provisions of the CEMP.

7.1.2.3 Management of Hazardous Materials and Hazardous Waste

Hazardous materials must be transported in accordance with the *Transportation of Dangerous Goods Regulations* and stored in retention basins or equivalent containers and as indicated in the specifications mentioned in the material safety data sheets. They must also be labelled as directed in the Canadian Workplace Hazardous Materials Information System (WHMIS).

To manage hazardous waste, safe temporary storage areas where this waste can be consolidated (e.g. storage in barrels), will be provided to enable contractors to complete packaging and labeling prior to shipment to authorized sites in accordance with the *Transportation of Dangerous Goods Regulations*.

Although there is no long-term storage planned on the construction site, temporary work areas must be prepared to meet the requirements of the Hazardous Materials Regulations. A register documenting hazardous materials transiting on these sites must be kept and copies must be submitted to the Environmental Officer on a monthly basis. Arrangements for the management of hazardous waste will be stipulated in the CEMP. The location of temporary work areas must be authorized by the Environmental Officer.

7.1.2.4 Management of Concrete Waste

Concreting works produce alkaline residues that could have adverse effects on the environment if they are not properly managed. Thus:

- Concrete waste from the final emptying of concrete mixers or concrete pumps must be collected in sealed containers or recycled into bumpers;
- Wash water from concrete mixers/concrete pumps should be collected in sealed containers or tanks and must be treated (neutralized) on-site or off-site before being disposed of. Crust forming at the bottom of these basins must also be managed as waste.

To wash a concrete mixer of which only the slider is cleaned, 25 liters of water will be required. From 100 to 125 liters of wash water will be generated for concreting operations every day.

One or several areas specially prepared for the cleaning of concrete mixer sliders or pumps and concrete residue recovery will be delineated and identified in accordance with the distances to be maintained from habitats and waterways. Containers will be available to collect non-recoverable waste concrete that will be sent to dry materials disposal sites.

7.1.2.5 Emergency Prevention and Response Plan

A prevention and emergency response plan for incidents such as spills will also be implemented throughout the construction period. The anticipated emergency response measures will make it possible to rapidly deploy personnel and equipment in order to limit damage. Soil and materials contaminated as a result of spills will be disposed of in compliance with current regulations. This plan will include the following elements or obligations:

- Procedure to be followed in the event of a spill;

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› Content of the emergency recovery kits.

Location of the emergency recovery kits, especially near all work sites conducted near water courses like construction works for the LNG pipeline network on the wharf.

7.1.2.6 Construction Site Sewage Water

Temporary sanitary facilities (toilets) will be available on site from the beginning to the end of the construction period. A specialized company will be in charge of emptying and maintaining these toilets.

7.1.3 Soil and Groundwater Quality

As indicated in Chapter 4, soil and groundwater characterization studies were carried out to establish the possible presence of contaminated soil. The results showed that these soils are not contaminated and that they meet the limit values set in Appendix I of the Land Protection and Rehabilitation Regulation (RPRT) for the parameters analyzed. For groundwater, the results of the analyses show slight exceedances of the criteria for “consumption water” with respect to dissolved manganese, total sulphides and toluene but no exceedance of the RESIE criterion.

The potential impacts of construction works on soil quality and groundwater are generated by the same activities as those likely to contaminate surface water.

Although the groundwater is moderately vulnerable, since there are no groundwater catchment structures within a radius of 1 km from the site, no impact is expected on groundwater or soil quality.

Therefore, the same means and measures are deployed to preserve soils and groundwater quality. These consist of a series of preventive procedures and management plans:

› Cleanliness on the site;
› Management of fuels and petroleum equipment;
› Management of hazardous materials and hazardous waste;
› Management of concrete waste;
› Emergency Prevention and Response Plan;
› Management of sewage water.

These means and measures are described in the previous section.

7.1.4 Impacts on Vegetation

The analysis of the environmental impacts generated by the construction works on vegetation includes identifying and assessing anticipated impacts on terrestrial vegetation and wetlands.

7.1.4.1 Terrestrial Vegetation

The main impacts on the terrestrial vegetation during the construction phase will be generated by clearing and site preparation activities for the construction of the plant. However, the site for

the foundation of the facilities of the plant will be completely cleared and leveled before the start of the construction works. It is therefore free from vegetation. The mobilization area and the site temporary facilities will be adjacent to the site and will be located on already deforested and leveled lands that belong to the Saguenay Port Authority (APS).

The only plant species of interest inventoried and located in the study zone is the ostrich fern, a common species in Quebec but designated vulnerable to cultivation. The two inventoried populations are, however, located at considerable distances from the facility site (140 and 172 m) and will not be touched by the construction activities as the site and the infrastructure will not require any deforestation. No impact is thus anticipated on the vegetation, including species of special status.

7.1.4.2 Wetlands

During the construction phase, the main sources of impacts on wetlands are caused by the clearance, excavation and backfilling of the plant site. Map 4.2 shows a small wetland (MH13) and part of a wetland complex (MH4) on which the footprint of the project would encroach. The affected areas are swamps. It must be emphasized that these wetlands will have disappeared by the time the plant's construction begins. The construction of the plant's platform is part of a separate project led by the APS. Therefore, there is no impact anticipated on wetlands in the study area as a result of the construction of the plant.

7.1.5 Impacts on Wildlife

The construction of the facility will bring about certain effects on the wildlife in the study zone.

7.1.5.1 Terrestrial Wildlife

During the construction phase, the main negative impact on wildlife is habitat loss due to deforestation. However, since the plant site will be vegetation-free, no deforestation activities will take place. Therefore, no potential habitat of any species of birds, amphibians, reptiles and mammals or any special status species that may frequent the study area will be destroyed.

The second source of impact is noise and lighting from the site which could disturb wildlife in the area during the construction phase. Only the impact associated with this source is evaluated for the construction phase, separately for common and special status species.

A **moderate environmental value** was attributed to wildlife species that will be disturbed by noise and lighting during the construction of the plant. Terrestrial wildlife is generally of interest to the majority of the population. However, there is a lack of concern regarding its conservation and protection. Nonetheless, special status wildlife species whose occurrence potential is considered high in the area have a **high** environmental value.

The anticipated **degree of disturbance** of the terrestrial fauna is **low.** Although the works will cause some disturbance, they will not compromise the presence of terrestrial wildlife in the study area nor the integrity of the populations already present there. The intensity of the disturbance is described as **low**. Only site-specific effects are anticipated for the entire construction period (**short**).

Due to the interaction between the intensity, range and duration of the expected impacts, the environmental impacts related to the disturbance of terrestrial wildlife if **of very low** and **low significance** respectively for common and special status species

7.1.5.2 Aquatic Fauna

During the construction phase, the impacts of the works will be limited to small watercourses in the study area; the Saguenay River would not be affected due to the distance separating it from the work site.

Certain construction activities require the handling of materials such as steel joists, reinforcing rods, structural timber, etc. and the construction of temporary structures to be demolished at the end of the works (e.g.: formwork). During works near watercourses (watercourses # 5, 6, and 7), ditches or inside floodplains considered as fish habitats, the voluntary or involuntary deposit of waste or building materials of all kinds and falling debris may degrade the quality of fish habitats.

Other construction activities that are likely to affect the quality of surface water could have an indirect effect on fish and fish habitats such as dust release, runoff catching fine particles and flowing into rivers and the discharge of wash water from concrete mixers. The prevention measures planned in this regard are presented in Section 7.1.2. The work description does not include any crossing structure.

With the exception of the Saguenay River, watercourses in the study area were surveyed and associated with reliable indicators (i.e. impassable obstacles downstream), the findings of the survey campaign demonstrated the absence of fish in watercourses near the future facilities and the low habitat potential there. However, fish and fish habitat are important for the general population even without status species being found in the area. For these reasons, the **environmental value** of fish habitats likely to be affected by the project and located on the study site or nearby was estimated to be **moderate**. The **low degree of disturbance** associated with the environmental value of fish and their habitat will be **low** and the **impact will have a limited range**.

Fish habitats affected by earthworks during the construction phase (fall of debris, decreased water quality) are very limited in the areas concerned. In fact, they represent less than 2% of the floodplain of the study area. For this reason, the **range** of the impact on fish and fish habitats is considered **site-specific.** This disturbance occurs over a **short** period of time because it is limited to the construction period.

Following the analysis of the disturbance level, range and duration of the impact, the **significance** of the project's impact on fish and fish habitats is considered **very low.**

In addition to the measures identified to prevent impacts on the quality of surface waters (Section 7.1.2), the following mitigation measures will be implemented to reduce the significance of the project's impact on fish and fish habitat:

› Establish a retention system in order to prevent the fall of materials, debris or waste in any watercourse and wetland or their banks. In the event of debris, waste or other materials being accidentally introduced into a fish habitat, they should be removed as soon as possible without causing further damage to this fish habitat.

Once all of these mitigation and compensation measures have been implemented, the **significance of the residual impact** on fish and fish habitat is considered **very low.**

7.2 Impacts on the Biophysical Environment during the Operation Period

7.2.1 Air Quality

Atmospheric dispersion modeling was used to estimate the concentrations of contaminants in ambient air arising from the operation of NAIC's pig iron plant in Saguenay. These results were then compared with ambient air quality standards specified in Appendix K of the Quebec Clean Air Regulation (CAR). Appendix D2 provides a detailed description of the emission scenario considered, the model's inputs, the detailed configuration of the air dispersion model, and more detailed results.

In summary, the air dispersion study is based on the following elements and meets the requirements of the MDDELCC *Guideline on Air Dispersion Modeling* (Leduc, 2005) and those of Appendix H of the CAR:

› The AERMOD air dispersion model, developed by the US-EPA and the American Meteorological Society was used. This is the MDDELCC's "default" air dispersion model.
› Five years of meteorological data were prepared for the AERMOD model by the MDDELCC from the data collected at the weather station of the Airport of Bagotville were used;
› There are 16 buildings inside the plant's property and a building outside the plant site, at the wharf, which could affect the plumes from point sources;
› Local topography was taken into consideration in the analysis.
› The receptor grid covers a 10 x 10 km modeling area including the city of La Baie located 6 km south of the plant site near the Saguenay River. Discrete receptors were also placed in all residences inside the modelling area.
› There are no sensitive receptors (schools, kindergartens, centers for the elderly) inside the modelling area.
› The plant's production corresponds to its rated daily capacity increased by 10%.
› The emissions correspond to those mentioned in Chapter 3 (Section 3.8) and presented in more detail in Appendix D1.
› The parameters considered are sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ammonia (NH_3), total (PM_t) and fine particulate matters ($PM_{2.5}$).
› Total and instantaneous conversion of NO to NO_2 was considered.
› The CAR's default background concentrations were used, with the exception of PMt and $PM_{2.5}$ whose initial concentration levels were established after observations carried out at

the measurement stations of La Baie (PMt) and Chicoutimi ($PM_{2.5}$). These concentrations are added to the results calculated using the air dispersion model in order to take into account the concentration of contaminants already present in the area.

The model calculates the concentrations of contaminants in ambient air from every source for every hour of input meteorological data. The hourly concentration of a contaminant at a receptor is then calculated by adding the contributions of each one of the sources. The model determines average concentrations over longer periods (e.g.: 8 hours, 24 hours or 1 year) by calculating the arithmetic average of the hourly concentrations calculated over the period. The model considers that every day corresponds to three periods of 8 hours or to a period of 24 hours.

The modeling approach is conservative, because no chemical transformation and no well (deposit, wash by precipitation) are considered in the modeling.

The continuous sources considered in the analysis include the preheating furnace, the vent of the CO_2 removal system, the flare pilot, dust collectors, the acid scrubbers of the wastewater treatment unit, the electric arc furnace and sources from roads inside the site. The following additional sources were considered for the assessment of the cumulative impacts: the road between the plant and the wharf, the storage pile and sources related to the loading and unloading of pellets at the Grande-Anse Terminal.

A normal operation scenario (Scenario 1) and a transient conditions scenario (Scenario 2) with the auxiliary boiler at maximum capacity and process gas flaring were considered. These scenarios also consider emissions related to trucking on the site. A third scenario was assessed in order to account for sources attributable to the handling and transportation of materials from the wharf to the plant (cumulative scenario).

Table 7.1 presents the maximum concentrations of contaminants calculated in the air as a result of the operation of the pig iron plant under scenarios 1 and 2 and compares them to RAA standards and Quebec's ambient air quality criteria, with and without the addition of the initial concentrations:

- The maximum concentrations presented in Table 7.1 would all occur on the edge of the industrial site.
- The project's most significant contribution with regard to ambient air quality standards and criteria would be particulate matters (PM_t and $PM_{2,5}$) over 24 hours with calculated maximums of 10.4 µg/m³ (8.6% of the standard of 120 µg/m³) and 3.2 µg/m³ (10.6% of the standard of 30 µg/m³) for the transient conditions scenario (Scenario 2);
- The maximum concentrations calculated in ambient air for the project's contribution decrease rapidly as the distance increases (see Figures D2.6 and D2.7 in Appendix D2). The concentrations calculated in residential areas are significantly lower than the valuespresented in Table 7.1.
- For the transient conditions scenario (Scenario 2) with the use of the flare and auxiliary boiler, the Project's maximum contribution for NO_2 could reach 28.8 µg/m³, or about 7% of the hourly standard, assuming a total conversion of NO into NO_2. This, however,

corresponds to a mode of operation that corresponds to the start-up and shutdown periods of the DRI process.

Table 7.1 clearly shows that, if the initial concentrations are added, the Project would not cause an exceedance of the air quality standards.

Table 7.1 Summary of the Results of the Atmospheric Dispersion Study for Scenarios 1 and 2

Scenarios/Maximum Simulated Concentrations						Initial con.	Total Concentrations (Worst-Case Scenario)		Standards (µg/m³)
Auxiliary Boiler Flare		Idle	Maximum	Worst-Case Scenario					
		No	Yes						
Contaminants	Duration	Scenario 1 (µg/m³)	Scenario 2 (µg/m³)	(µg/m³)	% standard	(µg/m³)	(µg/m³)	% standard	
SO_2	4 min	4.2	4.3	4.3	0.3 %	150	154.3	11.7 %	1310
	24 h	0.39	0.39	0.39	0.1 %	50	50.39	17.5 %	288
	year	0.06	0.06	0.06	0.1 %	20	20.06	38.6 %	52
NOx (into NO_2)	1h	16.9	28.8	28.8	7 %	150	178.8	43 %	414
	24 h	3.7	5.2	5.2	2.5 %	100	105.2	50.1 %	207
	year	0.5	1.2	1.2	1.2 %	30	31.2	30.2 %	103
CO	1 h	13.1	105	105	0.3 %	2 650	2 755	8.1 %	34 000
	8 h	4.1	70.4	70.4	0.6 %	1 750	1 820.4	14.3 %	12 700
PM_t	24 h	10	10.4	10.4	8.6 %	65	75.4	62 %	120
$PM_{2.5}$	24 h	3.2	3.2	3.2	10.6 %	19.3	22.5	75 %	30
NH_3	4 min	30.6	30.6	30.6	8.7 %	0	30.6	8.7 %	350

Note : Maximum results outside industrial and port areas, but including residences.

7.2.2 Surface Water Quality

During the operation of the plant, various factors are likely to alter the quality of the water of the receiving environment. They include the following:

- Potential effects of atmospheric emissions;
- Storm water discharges;
- Discharges of treated sanitary waste waters;
- Discharge of treated residual process waters;
- Accidental spills.

Contaminants released into the atmosphere can be washed away by the rain and have indirect effects on water quality. However, the impact of atmospheric emissions from the plant on air quality is considered insignificant. Therefore, the indirect impact of atmospheric emissions on the quality of watercourses near the site of the plant and on the Saguenay River is considered negligible.

Storm water collected on the plant site will be drained towards a holding tank before being discharged into watercourse # 5. Storm water may be contaminated by petroleum

hydrocarbons, suspended solids and iron from the raw material. Trucking activities are likely to generate dust, which will be controlled through water spray. Various measures taken during the design phase will help minimize the release of dust, iron and hydrocarbons in storm water:

- Storage of iron pellets inside a building;
- Use of closed conveyors;
- Transfer points equipped with a dust collector;
- The majority of the production equipment of the iron reduction area will be located inside buildings;
- The CO_2 removal area will be surrounded by a retention dike in order isolate it and ensure there is no accidental release of amines into runoff waters. An operational procedure will make it possible to validate the absence of amines prior to discharge into the retention pond;
- Installation of hydrocarbon separators in the electrical substation and diesel refueling area;
- Impermeable surfaces for the loading/unloading of liquid chemicals areas with drainage towards a sump;
- Addition of coagulant to the retention pond for iron precipitation.

The water quality expected at the exit of the storm water retention pond will be free of acute toxicity. It should be noted that there will be no discharges during the winter. The way the drainage system was designed will help control the flow of runoff water so that the hydraulic flow prevailing before the plant's construction remains substantially the same.

Sanitary wastewaters will be treated through a complete processing chain including the removal of solids and phosphorus as well as disinfection. The water quality criteria will also be met. It should be noted that as far as phosphorus is concerned, a residual concentration of less than 0.1 mg/l is expected. This concentration level is in line with the best treatment technologies (MENV, 2001).

As far as accidental spills are concerned, the factors contributing to their occurrence have already been taken into account in the design of the equipment (e.g. retention ponds) or in the analysis of the technological risks. Preventive maintenance of equipment and a sound environmental management of activities will help minimize breakdown and discharge risks.

The physico-chemical characteristics of the liquid waste from the plant are of interest mainly in relation to the risk of toxicity to aquatic life (ichtyofauna). This issue is addressed in Section 7.2.5. Considering the low flow of the receiving watercourse, impact on the hydrology of the watershed was assessed and is discussed in Section 7.2.4.

7.2.3 Soil and Groundwater Quality

During the operation phase, the potential sources of contamination of soil and groundwater are related to incidents such as spills. As mentioned in the previous section, the factors contributing to their occurrence have already been taken into account in the design of the equipment (e.g. retention ponds) or in the analysis of the technological risks. Preventive maintenance of equipment and a sound environmental management of activities will help minimize breakdown and discharge risks. An emergency response plan will help deal with unforeseen events.

Slag will be stored outside on an impermeable surface with a permeability coefficient of less than $1x10^{-6}$ cm/s. Despite the fact that slag is identified as a hazardous residual material by the Hazardous Materials Regulation (RMD), the results of tests conducted in June and July 2016 show that it does not have the characteristics of a hazardous material (results of leaching tests presented in Appendix B3). The results show that slag is neither corrosive nor toxic or leachable. When tested for leaching using the methods specified in the Hazardous Materials Regulations, all the parameters analyzed are below those indicated in Article 3 of the RMD.

Additional analyses were conducted in order to determine the recovery potential based on the Guidelines for reclaiming non-hazardous inorganic materials for use as construction material (*Guide de valorisation des matières résiduelles inorganiques non dangereuses de source industrielle comme matériau de construction*).

One of the first tests performed consisted in establishing composition, by weight, of the metals and metalloids identified in the Soil Protection and Contaminated Sites Rehabilitation Policy. Although the residual matters are not soils, there are some similarities with respect the exposure of various receptors (MDDELCC, Guide de valorisation, 2002). The characterization results are compared to the A criteria which are the background levels (natural contents of the soils) for inorganic substances. All the parameters analyzed are below Criterion A of the Policy, with the exception of copper whose value exceeds Criterion A but is below Criterion B. However, it is likely that the copper concentration is due to the composition of the pre-reduced pellets used which have a copper concentration that is slightly higher than the concentration in the Port-Cartier pellets.

The neutralization capacity test is the only one missing from the series of tests indicated in the Guidelines' Protocol. Based on the results, contamination by total organic compounds is less than 1% and the sulfur content is less than 0.2%.

Another series of tests, i.e. leaching tests in acid environments and water, are conducted mainly to assess the mobility of contaminants, i.e. their potential to migrate into the soil or groundwater. The results are then compared to the potability criteria.

The results of leaching tests in acid environments and water show that the potability criteria are met.

Based on results recorded to date, slag seems to classify as Category I which allows for the most diverse range of use types.

The type of use recommended by the Guide is to use slag as aggregates in road or street construction or repair, abrasives, concrete manufacturing and as coating or sandblasting material. NAIC is working with Les Minéraux Harsco to define the various recovery avenues possible. Les Minéraux Harsco's role is to completely manage waste generated by metallurgical companies on their production site, and deal with their transportation, treatment and recovery. Harsco Minerals recover close to 1 million tons of co-products from the metal industry, mainly from Sorel-Tracy, and turn them into commercial products that are efficient and safe for the environment and the users (website consulted in June 2016 http://www.harscomineraux.com/). The products or aggregates meet a recovery agreement between Les Minéraux Harsco and the Government of Quebec. The slag produced by Arcelor Mittal in Contrecoeur (electric arc

furnace powered by reduced iron pellets and metal scrap) are recovered and sold as aggregate. The slag produced by NAIC will originate from the same matrix, i.e. iron pellets produced at the pellet plant of Port-Cartier. The pellets will also be reduced before being introduced into the electric arc furnace by means of a similar reduction process. The slag produced by NAIC should theoretically contain less metal, as scrap is not used.

Characterization and classification tests in line with the Hazardous Materials Regulations and the Recovery guidelines will be conducted again in the first year of operation to confirm the nature of the slag and its recovery potential.

Slag runoff will be captured and discharged into the storm water retention pond where the metal can be treated by adding a coagulant. The method to be used to seal the storage area will be defined during the detailed engineering phase. A permeability design criterion below 1 x 10^{-6} cm/s will be used. The clay present in the storage area at depths of 6 to 9 m on site is likely to be used. The clay permeability tests show a permeability coefficient of 1 x 10^{-9} cm/s (SNC Lavalin, 2016). In addition, clay rearranged under controlled conditions will have an even lower permeability.

Monitoring wells will be installed at the boundaries of the plant perimeter as well as up and down the slag storage area in order to monitor the quality of the groundwater (see Chapter 9).

The NAIC plant will generate 0.16 tons of slag per ton of pig iron produced. This is lower than the 0.25 to 0.30 ratio (NM Piatak et al./Applied Geochemistry 57, 2015) of the traditional blast furnace sector.

7.2.4 Hydrology of the Receiving Watershed

Description of the Receiving Watershed

Watercourse # 5 has been selected to receive the industrial and sanitary effluents of the plant. Its watershed (Watercourse No. 06f80000) is small (677 ha). It is mainly forested and its overburden, which consists of sand and gravel overlying the bedrock, is thin.

The effluents are discharged southwest of the project site, some 3 km away from the mouth of Water course 06f80000 in the Saguenay by following the river's route. The average slope of Watercourse # 8 where River No. 5 flows is relatively steep (4.5%).

Water flow

There are no hydrometric stations in the watershed that will receive the plant's effluents. The Flows of Watercourse 06f80000 were therefore estimated by transferring data from a station that is considered to be representative of the conditions of that watercourse based on the ratio of the watersheds' surface areas. This method made it possible to approximately determine Flows in the watershed in the absence of gauging over a sufficient period of time.

The most comparable hydrometric stations in the Saguenay-Lac Saint-Jean, were studied in accordance with various parameters such as:

› The surface area of the sub-watershed;

› The climatic conditions affecting the watershed;
› Its proximity to the study area
› The type of land use;
› The presence of large bodies of water that are likely to laminate water inflows.

Based on this information, two stations were considered. For these two stations, the watersheds are mostly forested and have water bodies that may have a significant impact on flood lamination and the maintenance of low water levels.

The first one is the station of Belle River. It is located 64 km west of the site and covers a 306 km^2 watershed. The climatic conditions of this watershed can be influenced partly by the proximity of Lake Saint-Jean. In addition, approximately 10% of its surface area supports agricultural activities. About 20 years of validated daily data are available on the website of the Quebec Hydric Expertise Center (website accessed in June 2016: https://www.cehq.gouv.qc.ca/suivihydro). These data span over the period from November 1996 to June 2015. It should be noted that there are no data covering the period from November 7, 2004 to January 23, 2005, which means there is a series of 6698 daily data that can be used for statistical purposes.

The second one is the Valin station which covers a larger watershed whose surface area is 768 km^2. As this watershed is located near the project site, specifically to 14.7 km in the north, the weather conditions are likely to be comparable to those prevailing in the study area. In addition, this watershed is mountainous as is the receiving watershed. Data are available from October 1974 to June 2016. There are no data covering the period between November 29, 2015 and April 25, 2016. This station offers a long series of 15,079 daily data, i.e. data covering a period of more than 40 years.

The specific low-water flows at these stations were calculated by the Quebec Hydric Expertise Center (website accessed in June 2016: https://www.cehq.gouv.qc.ca/debit-etiage/cartes/debits-etiage.htm)). Table 7.2 summarizes the $Q_{10,7}$ low-water Flows (7 consecutive days, 1 recurrence every 10 years).

Table 7.2 Specific Low-Water Flows at the Stations Considered

Station	Period Considered	Annual $Q_{10,7}$ ($l/s/km^2$)	Summer $Q_{10,7}$ ($l/s/km^2$)
Belle Rivière	1997 – 2008	2.36	2.44
Valin	1975 - 2008	3.49	6.41

The mean, median and flood flows at the Station of Valin were selected due to its proximity and more similar rainfall conditions. Concerning low-water flows, the Belle River station was the one chosen because of its smaller watershed. As a matter of fact, although the transposition method makes it possible to have a good estimate of the mean and median flows, it is recognized that low flows are usually overestimated when data from a large watershed are transposed towards a small watershed. The hydrological characteristics of Water 06f80000 determined approximately using the method described above are summarized in Table 7.3.

Table 7.3 Flows Estimated for Watercourse 06f80000 at its Estuary with the Saguenay River

Flow Type	Estimated Flow
Flow (percentile 0,8)	300 l/s
Mean flow	209 l/s
Median flow	132 l/s
Annual $Q_{10.7}$	16.0 l/s
Summer $Q_{10,7}$	16.5 l/s

The plant's anticipated discharges consist primarily of industrial and sanitary water. All waters will be treated before being discharged into the environment. Drainage storm waters are not taken into account because they already contribute to the natural flow of the watershed.

The effluent's flow will be 4.44 l/s (16 m^3/h), which represents 2.1% of the average flow of watercourse 06f80000 at its mouth and 3.4% of the median flow. The impact on the hydrological conditions in the watershed and on erosion conditions will be little or insignificant.

In flood situations, considering a flow rate that is exceeded 20% of the time, the effluent's flow is lower than 1.5% of the flow of watercourse 06f80000 at its mouth. However, during low-water periods (summer low-water flow), it represents about 27% of the flow.

7.2.5 Vegetation

The operation of the proposed pig iron plant will have little impacts on vegetation. The indirect impacts that may result from atmospheric emissions are considered negligible, since emissions from the plant will marginally contribute to air quality deterioration and since all relevant standards and criteria will be met. These criteria and standards have been enacted in order to protect all the components of the environment. No notable effect is expected on the vegetation.

7.2.6 Terrestrial Wildlife

Noise and lighting from the site during the operation of the pig iron plant will have a negligible impact on terrestrial wildlife in the study area. Besides, considering the modeled concentrations of air emissions from the plant, no significant impact will be felt by terrestrial wildlife.

7.2.7 Aquatic Wildlife

7.2.7.1 Ichtyofauna

Impacts on ichthyofauna during the operation period are primarily related to the discharge of industrial, sanitary and pluvial effluents into watercourse # 5 which meets watercourse # 8 some 550 m further downstream before the waters into the Saguenay River 2.2 km downstream the confluence of watercourses # 5 and 8.

The pig iron plant's effluent, at the discharge point in watercourse # 5 will have a temperature of 40 ˚C and the average flowrate will be 16 m^3/h. Sanitary wastewater is discharged at low flows

and their contaminants load is limited, less than 10 m^3/d is expected. As for storm water, its flow will range from zero to 5.5 m^3/h. Only TSS, iron, oils and fats are likely to be found in it.

Evaluation of the Toxicity of Liquid Discharges

The main contaminants likely to be found in the final effluent are presented in Table 7.4. The values for the plant's effluent (Check Point 2) are the expected average values. Based on the information provided by the Project's designer, the effluent will be free of acute toxicity. However, the average values for ammonia nitrogen, total particles, nitrate, and petroleum hydrocarbon values exceed the chronic toxicity criteria for aquatic life protection.

Table 7.4 Quality of the Effluent based on MDDELCC Criteria

Parameter	Run-off Effluent no.2) mg/l[1]	Plant Effluent (no.3) mg/l[1]	Aquatic Life Protection Criteria	
			Acute Toxicity (mg/l)	Chronic Toxicity (mg/l)
Flow	0 to 5.5 m^3/h	16 m^3/h	NA	NA
pH	UN	6 to 9.5	6.5	9
Temperature	variable	40°C	UN	UN
Total hardness ($CaCO_3$)	UN	500	UN	UN
Total alkalinity ($CaCO_3$)	UN	120	UN	UN
Total iron	< 1.3	0.2	3.4	1.3
Petroleum hydrocarbons ($C_{10}C_{50}$) [4]	**< 2**	**< 2**	2.8	0.2
Total Ammonia Nitrogen	UN	**5**	19 to 21[2]	1.2 - 1.9[3]
Nitrates (NO_3)	UN	**5**	UN	2.9
Sulfates	UN	460	500	500
Chlorides	UN	200	860	230
Suspended solids	<25	**10**	25	5

UN : unavailable ; NA : Not applicable
In **bold**: Criteria exceeded by the value at the effluent (dilution factor not considered)
(1) Unit applicable, with the exception of the flow (m^3/h), pH and temperature (°C)
(2) Respectively, for water at a temperature of 20°C to 7°C and a pH of 7
(3) respectively, to the water of a temperature of 20°C to 7°C and pH 7
(4) provides criteria for the diesel.

With respect to petroleum hydrocarbons, no continuous discharge is anticipated. However, as oils are present in various pieces of equipment that could contaminate storm water, separators are planned at various locations, in addition to retention areas to ensure a concentration of less than 2 mg/l is maintained. The value of 2 mg/l is a maximum value and the value should be much lower than 2 mg/l most of the time.

As far as total ammonia nitrogen is concerned, the expected concentration is 5 mg/l. This value corresponds to the limit specified in the Environmental, Health, and Safety Guidelines for Integrated Steel Mills (IFC, 2007) and according to the Project's designer, this is the best available technology economically achievable. As for nitrates, they are largely associated with the presence of ammonia.

During the operating phase, chemicals will be used for the conditioning of cooling water and the feed water in the Auxiliary Boiler, as well as for the removal of solids in the wastewater treatment unit. These products can contribute to the toxicity of the effluent.

A specific request was made to the chemical supplier for the compounds to be selected based on the lowest toxicity level required to achieve the desired efficiency. The dosage of each compound used for the chemical conditioning of the water is presented in comparison with the known toxicity level of these compounds, in Table 7.5. The toxicity data are listed on material safety data sheets (MSDSs) presented in Appendix A. This table shows the expected maximum concentrations of the chemicals used at the plant in the final effluent, based on the following conservative assumptions:

- The concentration of the active ingredient in the chemical is at its maximum level;
- The chemical does not degrade, react or evaporate; does not adhere to the droplets and is entirely present in the final effluent;
- It is assumed that 90% of coagulants and flocculating agents will end up in the sludge produced by the removal of the suspended solids in the effluent. Only 10% of these products will end up in the final effluent;
- The final concentrations are compared to the most demanding toxicity indicators for aquatic life as indicated on the MSDS for each of the products.

Table 7.5 Assessed Toxicity of the Compounds used for the Conditioning of the Water

Product	Compound	Usage	Frequency	Dosage[1] ppm	LC_{50} [2] Toxicity mg/l	Species
GenGard GN8020	Carboxylic polymer	Cooling circuits	Continuous	100	3628	Daphnia magna
FloGard MS6206	Tetrapotassium pyrophosphate	Cooling circuits	Continuous	20	724	Myside
Spectrus BD1501E	Alcools, C10, alkoxylated	Cooling circuits	Once a week	25	38.2	Daphnia magna
Solus AP24	Not disclosed	Auxiliary Boiler	Continuous	5	3674	Daphnia magna
Steamate PAS6066	Cyclohexylamine Morpholine N,N Diethylhydroxylamine Dimethylaminopropylamine (DMAPA)	Auxiliary Boiler	Continuous	10	39	Daphnia magna
Cortrol S3070	Sodium bisulfite	Auxiliary Boiler	Infrequent: boiler shutdown	To obtain 0.035 ppm of residual chloride	354	Daphnia magna
Optisperse ADJ5050	Sodium hydroxide	Auxiliary Boiler	Infrequent: boiler shutdown	UN	100-500[4]	Daphnia magna
MagnaFlocLT25 or equivalent, 0.1%	Flocculating agent , Not disclosed	Wastewater treatment	Continuous	2 to 4	>100	Daphnia magna
Ferric chloride	$FeCl_3$	Wastewater treatment	Continuous	7 to 13	N/D	N/D
Spectrus DT1404	Sodium bisulfite	Wastewater treatment	Continuous	10	175	Daphnia magna

(1) Concentration at the discharge point, prior to discharge into watercourse # 5.

(2) Lethal concentration : 50% over 48 hours
(3) When several bioassay results are available, the testing demonstrating the lowest LC_{50} isselected
(4) LC_{50} is not available for this compound. 100% mortality observed at 500 mg/l and 5% at 100 mg/l or 5000 mg/l if pH adjusted
(5) ND = Not determined

Considering the expected dosages, the additives used for the conditioning of the makeup water in the cooling towers and boilers as well as in the wastewater treatment unit are not at toxic concentrations for aquatic life, based on the results the toxicity bioassays (LC_{50}) indicated in the MSDS.

Considering the dosages anticipated, the additives used to condition the makeup water for cooling towers and boilers as well as wastewater treatment units are not at concentrations that are toxic for aquatic life, according to organic results LC_{50} tests indicated on the MSDS.

Effluent Discharge Criteria and Objectives

At the time of drafting the impact assessment, effluent discharge objectives (EDOs) are unknown. Based on the information provided on discharge characteristics and water quality in the receiving environment, the MDDELCC will set EDOs to be used to assess the environmental acceptability of the Project and guide the detailed design of the wastewater treatment facilities. EDOs are not discharge standards to be met. Instead they are objectives set while taking into account the best available and economically feasible treatment technologies as well as the sensitivity of the receiving environment.

Impacts on aquatic wildlife will be assessed in comparison with the water quality criteria established by the MDDELCC, including with respect to acute and chronic toxicity. Acute toxicity measures effects appearing quickly while chronic toxicity measures the sub-lethal effects occurring in the longer term (MDDEP, March 2008).

The MDDELCC recommends that the chronic toxicity criteria for aquatic life be met at the boundary of a predefined mixing zone. Under the current situation, it is likely that no mixing zone can be considered since water flow in watercourse # 5 is relatively low.

Hydrological and Hydraulic Characteristics of the Receiving Watercourse

Watercourse # 5 is an intermittent creek whose source is located near the effluent's planned discharge point. During low water periods, it has a very low or no flow at all. There are currently numerous beaver dams on its course downstream from the discharge point. These beaver dams form retention ponds and can act as sedimentation basins. Downstream from these dams, watercourse # 5 flows into the watercourse # 8 which has less severe low-water conditions as it is supplied by watercourses # 7, 9 and 10 upstream. It should be said that, from the effluent's discharge point on watercourse # 5, via watercourse # 8 up to its confluence with the permanent watercourse, 100 m from its estuary with the Saguenay River, the watercourses have been characterized and are not considered as a fish habitat (presence of insurmountable obstacles and no catches were made during the surveys). Watercourse # 8 meets a permanent stream, about 100 m from its mouth in the Saguenay River. This watercourse, which has not been characterized, as it is not located in the immediate vicinity of the plant site, has a permanent flow and would be a potential fish habitat. Based on consolidated data on the description of the

environment (Chapter 4), special status fish species identified and potentially present in the study area, are unlikely to use this watercourse before it joins the Saguenay River. Appendix E1 provides more information on characterized watercourses near the project site.

Concentrations Anticipated

At the discharge point into the Water course No.5, there is little or no mixing zone. At that location, the ammonia concentration presents a variance, in the amplitude of the exceeding, assessed as medium (between 3 and 7[2]) when compared to the chronic toxicity test. Since there are no fish habitats in this area due to insurmountable obstacles downstream, the impact is instead assessed for the downstream section of watercourse 06f80000, from the confluence of watercourse # 8 and the permanent watercourse up to the Saguenay River. Based on the hydrological analysis of the watershed (Section 7.2.4), the effluent's flow corresponds to about 27% of the summer low water flow ($Q_{10.7}$) of watercourse 06f80000 at its mouth on the Saguenay River, the effluent's dilution factor being equal to 4.7. The total ammonia nitrogen concentration would average 5 mg/l at the final effluent. Considering the dilution factor, the average ammonia concentration in the downstream part of watercourse 06f80000 would be about 1.1 mg/l under low water conditions in the summer ($Q_{10.7}$), which would meet the chronic toxicity criterion for aquatic life protection (1.2 mg/l). Using half of the summer low water flow ($Q_{10.7}$) as recommended for the calculation of the EDOs of the toxic contaminants, the dilution factor drops to 2.9 and the ammonia concentration in the downstream part of the watercourse 06f80000 would be 1.7 mg/l, i.e. slightly above the criterion (1.2 mg/l). It should be noted that the method used to estimate low water flows could lead to it being slightly overestimated. As for the maximum ammonia concentration, which should be observed over short periods, it is below the acute toxicity criterion for aquatic life protection. The dilution obtained in the downstream part of watercourse 06f80000 will also lower the nitrate concentration in the effluent (5 mg/l) below the chronic toxicity criterion for the protection of aquatic life (2.9 mg/l).

Impacts

There will be **no impacts** on ichtyofauna in watercourses # 5, 7, 8 and 9 since there are no ichtyofauna species present in these areas. In the downstream segment of watercourse 06f80000, over a distance of about 100 m from the confluence of Creek # 8 and a larger watercourse up to the Saguenay River, the habitat is considered favorable to the presence of fish, but special status fish species identified in the study area are unlikely to be found in this watercourse. There the value of ichtyofauna species is considered average. Considering the relatively low discharges of contaminants, the dilution caused by the watershed in its downstream part and the resulting concentrations, the degree of disturbance is assessed as **moderate**, resulting in **moderate** impact intensity. Associated with a local scope (100 m) and a long duration, the size of the impact is considered **moderate.**

Considerable efforts will be made to treat and recycle effluents from the plant in order to reduce the flow of the discharge in the watercourse and water consumption. The water management strategy consists in working towards a "zero liquid discharge plant". Just over 80% of the total waste water treated flow is re-used in the plant. During the Project's detailed engineering phase,

[2] Based on values presented in Table 3 of the guidelines for the use of EDOs relating to industrial discharges in the aquatic environment (MDDEP, March 2008). It should be noted that guide values are indicated for the difference with the EDOs, where here the comparison is made with the chronic toxicity criterion, in the absence of an EDO.

NAIC will assess the various options available in order to reduce the flow of the final effluent, including increasing the number of concentration cycles of the water in the two cooling circuits (see Section 2.9.5). It is more likely that the discharge flow will be reduced but not eliminated.

We should also mention that the quality of the effluent monitoring program before the discharge into the watercourse is proposed in Chapter 9.

Since the extent of the reduction of the effluent flowrate that can be achieved once the analysis of the options is completed is unknown, the significance of the residual impact is undetermined.

7.2.7.2 Marine Mammal

During the operation phase, the source of potential impact on marine mammals is indirect since it is connected to the increased maritime traffic associated with the supply of plant and the shipment of the finished product.

Two species of common marine mammals are more likely to be found in the local study area, including the Saguenay River. The northern minke whale (*Balaenoptera acutorostrata*) and harbor seal (*Phoca vitulina vitulina*) could venture into the study area but do not have special legal protection. These species sometimes swim up the Saguenay waters and their sight is uncommon in the Saguenay Port area.

However, the beluga whale (*Delphinapterus leucas*) which occupies the St. Lawrence Estuary, is designated as “threatened” in Quebec and is protected under the Species at Risk Act (SARA). The concentration of this species is better known further down the river, outside the study area and within the boundaries of the Saguenay-Saint-Laurent Marine Park. In the Saguenay River, it is more present in the Baie Saint-Marguerite area and at the mouth of the Saguenay River, near Tadoussac. Thus, the presence of beluga in the local study area is unlikely.

In July 2005, on the recommendation of the Environment Minister and following the assessment of this beluga population by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), the Governor in Council decided to register it in Part 3 of Appendix I of the List of endangered species under SARA. Following this registration, the Minister of Fisheries and Oceans was required to develop a recovery strategy for the species. Under SARA, the species’ critical habitat must be legally protected against destruction once designated as such. This protection is provided by an order issued under Article 58 of SARA, which prohibits the destruction of the designated critical habitat, unless authorized by the Minister of Fisheries and Oceans Canada under the terms of SARA. Since the use of the habitat varies over time, each activity must be assessed individually and specific mitigation measures should be applied when effective and available (Canada Gazette, 2016).

According to the species recovery program, the critical habitat for the beluga population in the St. Lawrence Estuary extends from the Battures aux Loups Marins area to the southern portion of the estuary, off St.-Simon. This habitat also includes the lower part of the Saguenay River (MPO 2012) and some areas necessary for the survival of the beluga, including farrowing and calf breeding areas, which is a fundamental biological process that is necessary for the survival and recovery of this threatened species. In most cases, the critical habitat will be protected by a government-issued protection order that prohibits the destruction of any part of the species

critical habitat. Therefore, the Order on the Critical Habitat of the Beluga Whale (*Delphinapterus leucas*) in the St. Lawrence Estuary Population aims to legally protect the critical habitat by triggering the clause in the SARA regarding the prohibition to destroy any part of the species' critical habitat.

Examples of threats to the habitat of the beluga population in the St. Lawrence Estuary include, without limitation, activities that generate excessive noise (in frequency and intensity), and activities disrupting or destroying components and characteristics that may influence the presence and abundance of prey (quality and quantity of prey such as the Capelin, the Atlantic Herring, the Sandeel and the Rainbow Smelt).

Below are examples of activities that are likely to destroy the critical habitat of this species:

- Generation of excessive noise (i.e. commercial or military sonars, construction and dredging works);
- Disturbance or destruction of components those are likely to affect the presence of prey (i.e. construction and dredging operations).

The Port of Saguenay is not located within the boundaries of the beluga's critical habitat. However, the ships sailing to the port's facilities in order to supply the plant will have to cross it. The impact source associated with the presence of the NAIC plant lies in the increased number of ships that will sail across the Saguenay River. Approximately 25 km of the downstream area of the Saguenay River part of the beluga's critical habitat that could lead to an increased level or frequency of noise events and the risk of collisions with marine mammals.

Excessive noise may prevent belugas from performing vital functions and destroy critical habitat (MPO, 2012). The second type of disturbance related to increased maritime traffic is the risk of collisions that could injure or kill marine mammals. The types of disruption caused by increased maritime traffic generated by the Project may range from a temporary dislodgment of the species to a decrease in its ability to search for food and a disruption of its social and mating behavior (MPO, 2015).

Approximately 2 to 3 ships carrying supplies for the plant will use the port while approximately 2 ships will leave it with finished products. Therefore between 4 and 5 additional ships will make round trips on the Saguenay River, hence a total of 40 to 49 additional trips annually. Increased traffic is an indirect impact of the project caused by the transportation of raw materials and finished products. In the early 1990s maritime traffic on the Saguenay gradually decreased from 300 ships a year and stabilized at around 200 in the 2000s before reaching 244 ships per year in 2015. Based on the 2015 figures, NAIC's activities will increase maritime traffic in the area by 16 to 20%.

As part of the environmental impact study of the Marine Terminal Project on the north shore of the Saguenay (consulted online; http://www.ceaa.gc.ca/050/documents/p80103/114850F.pdf; CEAA, June 2016), the Saguenay Port Authority (APS) must provide a detailed analysis of the cumulative effects on the beluga, including the noise impact associated with maritime traffic in the Saguenay, in connection with increase port activities anticipated in its development plan. The results are still unknown at the time of writing this report.

Since 2011, a working group on maritime transport and the protection of marine mammals in the St. Lawrence Estuary has been developing practical solutions in order to reduce risks associated with maritime transport which marine mammals are exposed to in the St. Lawrence Estuary while allowing the merchant navy to carry out its activities without compromising security (consulted online in July 2016; http://baleinesendirect.org/des-baleines-en-peril/des-actions-pour-lavenir/le-groupe-de-travail-sur-le-transport-maritime-et-la-protection-des-mammiferes-marins/). Protection measures are proposed and adopted voluntarily by carriers. These measures add to these already planned in Regulation respecting marine activities in Saguenay-Saint-Laurent and to the regulations in force in the Port of Saguenay's area of jurisdiction. These measures will also apply to the carriers of NAIC's raw materials and finished products.

Belugas are among the protected marine mammals, which give them an important environmental value. However, the degree of disturbance to its habitat caused by increased traffic rate is not fully known and is difficult to determine. The study being conducted by the APS will provide more information that could eventually be transposed to the activities planned for the transportation of NAIC products.

7.3 Impacts on the Human Environment

7.3.1 Land Use Planning

The land development and planning guidelines discussed in this section apply to the objectives stated in the land planning tools of the City of Saguenay, i.e. the Revised Planning and Development Plan (2011), the Urban Plan (2012) and Zoning Regulation No. 71770 (project site). The evaluation that has been conducted aims to ensure the Project's compliance with current regulations and with the planning and development guidelines recommended by the local and regional authorities.

According to the Revised Planning and Development Plan of the City of Saguenay and its associated Land Use Map, the future pig iron plant will be located in an industrial expansion area. Specifically, the plant's facilities will be located inside the Grande-Anse Intermodal Marine Industrial Park. The location of the plant is therefore consistent with the City of Saguenay's Land Use Plan.

The zoning plan of the City of Saguenay shows that the types of land used authorized in Area 71770 are mainly industrial types of land use related to port activities in the Grande-Anse area. Therefore, the pig iron plant will meet the zoning requirement set by the municipality.

The transportation of pig iron products between the plant and the Grande-Anse dock will go through the existing road (Chemin du Quai-Marcel-Dionne) and will not require new infrastructure. Raw materials will also be routed to the plant via the existing road network. NAIC will occupy lands deforested in advance by the Saguenay Port Authority, adjacent to the existing platform and developed between 2010 and 2014. The land is subject to no landslides constraints and will be built on a mainly rocky terrain.

During the operation as well as the construction phases, there are no anticipated impacts associated with land use planning since the plant site meets the City of Saguenay's land planning and development for the area concerned.

7.3.2 Public Infrastructure

7.3.2.1 Water Supply and Liquid Waste

The proposed project site is served by a water system via the Chemin de Grande-Anse. To meet the plant's water needs, an additional supply pipe would be built between the St-Anicet reservoir and the plant site. This would be a 250 mm diameter pipe (that would allow of 210 m^3/h flow) following the corridor of the existing railway line, over a distance of about 15 km. These works would be carried out by the City of Saguenay to improve water distribution in the Grande-Anse Intermodal Maritime Industrial Park. As mentioned during exploratory meetings with representatives of the City, the presence of an additional water pipe to meet plant's water needs should not put additional pressure on the existing water network.

The plant's water systems have been designed to minimize the amount of municipal water system fresh water consumed and the amount released into the environment.

The Intermodal Maritime Industrial Park's area is not served by a sanitary sewer system. The City does not intend to serve this in the short or medium term sector. Therefore, NAIC plans to treat its sanitary wastewater on site, which means there will be no impact on the municipal network.

During both the construction and operation phases, there are no anticipated impacts with respect to water supply to the plant.

7.3.2.2 Power Grid

The plant's energy requirements of about 75 MVA will be provided by the Hydro-Quebec distribution network. A new 161 kV power line will be required over a distance of around 8 to 22 km, depending on the connection solution used. By the end of 2016 Hydro-Quebec will have completed its planning study. This plan will help determine the optimal connection. The extension of the power grid is the responsibility of Hydro-Quebec which will ensure any required environmental permits have been secured. Since the route of this power line is not known yet, its impacts are not covered by this study.

During the operation period, since as the power grid has been installed specifically to meet the plant's power requirement (HQ did not say if there would be a residual capacity), there is no anticipated impact on electricity supply or on the Hydro-Québec power grid in general. The new power line will strengthen the existing network, which is seen as a positive impact of the project.

7.3.2.3 Gas Network

Natural gas will be supplied by Gaz Métro. Currently, only the urbanized sectors of the boroughs of Jonquiere, Chicoutimi and La Baie have a natural gas distribution network. The Grande-Anse Intermodal Marine Industrial Park is not connected to the existing network. Gaz Métro must therefore install a gas line that would link the facility to the distribution network; a conduit of less than 10 inches over a distance of 16 km is currently being considered. Its final route is yet to be established by Gaz Métro. This conduit could potentially pass along the existing road or railroad up to the plant site.

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The potential impacts of this project will be assessed by Gaz Métro, which will ensure that all the required environmental permits have been secured. As for the reinforcement of the network, it could be a positive impact, especially with respect to the Intermodal Maritime Industrial Park attracting new industries, considering a residual capacity would be available.

7.3.2.4 Road and Rail Network

During the construction of the plant, the number of workers will vary between 100 and 390 workers (vehicles) a day while trucking activities will add between 65 to 130 trucks per day. Increased traffic of light vehicles will be felt particularly from 6:00 to 7:00 am, and between 3:00 and 6:00 pm, while heavy vehicle traffic would be taking place throughout the day. At the peak of the construction works, up to 520 additional daily round trips are expected on the local road network within the project area.

During the operation period, vehicle traffic is expected to slightly increase on the road network due to about 85 workers going back and forth to the plant (operation and maintenance). In addition, there are between 4 and 5 trucks per day that supply raw materials to the plant. Taking into account the possible trucking of slag (if treatment cannot be performed on a neighboring land), 8 to 10 trucks per day have to be added to the local traffic, which means about 100 additional round trips per day . Truck traffic in the isolated area of Grande-Anse will have overall a low impact on vehicle traffic, considering that the majority of the traffic will come from the Anse-à-Benjamin Road and to some extent from the Chemin St-Martin.

There are no data on traffic in the Grande-Anse area. However, according to the 2014 and 2015 APS annual reports, 280,127 tons and 341,042 tons of material were handled at the Port respectively. This represents about 10,000 trucks per year (or 30 to 40 trucks per day) on the Chemin de Grande-Anse, assuming that a truck carries 30 tons. There will also be approximately 5 to 6 daily round trips by APS employees.

Since 2015, the Grande-Anse Intermodal Maritime Industrial Park has had a railway line linking the marine terminal to the Quebec railway network. This section will not be used by the NAIC plant to transport pig iron and raw materials. Therefore, there are no impacts anticipated in relation to this mode of transport.

For **short periods** (discontinuously) during the construction period, the local roads will be increasingly used by concrete mixers and trucks. They will also be used by workers during rush hours. A **medium degree of disturbance** results in an impact of **moderate** intensity and low significance on the road network.

During the operation period, there will be a limited degree of disturbance due to increased traffic caused by NAIC employees, suppliers, subcontractors, hence a low impact on the road network.

Certain measures will be implemented to decrease traffic during the construction of the plant:

› Establishment of a worker outreach program presented during induction sessions;

› Review of issues related to traffic and access roads recommended for heavy vehicles during initial meetings with contractors (avoiding *Chemin* Saint-Martin);

› Development of a traffic plan for the delivery of certain heavy and oversized equipment;

7.3.2.5 Port Facilities

Traffic at the Port

NAIC's activities will require the transshipment of 4 to 5 ships every month. The number of ships carrying pellets will vary from 2 to 3, whereas less than 2 ships will carry pig iron towards the target markets every month. The project will increase the number of ships at the Grande-Anse Maritime Terminal, which currently receives 60 to 100 ships per year (average for the 1988-2015 period). The pier of the Grande-Anse terminal can simultaneously accommodate up to two ships. Increasing the frequency of use of the pier will require increased coordination by the harbor master.

The increased number of ships is therefore perceived positively for the Saguenay Port activities aimed at supporting the industrial development of the region.

Traffic on the Seaway

Activities at the Grande-Anse terminal will also lead to an increase in the number of ships on the Saguenay River. As mentioned in Chapter 4, the average number of ships visiting the Grande-Anse Terminal has followed a downward trend since the early 1990s and stabilized at around 200 ships per year in the years 2000 with a slight increase to 244 ships in 2015. NAIC's activities could lead to an annual increase in the local maritime traffic from 16 to 20% compared to 2015, which is almost equivalent to the annual change that took place in years 2000. However, the increased number of ships will be below the level observed during peak traffic on the river. For example, the APS data show that some 300 ships sailed on the river in 1990.

During the **operation** period, the project's impact on port facilities will be **positive,** considering it will optimize the use of port facilities that are currently under-used, without affecting current activities.

Besides, considering the small increase in maritime traffic, its economic value and annual variability, the intensity of the impact and significance of the impact have been assessed as **low**.

7.3.3 Human Health and Odors

During the operation period, the highest concentrations of NO_2, SO_2, CO, NH_3 and particles estimated in populated areas around the plant, including background levels and the contribution of the natural gas plant, will be below the MDDELCC criteria. In addition, they decrease rapidly as one moves away from the plant's location. These standards and targets were established by the authorities in order to protect the environment and human health. One can conclude that the conventional contaminants (NO_2, SO_2, CO, NH_3 and particles) emitted by the future plant will not significantly affect human health, even for the most vulnerable people.

Ammonia is the emitted contaminant most likely to be associated with an odor. The odor threshold for ammonia varies between 1 and 5 ppm (0.7 to 3.5 mg/m^3) based on individuals (Smeets et al., 2007; Cawthon et al. 2009). The minimum odor threshold is 10 times higher than the MDDELCC's ambient air criterion (350 µg/m^3 or 0.35 mg/m^3) established for a period of 4 minutes. No ammonia odor should thus be associated with the normal operation of the plant, the maximum concentrations anticipated for a period of 4 minutes equaling less than 9% of the criterion (Table 7.1).

Hydrogen sulfide is the only other odoriferous compound in the process gas. It is oxidized in sulfur dioxide by a thermal oxidation unit, thus eliminating this source of odor.

7.3.4 Greenhouse Gas

As presented in Chapter 3, Table 3.5, the pig iron plan would produce about 328,000 tons of greenhouse gases annually. These emissions are associated with the combustion of natural gas and the reduction of iron oxide contained in the pellets. The annual amount is also based on a maximum operation level, i.e. 10% of the rated capacity for 8,760 hours per year, regardless of annual outages. This operation rate is not quite realistic but was used in order to remain conservative in assessing impacts by overestimating them.

These emissions represent less than 0.4% of GHG emissions in Quebec in 2013, which then amounted to 81.2 Mt CO_2 equivalent. The 2013-2020 Government of Quebec's Action Plan on Climate Change aims to reduce GHG emissions in the province to 67.1 Mt of GHG by 2020 (a 20% reduction compared to 1990). NAIC's proposed pig iron plant would represent less than 0.5% of Quebec's GHG emissions. In a context where GHG reduction effort amounts to about 14 Mt CO_2 equivalent, any significant addition of GHG becomes difficult to offset. NAIC, which is aware of this challenge, opted for a major change in production technologies in order to reduce its carbon footprint. The project that was originally developed by NAIC was about the reduction of a cold briquette in a rotary heart furnace with coal as a reducing agent. The change is significant because it applies to the handling of raw materials, including the whole reduction process unit, therefore anything upstream of the electric arc furnace. The proposed method now uses natural gas as both a fuel and a reducing element and iron pellets are reduced in a reactor using the HYL ZR Energiron technology. This change, which was made after the filing of the project notice of project and preliminary consultations with the community, resulted in a reduction of about 25 to 30% of the total emissions initially anticipated based on estimates by Tenova, the designer of the project, i.e. avoidance of around 90,000 t of GHGs. NAIC's pig iron plant will be one of the best in the world, with an emission rate of 0.63 t of $CO_{2\ eq}$/t of pig iron produced.

Another energy measure that is efficient, but with no direct impact on GHG emissions consists in a plant layout where the reduction reactor is placed just above the electric arc furnace in order to avoid using a conveyor transfer and its associated energy losses.

The NAIC project, by adding 328,000 of GHG could make it more difficult for Quebec to meet the objectives of its 2013-2020 Action Plan on Climate Change. Climate change and the need to reduce GHG emissions are the subject of a consensus amongst the scientific community and most governments, including in particular the Government of Quebec. This gives a **high value** to this environmental component. Considering a **medium degree of disturbance** (0.5% of the planned GHG target), a **regional extent** and that the plant will emit roughly the same GHG emissions throughout its useful life (long-term), the project's impact project on Quebec's ability to meet its commitments is **very high**. However, the recognition of NAIC's efforts to avoid the emission of close to 90,000 of GHG emissions by changing its production technology and turn its plant into of the one of the world's most efficient pig iron plants, makes it possible to reduce to reduce the significance of the impact to **high.**

The reduction technology would enable NAIC to recover and enhance the CO_2 extracted from the process gases. Steps have been initiated with companies involved in the production of industrial gases, including CO_2, in order to assess their interest in recovering and enhancing the CO_2 produced. The location of the plant away from potential consumers of CO_2 and the production rate, which is relatively low from a marketing point of view, means the CO_2 recovery appears to be an unattractive alternative at this stage of the project, despite the avoided costs of recovering CO_2 as per the Regulation respecting a cap-and-trade system for greenhouse gas emission allowances. NAIC will reserve enough space to add CO_2 recovery equipment for future use.

7.3.5 Soundscape

The construction and operation of the plant could affect the soundscape. The following sections provide the methodology used to calculate projected noise levels and the impact assessment method for the resulting noise, noise sources and calculation results

7.3.5.1 Calculation Method

Noise generated by the site, which is technically qualified as specific[3] noise, was evaluated using the ISO 9613-2[4] method. This method is employed to calculate sound attenuation during its propagation outdoors and to predict noise levels under weather conditions that are favorable to propagation to the receptor. These conditions consist of a downwind or moderate temperature inversion, as is commonly the case at night. The method takes into account geometric divergence due to distance, atmospheric absorption, ground effect, surface reflections, screen effect and propagation through industrial, residential and natural areas (vegetation).

Noise levels were calculated using the SoundPLAN® software (version 7.4) for specific receptor points, i.e. those deemed most likely to suffer the greatest impact due to their proximity to the site, and/or due to the fact that they are located in a calm initial environment. Operation phase noise levels were also calculated for meshing purposes in order to produce a noise map.

The results are representative of the average level of noise anticipated at the assessment points, expressed in equivalent continuous A-weighted sound pressure level (L_{Aeq} in dBA).

Following these assessments, the compliance of noise emissions is determined, in addition to the impact around the plant.

7.3.5.2 Noise Impact Valuation Method

Anticipated effects on the soundscape are evaluated while taking into account the initial noise, the specific noise and the characteristics of the environment. The dose-effect relationship appearing with ISO 1996-1[5], which is based on the Schultz curve and on several other

[3] According to the MDDEFP, specific noise is the component of ambient noise that can be specifically identified and which is generally associated with a specific source.
[4] International Standardization Organization ISO 9613-2: Acoustics - Attenuation of Sound during Propagation Outdoors.
[5] International Standards Organization, ISO 1996-1 : Acoustic – Description, measurement and evaluatation of noise in the environment.

researches, is used to assess the community's response to the discomfort caused by the plant's noise sources (Appendix H5).

For the plant's operation phase, the day/night valuation level ($L_{Ar\ dn}$) is determined by applying adjustments to the initial noise and specific noise in order to take into account the type of noise (noise impact, tonal noise and noise generated under special circumstances), the time of day and the characteristics of the environment. One of these adjustments is one that applies to the night period or +10 dB, between 10pm and 7am, to reflect the fact that the noise is more disturbing during this period.

The intensity of the anticipated effect, from the change between the initial noise and the projected ambient noise is determined by the magnitude of the change (relative approach) as well as by target noise levels (absolute approach), based on the methodology presented in Appendix H5. The projected ambient noise level is determined by adding the specific noise level to the initial noise level.

Noise extent and duration are then considered using the methodology on the chapter entitled *Environmental Effects Analysis Method* (see Chapter 6) to determine the magnitude of the anticipated effect

7.3.5.3 Projected Noise Levels - Construction

Rock excavation works to level the site will be carried out by the APS. The noise generated by this activity will be evaluated as part of the environmental study to be undertaken by the APS. The impact of this activity on the noise environment is not directly attributable to NAIC since the APS has already begun the construction of a platform and the future works will be the continuation of these construction works.

The construction of the plant will take place during the day from 7am to 7 pm. Soil preparation (detailed excavation) and foundation works are the activities that generate the most noise around the site. The pieces of equipment used on site at the construction site during these phases are identified in section 3.14.4.

Regarding the possible increase in the noise generated worker traffic and trucking operations associated with the project, 65 to 130 trucks and 100 to 390 workers will travel to the *Chemin* de Grande-Anse from the road de L'Anse à Benjamin. The material transshipped at the dock requires about 30 to 40 trucks per day. The traffic of light vehicle used by dock employees is low (around 5 to 6 vehicles per day). The anticipated noise level generated by traffic on the Chemin de Grande-Anse equals $L_{Ar\ dn}$: 64 dBA, 30 m away from the center of the road. The projected at the nearest receptor, R2, which is located over 700 m of the road equals $L_{Ar\ dn}$: 40 dBA. The initial noise level at Reception R2 is $L_{Ar\ dn}$: 43-45 dBA (see Table 4.24). The impact of noise generated by workers' traffic and trucking operation during the construction period will be **low**.

The levels of noise generated by equipment used on the construction site were determined using the RCNM (Road Construction Noise Model) software, version 1.0 devised by FHWA (Federal Highway Administration) in the United States. The noise levels used in the calculations are presented in Table 7.6. Finally, the number of equipment previously presented in Table 3.4 was taken into account in the calculations. The noise levels calculated for the site are

representative of the projected hourly levels (L_{Ar12h}) during the day. These levels are presented in Table 7.7.

Table 7.6 Noise Levels and Equipment Use Percentage

Equipment Type	Noise Level L_{ASmax} at 15 m (dBA)	% of Use on Construction Site
Truck	77	40
Cement mixer	79	40
Bulldozer	82	40
Excavator	81	40
Crane	81	16
Compactor	83	20
Drilling machine	81	20
Concrete pump	81	20

Table 7.7 Projected Noise Levels – Plant Construction

Point	Zone	Period (1)	MDDELCC Limit (2) $L_{Ar\,T}$ (dBA) (3)	Valuation Level (4) $L_{Ar\,T}$ (dBA) (3)
No 1 4893, *Chemin* St-Martin, La Baie	Agricultural (3) 2218	Day	$L_{Ar\,12h}$ = 55	40
		Evening	$L_{Ar\,1h}$ = 45	S.O.(5)
		Night	$L_{Ar\,1h}$ = 45	S.O.(5)
No 2 4583, *Chemin* St-Martin, La Baie	Industrial (4) 71774	Day	$L_{Ar\,12h}$ = 55	21
		Evening	$L_{Ar\,1h}$ = 45	S.O.(5)
		Night	$L_{Ar\,1h}$ = 45	S.O.(5)
No 3 4413, Route de l'Anse-à-Benjamin, La Baie	Agricultural (3) 2236	Day	LAr 12h = 62	36
		Evening	$L_{Ar\,1h}$ = 45	S.O.(5)
		Night	$L_{Ar\,1h}$ = 45	S.O.(5)

Notes :
1. Day = 7 am to 7 pm; Evening = 7 pm to 10 pm; Night = 10 pm to 7 am.
2. L_{Aeq} + correction, rounded to the unit.
3. See Table 4.26
4. For the day, T = 12 hours; for the evening and night, T = 1 hour.
   N/A: Works take place from 7am to 7pm.

The assessed levels of specific noise from the site are below the MDDELCC limits. Thus, the projected noise levels generated during the construction phase are consistent with provincial criteria for noise.

It should be noted that adjustments are equal to zero in the calculation of valuation levels. This assumption should be validated during the implementation of the monitoring program.

7.3.5.4 Evaluation of the Effect of Noise on Construction Site on the Soundscape of the Inhabited Zones around the Facility

The anticipated impact of noise from the plant's construction in residential areas, depending on the day/night sound level ($L_{Ar\ dn}$) over 24 hours is presented in Table 7.8.

Table 7.8 Intensity of the Noise Level Anticipated during the Construction of the Plant

Point	Zone	Day/Night Sound Valuation $L_{Ar\ dn}$ (dBA) (1)			Impact Intensity
		Bruit initial (2)	Specific Noise (3)	Projected Ambient Noise (4)	
No 1 4893, Chemin St-Martin, La Baie	Agricultural (3) 2218	57	38	57	Low
No 2 4583, Chemin St-Martin, La Baie	Industrial (4) 71774	43 and 45	19	43 and 45	Low
No 3 4413, Route de l'Anse-à-Benjamin, La Baie	Agricultural (3) 2236	60	34	60	Low

Notes :

(1) $L_{Aeq\ T}$ + adjustments, rounded to the unit.

(2) See Table 4.34, L_{dn}.

(3) The specific noise is calculated from the valuation levels in Table 7.7. It was weighted according to working hours on the site, i.e. from 7am to 7pm.

(4) The projected ambient noise is the logarithmic sum of the initial noise and the specific noise

The anticipated **intensity** of the noise impact associated with the project is estimated to be **low** at the 3 receptor points considered. Taking into account a **local range** and a **short duration**, the environmental impact on the soundscape is considered of **very low** significance.

7.3.5.5 Projected Noise Levels - Operation

Noise sources associated with the operation of the natural gas plant are described in Section 3.9. They consist of equipment located at the site of the future plant. Regarding cumulative impacts, sources associated with the transportation of materials by trucks between the plan and the dock were considered.

The possible increase in noise emissions caused by the transportation of finished products and raw materials on the Saguenay River is low. In fact, recent APS data show 242 ships sailed up the Saguenay River in 2015. The addition of about 40 ships corresponds more or less to the annual fluctuation and is considered low. Therefore, noise during the operating period has not been subject to detailed calculations.

The plant will be in continuous operation 24 h a day. Therefore, noise generated by the future equipment will be mainly constant, day and night.

Thus, noise levels during the operation phase were calculated by considering facilities that are likely to generate the most noise. The equipment's sound power level indicated in Table 7.9 was estimated from specifications provided by NAIC. Mitigation measures will be planned during the detailed engineering to ensure the noise generated by the equipment is below or at the levels indicated in Table 7.9.

Table 7.9 Plant Equipment Sound Power Level

Equipment (number)	Unit Sound Power Level L_{wA}	Anticipated Mitigation Measure	Sound Power Level with Mitigation Measure L_{wA}
Power transformer (1)	98	S.O.	S.O.
EAF dust collector			
Ventilators and ducts (2)	103	S.O.	S.O.
Ventilator motors (2)	101	S.O.	S.O.
Stack (1) for 2 ventilators	118	S.O.	S.O.
Transfer building dust collector			
Ventilator and ducts (1)	80	S.O.	S.O.
Engine (1)	92	S.O.	S.O.
Stack (1)	92	S.O.	S.O.
Storage building dust collector			
Ventilator and ducts (1)	82	S.O.	S.O.
Engine (1)	92	S.O.	S.O.
Stack (1)	95	S.O.	S.O.
Screening and coating building dust collector			
Ventilator and ducts (1)	80	S.O.	S.O.
Engine (1)	92	S.O.	S.O.
Stack (1)	92	S.O.	S.O.
Buildings' ventilators			
Ventilation and air conditioning (22)	95	S.O.	S.O.
Cooling			
Cooling tower, (4) **45-kW cells**	104	S.O.	S.O.
Cooling tower, (2) **7.5-kW cells**	97	S.O.	S.O.
Dry cooler, (4) 37-kW ventilators	104	S.O.	S.O.
Dry cooler, (6) 30-kW ventilators	102	S.O.	S.O.

Equipment (number)	Unit Sound Power Level L_{wA}	Anticipated Mitigation Measure	Sound Power Level with Mitigation Measure L_{wA}
Preheating furnace, induced air ventilator			
Ventilator and ducts (1)	101	S.O.	S.O.
Ventilator motor (1)	98	S.O.	S.O.
Stack (1)	117	S.O.	S.O.
Preheating furnace, forced air ventilator			
Ventilator and ducts (1)	97	S.O.	S.O.
Ventilator motor (1)	98	S.O.	S.O.
Stack (1)	110	S.O.	S.O.
Transfer towers between conveyors			
Tower including conveyor drivers and hoppers (3)	116	Closed building	106
Mobile equipment on the plant site			
Dust, sludge and fines near the agglomeration building (5) trips per day	117	S.O.	S.O.
Slag near the storage area (12) trips per day	*117*	*S.O.*	*S.O.*

It should be noted that the sound power levels shown in Table 7.9 are information that is introduced into the calculation model to determine the sound pressure level at a receptor point. It is the sound pressure level that determines the intensity of the noise actually perceived by humans.

The noise levels calculated from the emission levels indicated in Table 7.9 are representative of the projected day and night hourly valuation levels ($L_{Ar\ 1h}$). These levels are presented in Table 7.10. Map H1 in Appendix H shows noise levels presented as isocontours at the receptor points and at the boundaries of the plant.

The anticipated noise levels generated by the natural gas plant are below the MDDELCC's limits. Thus, the Project's noise emissions are consistent with provincial noise requirements.

It should be noted that adjustments are equal to zero in the calculation of the valuation levels. This assumption should be validated during the implementation of the monitoring program.

Table 7.10 Projected Noise Levels Generated during the Operation of the Plant

Point	Zone	Period [1]	MDDELCC Limit [2] $L_{Ar\ 1h}$ (dBA)	Valuation Level [3] $L_{Ar\ 1h}$ (dBA)
Nº 1 4893, Chemin St-Martin, La Baie	Agricultural [3] 2218	Day	45	36
		Night	40	
Nº 2 4583, Chemin St-Martin, La Baie	Industrial [4] 71774	Day	55	15
		Night	50	
Nº 3 4413, Route de l'Anse-à-Benjamin, La Baie	Agricultural [3] 2236	Day	50	34
		Night	40	
Boundary of the project area	Industrial 71770	Day et Night	70	Lower than 70

Notes
1. Day: from 7 am to 7 pm and night: from 7 pm to 7am (MDDEP 2006)
2. L_{Ar}: Reference noise level, which includes corrective terms for impact noise, tonal noise and special situations, according to Instructions Note 98-01 (MDDEP 2006)
3. On the ground of an existing residence in an agricultural zone.
4. On the ground of an existing residence in an industrial zone.

7.3.5.6 Evaluation of the Effect of Noise Generated During the Operation of the Plant on the Soundscape in Inhabited Areas Around the Plant Site

The anticipated effect of the noise generated during the operation of the plant depending on the day/night noise level ($L_{Ar\ dn}$) over 24 hours is presented in Table 7.11.

Table 7.11 Intensity of the Noise Level Anticipated during the Operation of the Plant

Point	Address	Day/Night Sound Valuation $L_{Ar\ dn}$ (dBA) [1]			Impact
		Initial Noise [2]	Specific Noise [3]	Projected Ambient Noise [4]	Intensity
Nº 1	4893, Chemin St-Martin, La Baie	57	42	57	Low
Nº 2	4583, Chemin St-Martin, La Baie	43 et 45	21	43 and 45	Low
Nº 3	4413, Route de l'Anse-à-Benjamin, La Baie	60	40	60	Low

Notes

1 $L_{Aeq\ T}$ + adjustments, rounded to the unit.
2 See Table 4.34, L_{dn}.
3 The specific noise is calculated from the valuation levels in Table 7.7.
4 The projected ambient noise is the logarithmic sum of the initial noise and the specific noise

The anticipated **intensity** of noise generated during the operation of the plant is estimated to be **low** at 3 receptor points. Taking into account a **local range** and a **short duration**, the environmental impact on the soundscape is considered of **low significance**.

7.3.6 Visual Environment

Two variables are used to determine impact significance: the resistance of the landscape unit with respect to equipment installed in the area, and the equipment's degree of integration and perception, within the visual field of potential observers, as defined in Hydro-Québec's *Environmental Assessment Method for Lines and Substations.*

7.3.6.1 Analysis of the Landscape's Absorption Capacity

The planned facilities include various types of equipment (see Figure 3.1) whose height ranges from 20 to 50 meters, with the exception of the 123 m high reactor tower. The expected impact on the landscape varies according to the height of the equipment. The location of the proposed facilities in the Cap-à-l'Ouest sector contributes to their partial integration in the regional landscape, which is facilitated by two factors: topography and vegetation.

The facilities stand at an elevation of approximately 130 meters. This artificial plateau which was created for the purpose of developing an industrial area, is bordered, in the north, by a ridge whose summit stands at about 150 meters and is surmounted by evergreen forest trees with an approximate height of 15 to 20 meters, thereby forming a screen of about 40 meters in height on the north side.

In the south and east, Cap-à-l'Ouest includes a set of small peaks ranging from 190 to 210 m in height, surmounted by a dense canopy of conifers with a height of 15 to 20 m, forming a screen of about 90 to 100 m in height of the project site.

In the west, the site's topography forms a large plateau whose average elevation is about 100 meters. The fact that most of the land is used for agricultural purposes, means there are numerous visual access points. However, the undulating topography of the site contributes to restricting the visual field. In some places, the presence of some forests obstructs the view. The vegetation surrounding the site hides the lower portion of the projected equipment (15 to 20 meters).

The topography and vegetation hide a large portion of the equipment over the largest part of the study area. However, the highest elements remain visible in places, which is why the absorptive capacity of the landscape is considered moderate in most of the study area (for the visibility map, see Appendix 1)

7.3.6.2 Analysis of the Landscape's Integration Capacity

The integration capacity of the landscape corresponds to the study of the physical compatibility of its dominant characteristics with the Project's components. Thus, although the Project is located in an industrial area, its facilities are the first large-scale industrial installations planned in this area which is currently occupied by the Cap-à-l'Ouest forest. The integration capacity of the landscape is thus low.

7.3.6.3 Value Attached to the Quality of the Landscape

The Cap-à-l'Ouest landscape unit, where the plant site is located, is part of the Saguenay fjord landscape which is recognized in the development plan as an area of aesthetic interest. This recognition of the area's landscape value in the development plan shows the considerable value attached to it by the population of the region.

7.3.6.4 Landscape Resistance Level

Considering the average absorption capacity of the landscape, its low integration capacity and the high value attached to it, the area's level of resistance (or sensitivity) to the integration of the proposed equipment is strong.

7.3.6.5 Assessment of the Significance of the Visual Impact

The following variables are taken into account in the assessment of the visual impact:

- Resistance of the landscape unit, as described in the previous section;
- Degree of disturbance of the landscape
- Degree of perception of the equipment

Based on the Hydro-Québec landscape study method:

- An impact of major significance corresponds to:
  - profound change in the landscape which generally has a very high or compelling level of resistance and where the degree of disturbance and perception of equipment is significant;
- An impact of moderate significance is:
  - a partial modification of the landscape which has a high degree of resistance, but where the expected degree of disturbance is high, moderate or low;
- An impact of minor significance is :
  - a minor modification of the landscape. This landscape is generally characterized by a low resistance and a generally variable degree of disturbance and perception; the impact will also be of minor significance if the source is located in a landscape unit with high and very high resistance and where the degree of disturbance and perception is generally low.
- An impact of minor to no significance is a negligible change in the landscape which has a very low resistance and where the degree of disturbance and perception is low.

A table summarizing the various analysis variables used to assess the significance of the impacts based on observations in various landscape units is available in Appendix l3.

This analysis shows that in the majority of the study area (units 1, 2, 5 and 6), the anticipated visual impact is moderate. In fact, although the landscape unit presents a high resistance, the remote position of the observers in relation to the plant site means that the equipment is generally seen in the background of the landscape, at an average distance of nearly 8 km.

Besides, only a portion of the equipment is visible above the vegetation and landscape and, with the exception of La Baie, the study area is sparsely populated with a small number of permanent observers. The impact on the panoramic views from units 5 and 6 remains moderate because the landscape change is isolated and the number of observers is limited. However, special attention should be paid to views from these areas in order to meet guidelines of the City of Saguenay's land planning and development guidelines, where the importance of "preserving the natural features and landscape of the fjord and the Saguenay River" is mentioned and, more specifically, "to preserve and enhance the large views to the Saguenay".

In Landscape Unit #3 in the La Baie area, the site's topography means a very small part of the facilities will potentially be visible above the vegetation. Therefore, despite the larger population that may be affected, the significance of the anticipated impact is low.

The visual impact of the facilities as perceived from Landscape Unit #4 in Cap-à-l'Ouest is considered of minor significance overall, as the vegetation cover and topography will contribute to hiding equipment and limit the visual impact. The number of observer is very limited.

However, certain specificities need to be clarified with respect to Subunits 4a and 4b. Landscape Subunit 4b includes the only area with permanent observers in the Cap-à-l'Ouest unit and these observers are very close to the proposed facilities. However, the observers' position below the site, as well as the topography and vegetation, mean that the visual impact from this area is of low significance.

The significance of the visual impact in Landscape Subunit 4a is considered moderate. As the site of the new facilities is located in a vast forest that is almost undisturbed immediately, the degree of visual exposure in the immediate landscape of the plant site will be high, but its direct impact will be limited to a small number of temporary users, i.e. industrial park workers. In addition, it is important to factor in that this subunit is located inside the Grande-Anse Intermodal Marine Industrial Park. The landscape in this area is expected to change as other industrial pieces of equipment are installed, which will help increase the degree of integration of the proposed equipment in a large industrial complex.

7.3.6.6 Nighttime Impact

The previous impact analysis was based on impacts on the daytime landscape. Impacts on the site's nightlife have not been assessed, since data on the anticipated levels of illumination were not available. However, considering the current level of ambient light is very low, one can assume that the construction of the new industrial facilities and lighting required to ensure their safety and operations will have an impact on the area's overall illumination level. Illumination associated with the equipment visible above the topography and vegetation can also change the nightscape. The impact of changes in the nightscape should be proportional to that of the daytime landscape in the various landscape units. However, it is impossible to determine its intensity at this stage of the project.

7.3.6.7 Mitigation Measures

Some pieces of equipment will be partly visible from various locations. However, some mitigation measures can reduce the visual impact of the visible parts this equipment. A visual

simulation of the proposed facilities was carried out from an observation point on the north bank of the Saguenay, i.e. Auberge la Tourelle. This simulation is shown in Figure 7.1. The following mitigations measures are recommended for this project:

Mitigations measures to be implemented in order to reduce daytime impacts:

- Paint the storage domes and transfer building with a dark color paint blending with the surrounding vegetation, which mainly consists of conifers;
- Landscape developments will be included to the project near the administration building, hence along the Chemin du Quai Marcel Dionne.

This color-focused mitigation measure is questionable since white domes will be less noticeable in the winter than in the summer. However, since vegetation in the area consists partly of conifers, this type of mitigation could also be beneficial in the winter. Additionally, two domes were represented and only one might be required, which would further reduce the visual impact. With regard to the transfer building, the volume could be smaller based on the sizing of the multi-user conveyor the APS could use. The measures will be discussed with the community during further consultations.

Mitigation measures to be implemented to reduce night time impacts:

- Design lighting to limit the illumination intensity to the minimum required for safe operations of the site;
- Use deflectors or other methods to direct the light only where needed and not outside of the site or towards the open sky (dark sky);
- Use color surface or textures that reflect light very little.

The previous mitigations measures reduce the visibility of the equipment as perceived from the study area. The significance of the residual impact remains **low to moderate** depending on the place where the observation takes place.

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Situation actuelle

Simulation visuelle

NAIC

SNC·LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Figure 7.1
Simulation visuelle
Visual Simulation

Projet / Project : 634451

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7.3.7 Quality of Life

It is not easy to give an objective definition of the notion of quality of life. Within the framework of an industrial-type project, an impact life quality could adversely affect some environmental components of value for the community such as health, peaceful (noise climate), landscape, air quality, the perception of a risk, etc.

Any construction site inevitably causes nuisances that are likely to temporarily disturb quality of life within the neighborhood. With the future pig iron plant, these nuisances are mainly due to the following:

› Dust emissions;
› Noise caused by heavy machinery; and
› Increased trucking.

A significant environmental value is attached to the quality of life of residents in the study area.

The potential emission of dust due to site preparation works will be limited by the use of the already paved roads of the Intermodal Industrial Park and the use of MDDELCC-approved dust suppressants on the plant site. Trucks carrying granular materials will in turn be tarp-covered to prevent fugitive emissions of particles.

Considering that the project is located in an industrial park that there are few homes that are closer to the work area, and the mitigation measures to be implemented, the anticipated effects of the construction activities on residents' quality of life should be of very low significance.

During the operation phase, there will be no significant impacts on air quality (see section 7.2.1), on the noise climate (section 7.3.5) and on health (section 7.4.2).

Finally, the consequences of a major accident were analyzed and risk management measures will be taken. The consequences of the accident scenarios analyzed will remain within the plant's perimeter. Only Scenario involving the accidental release of dimethyl disulfide could be perceived by the population due to very low odor threshold associated with this product. The pig iron production plant ties in within the industrial and port zone of Saguenay.

Therefore, the project should not have any significant impacts on the quality of life of residents living nearby the future installations.

7.3.8 Archeological Heritage

A study of the area's archaeological potential conducted by Subarctique Enr. concluded the project site has no archaeological potential. Besides, although several archaeological activities have been conducted in the region in recent years, there is no known archaeological site located within 5 km of the project site.

Two archaeological sites have been identified within a radius of 10 km from the project site. The first site (code Borden DcEr-a) is located near the Valin River in the municipality of Saint-Fulgence, a little more than 5 km northwest of the project site. The second site is located just

over 10 km south-east of the project site, in the municipality of Saint-Félix-d'Otis and includes the archaeological sites of the Anse-à-la-Croix (Borden codes DcEP-1, 2, 3, 4, 5). These archaeological sites testify to prehistoric and historic occupations by Native American and are located outside the local study area.

In the event of other archaeological sites being discovered by chance during the construction of the plant, the MCC would be immediately notified in accordance with Article 41 of the Cultural Heritage Act.

There are no impacts anticipated on the project site's archeological heritage during the construction or operation of the plant.

7.3.9 Economic Spin-offs

The economic impacts generated by the construction and implementation of the pig iron production plant are assessed using the Intersectoral Model of the Québec Statistical Institute (*Institut de la statistique du Québec*, ISQ). The impacts are measured in terms of labor, wage bill and government revenue.

7.3.9.1 The Québec Intersectoral Model

The Québec Intersectoral model is used to analyze the spread of demand in the economy of Québec, using the goods and services exchange relationships observed between various sectors. The model, which can quantify the effects of real or hypothetic changes in Québec's economy, is used to assess the economic impact of costs associated with the production of a sub-sector on major economic aggregates such as wages, labor, added value and direct and indirect taxes. It classifies impacts in the supply chain, whether they are found directly in the stimulated sector or with its suppliers.

Economic impacts are caused by expenses related to any project. Thus, two types of expenses may generate economic benefits: capital expenditures and operating expenses. This distinction is important because capital expenditures will not last beyond the construction phase, while operating expenses are likely to be repeated every year. Thus, capital expenditures are a transitory shock on the economy since they increase the level of activity on a temporary basis whereas in the case of operating expenses, the effects will be continually replicated and will permanently increase overall activity levels.

Before presenting the results of the various simulations, it is useful to immediately address some theoretical considerations inherent in economic impact studies.

Direct and Indirect Impacts

Direct impacts are usually associated with the immediate effects generated by the expenditure being analyzed. If we consider the example of a piece of industrial equipment, the direct impact is associated with the wages paid to workers, the contractor's margin and purchases from suppliers. Indirect impacts include impacts associated with the provision of goods and services. These impacts are due to the fact that industries (first suppliers), which are concerned by their initial expenditure, must get supplies of goods and services from various suppliers (second suppliers).

Labor Variable

The most common finding of an economic impact study is most certainly the variable associated with labor and not with the number of jobs provided. Thus, a person-year is a labor input value equal to the number of hours normally worked for a year by the workers concerned.

Revenue for the Government of Québec

The Québec Government's revenue streams include revenue from indirect taxes paid in Québec and taxes on wages and salaries. Québec's incidental revenues consist of contributions to the Québec Pension Plan (*Régie des rentes du Québec*, RRQ), the Québec Standards, Equity and Occupational Health and Safety Commission (*Commission des normes, de l'équité, de la santé et la sécurité du travail*, CNESST), the Health Services Fund (*Fonds des services de santé, FSS*), and the Québec Parental Insurance Plan (*Régime québécois d'assurance parentale*, RQAP).

Federal Government Revenue

Federal income includes federal income tax and indirect federal taxes. Indirect federal revenues include contributions to Employment Insurance (EI).

7.3.9.2 Economic Spin-offs During the Construction Phase

Capital expenditures will reach a total of approximately $468 million which break down in construction costs, equipment purchase and capital costs. From the start of the Project, NAIC contracted Italian firm Tenova to conduct a feasibility study as well as provide certain production equipment. The capital expenditures associated with the equipment purchased directly from Italy must be subtracted from the capital expenses considered for the evaluation of the economic spin-offs. The capital injected into Quebec's economy therefore amount up to 257 million CAD.

As shown in Table 7.12, these capital expenditures will support in total 1,538 person-years for and contribute to the gross domestic product, i.e. an added value of $169 million. The construction workers' aggregate payroll, which is estimated at $120 million, is included in this amount.

Table 7.12 Economic Impact of the $257 Million Capital Expenditures (in thousands of dollars, 2016)

Category	Direct Impacts	Indirect Impacts on Suppliers		Total Impacts
		First	Others	
Labor (person-years)	923	414	201	1 538
		Thousands of $ - 2016		
Value added to the cost base	126,395	24,717	18,001	169,112
Imports		69,114	18,367	87,481
Revenue for the Government of Québec	8,043	1,175	861	10,080
Revenue for the Government of Canada	5,722	687	545	6,953
Parafiscality				
Quebec (RRQ, FSS, CSST, RQAP)	13,220	2,187	1,408	16,815
Federal (Employment Insurance)	1,710	485	290	2,485

Source: Institut de la statistique du Québec, 2016.

The ISQ model estimates the direct impacts at 923 person-years, which is the number of direct jobs created on the construction site during the 22-month construction period. This estimate is coherent with the number of jobs estimated in the project's feasibility study, i.e. 390 jobs. The variation is partly due to the fact that the model does not take into account work scheduling. A large number of working hours will be counted as overtime, thus reducing the number of jobs assessed in the feasibility study. The indirect impacts on the first and other suppliers correspond to 615 person-years.

The ISQ model estimates that approximately 66% of the final demand in Quebec will be met by the domestic sector and the balance will come mainly from imports.

The project will also generate total tax revenues of $10 million and $7 million respectively for the governments of Québec and Canada.

The salaries will also generate $16.8 million in incidental taxation for the province and $2.5 million for the federal government.

For the construction period, the Construction Decree provides that every contractor must give recruitment priority to workers in the project area. This requirement should facilitate the hiring of local workers. It should be noted that the ISQ Intersectoral Model takes into account that the equipment required by the project will be produced in Québec without identifying potential suppliers.

To promote local spin-offs of the project and ensure proper sharing of information with the local population, NAIC agrees to hold an information session in collaboration with local development agencies and chambers of commerce in order to keep companies informed on the needs for labor and contractors for the construction of the plant.

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A **high social value** is attached to the economic spin-offs generated by the project during the construction phase. With value added to the base price of $169 million which, over two years, represents a little under 1% of the gross domestic product (GDP) of $10.3 billion in the Saguenay region, the **degree of disturbance** is **low** with a **moderate intensity**. The impact is **short-lived** with a **regional extent**. Therefore the **significance** of the economic impact of the construction of the project is described as **moderate.**

7.3.9.3 Economic Spin-offs during the Operation Phase

The plant's annual operating expenditures (Opex) amount to $141.3 million. Opex costs mainly include raw material purchase (60%), energy costs (25%), wages and salaries paid to employees as well as maintenance costs (15%).

These operating expenses will induce an annual added value of $63.2 million to the economy of Québec and will support the equivalent of 105 person-years for an estimated payroll of $8.8 million, as presented in Table 7.13.

Table 7.13 Economic Impacts of $141.3 Operating Expenditure (in thousands of dollars -2016)

Category	Direct Impacts	Indirect Impacts on Suppliers		Total Impacts
		First	Others	
Labor (person-years)	100 to 115	97	133	335
		Thousands of $ - 2016		
Value added to the cost base	14,047	32,345	16,787	63,180
Imports	--	57,795	18,779	76,574
Revenue for the Government of Québec	1,100	1,072	673	2,845
Revenue for the Government of Canada	806	781	440	2,027
Parafiscality Québec (RRQ, FSS, CNESST, RQAP) Federal (Employment Insurance)	 1,176 195	 1,133 175	 1,112 203	 3,421 573

The operation phase will result in total annual revenue of nearly $2.8 million and $2 million in income and other taxes, respectively for the governments of Québec and Canada. The Municipality of Saguenay will also benefit from income taxes induced by this industrial activitiy on its territory.

The salaries will also generate annual income equivalent to $3.4 million in incidental taxation for Québec and $0.57 million for the federal government.

The new jobs created by the operation of the plant, are well-paid quality jobs. These include more than 75 process and maintenance technicians and about thirty supervisors, foremen, engineers and administration positions. In addition, jobs will also be created at the headquarters. The company's operations related to its clientele, contracting, market development and logistics will be directed from the headquarters. For each of the direct jobs

created by NAIC, the ISQ model estimates that around 2 indirect jobs will be created, hence a total number of 335 direct and indirect jobs.

NAIC will adopt a policy to purchase goods and services locally when those available are qualified and competitive.

Importantly, this project will provide a business opportunity to mining companies operating in Côte-Nord and Northern Quebec by meeting their iron supply demands in these regions. NAIC believes that potential suppliers in these regions will offer a superior quality iron ore pellet at competitive prices. The operation of the pig iron plant in Saguenay could also add value to a mineral resource from Quebec through a second processing of the resource.

The operation of the NAIC plant is part of the Quebec government maritime strategy. It would be the first plant to be constructed in the industrial-port zone administered by the APS.

NAIC will most probably be the first company to operate in the intermodal industrial zone of the Port of Saguenay (SPA). Various amenities will now be present in the area (power supply, natural gas and drinking water), making the area more attractive to other investors. The Saguenay Port Authority is working to promote business expansion outside the region as well industrial and economic development in the inland region of Saguenay-Lac-Saint-Jean-Chibougamau-Chapais, and NAIC will help the SPA meet these goals. The handling of iron ore pellets and pig iron products from the port to the plant will be the responsibility of the SPA which will most likely recruit local subcontractors.

NAIC intends to facilitate the participation of local contractors and businesses in the supply of goods and services required for the operation of the plant through concerted efforts with local organizations such as Promotion Saguenay and the local employment center.

The social value of the Project's economic spin-offs is considered **high** as the project will entail limited a **low level of disturbance** (about 0.6% of the region's GDP), hence a **medium** impact **intensity**. The Project's economic spin-offs during the operation phase will be essentially **regional** and **long-term** in nature, and the **significance** of the impact will be **high.**

7.4 Impacts of the Plant's Closure

As mentioned in Chapter 3 (Section 3.12), it is premature to accurately determine the requirements and activities to be associated with the closure of the pig iron plant. The plant will have a service life of over 50 years and will keep operating as long as it remains safe, productive and cost-effective. Yet, the closure of any industrial site might require the following activities that have been identified as a source of potential impacts:

› dismantling and demolition of facilities;
› disposal of materials, obsolete equipment and demolition debris;
› site cleaning and rehabilitation.

The dismantling and demolition of facilities and the disposal of materials, obsolete equipment and demolition debris could generate impacts that are similar to those experienced during the construction phase. A closure plan prepared and discussed with the various Ministries concerned before undertaking the demolition of the facilities will help mitigate the adverse impacts of the plant's closure. This plan should include an employee support strategy developed in collaboration with local economic organizations by providing them with various tools designed to help them re-enter the labor market.

Since it is difficult to determine the diversity, strength and structure of the area's economic fabric, the significance of the impact of the plant's closure is unknown.

7.5 Impact Summary

Although various measures will be implemented to help mitigate most of the environmental impacts associated with the Saguenay pig iron plant project, some residual impacts on the environmental components of the study area are anticipated. Table 7.14 presents a summary of the mitigation measures to be implemented and the project's residual impacts on the physical, biological and human environments associated with the construction of the pig iron plant while Table 7.15 provides a similar summary for the operation phase.

Table 7.14 Summary of the Residual Impacts of NAIC's Pig Iron Plant Project– Construction Phase

Environmental Component	Impact Source	Impact Description	Impact		Prevention, Mitigation or Compensation Measure	Significance of Residual Impacts
			+/-	Impact Significance*		
PHYSICAL ENVIRONMENT						
Air quality	› Earthworks; › Trucking-Equipment delivery; › Blasting; › Operation of heavy vehicles, machinery and equipment.	› Increased quantities of dust in ambient air; › Emission of contaminants in ambient air generated by combustion engines.	-	----------	› Speed limitation; › Application of dust suppressants, where appropriate; › Use of containment measures on transported bulk materials (e.g. tarpaulins on trucks); › Cleaning of paved roads; › Repair or adjustment of vehicles, heavy machinery and equipment producing excessive emissions, visible from exhaust; › Raising truckers' awareness on idling; › Blasting: – pre-approved blasting plan; – controlled vibrations and blast pressure ; – installation of protective carpets, if necessary.	------
Surface water quality	› Activities related to site preparation (earthworks) that could affect runoff water. › Accidental spills: – trucks, equipment or machinery; – cleaning water from concrete mixers; – storage and handling of hydrocarbons, hazardous materials and waste; – sanitary wastewater from site.	Occasional increase in surface water: › suspended solids; › pH; › turbidity; › $C_{10\text{-}C50.}$ Contamination of surface water: › by sediments carried by run-off; › following a spill.	-	----------	› Directing drainage water to a holding and treatment basin. If this is not possible (topography): measures to control sediment and hydrocarbons at the exit of the ditches. › Passive water treatment systems (such as filter berms, a flocculation system or hydrophobic absorbents) in order to reach targets for TSS and hydrocarbons if necessary. › Obstruction mechanism and access platform for pumper trucks at the exit of the retention basin. › Monitoring the quality of drainage water at the discharge point. › Management and monitoring procedures: – periodic inspection of the drainage network; – cleanliness on site; – management of fuels, petroleum equipment and construction machinery (immediate repair of oil leaks); – management of hazardous materials and hazardous waste; – concrete waste management and concrete washing waters; – prevention and emergency response plan (spill kits); – sanitary water management.	----
Groundwater and soil quality	See Impact Sources of the "Surface Water Quality" component.	Contamination of groundwater due to a spill	-	----------	See Management and Monitoring Procedure in the "Surface Water Quality".	----
BIOLOGICAL ENVIRONMENT						
Terrestrial wildlife	Noise and lighting from the site.	Disturbance of wildlife in the vicinity of the construction site due to noise and lighting	-	Low (sensitive species) to very low (common species)	None	Low (sensitive species) to very low (common species)
Ichtyofauna	See Impact Sources of the "Surface Water Quality" component.	See Section "Impact Description" of the "Surface Water Quality" component degrading the quality of fish habitat.	-	Very low	See"Prevention, mitigation or compensation measures" in the "Quality of surface water" component. Establish a retention system to prevent the fall of materials, debris, waste or other materials in fish habitats.	Very low
	Construction activity in the vicinity of fish habitat; falling debris and waste.	Degradation of fish habitat.	-			

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Environmental Component Number	Impact Source	Impact Description	Impact		Prevention, Mitigation and Compensation	Significance of Residual Impacts
			+/-	Impact Significance*		
HUMAN ENVIRONMENT						
Public infrastructure	Road network: › Traffic of heavy and light vehicles; › Traffic related to the movements of construction workers.	› Increased traffic of construction workers on the road (between 100 and 390 per day) between 6 and 7 am and between 3 and 6 pm; › Increased flow of trucks on the roads for the transportation of concrete, aggregates and backfill/spoil (65 to 130 trucks/day).	-	Low	› Implementation of an awareness program for workers presented during welcome sessions; › Review aspects related to traffic and recommended access routes for heavy vehicles in the contractor welcome meetings (avoidance of Chemin Saint-Martin); › Development of a traffic plan for the delivery of certain heavy or oversized equipment.	Low
Soundscape	› Site preparation works; › Machinery used for the construction of the plant; › Heavy vehicle traffic.	Increased noise levels.	-	Very low	Noise monitoring conducted during construction to ensure that the noise impact is low, as planned.	Very low
Quality of Life	› Operation of heavy equipment and trucking; › Increased trucks and heavy vehicle traffic.	Disturbance and decreased quality of life due to increased nuisance: › Dust emission; › Noise › Increased traffic	-	Very low	See the section “Prevention, Mitigation or Compensation” for the following components: › "Quality of surface water ' › "Soundscape"	Very low
Economic spin-offs and employment	› Capital expenditures; › Hiring of labor for the construction of the plant; › Income for governments via taxes and fees.	› Capital expenditure of approximately $ 257 million; › 1538 persons-year on average per year (direct and indirect); › $ 26.9 million income for the provincial government; › $ 9.4 million in income for the federal government.	+	Very high	None	Very high

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Table 7.15 Summary of the Residual Impacts of NAIC's Pig Iron Plant Project– Operation Phase

Environmental Component	Impact Source	Impact Description	Impact		Prevention, Mitigation or Compensation Measure	Significance of the Residual Impact
			+/-	Significance of the Impact*		
PHYSICAL ENVIRONMENT						
Air quality	Emissions of gases and particles from the following sources: › Preheating furnace; › Vent of the CO_2 removal system; › Dust collectors; › Wastewater treatment plant acid scrubber; › Electric arc furnace; › Roads inside the site.	Emission of contaminants into the air generated by the combustion of natural gas and process units, mainly: › Sulfur dioxide (SO_2); › Nitrogen dioxide (NO_2); › Carbon monoxide (CO); › Ammonia (NH_3); › Total particulate matter (PMt); › Fine particles ($PM_{2.5}$).	-	----------	The selected process units were designed for a maximum reduction of atmospheric emissions (see chapter 3): › Materials contained in enclosed conveyors; › Thermal oxidation unit for the oxidizing of H2S emissions; › Thermal oxidation unit to oxidize ammonia emissions; › Evacuation of air from all material transfer points towards the baghouses; › If necessary, spray water on the plant's internal roads and on the slag pile during transfer operations in the storage area to keep dust down; Based on the modeling conducted on anticipated air emissions, the project would not result in the exceedance of air quality standards.	------
Surface water quality	Discharges into the environment through runoff water and streams made up of : › Discharges into the atmosphere captured by the rain or settling on the water; › Storm water discharges; › Discharges of treated sanitary wastewater; › Discharge of treated residual process waters; › Accidental spills; › Trucking activities.	› Degradation of the quality of surface water by the dust generated by trucking activities or by waste generated by plant operations; › Surface water contamination as a result of a spill.	-	----------	Use of dust suppressants if necessary. › Management of rain water by means of a retention basin. › Various measures taken during the design phase will help minimize the release of dust, iron and hydrocarbons into storm water: – Storage of iron pellets inside a building; – Use of closed conveyors; – Transfer points equipped with a dust collector; – Majority of the production equipment in the iron reduction area located inside buildings; – The CO_2 removal area will be surrounded by a retention dike – Operational procedure to validate the absence of amines prior to discharge into the holding tank; – Installation of hydrocarbon separators in the electrical substation and diesel refueling area; – Impermeable surfaces for the liquid chemical loading/unloading areas with drainage towards a sump; – Addition of coagulant to the retention pond for iron precipitation. Selection of conditioning products with the lowest toxicity level in order to achieve the desired effect. Wastewater treatment system: › More than 80% of treated wastewater flow is reused in the plant; › Primary clarifier, solids filtration, pH adjustment, ammonia removal, secondary clarification and sand polishing. › Regular monitoring of industrial effluent prior to discharge into the environment. › Regular monitoring of stormwater effluent prior to discharge into the environment. › During the detailed engineering, evaluation of different options to reduce the flow of the final effluent.	----
Groundwater and soil quality	› See Impact Sources of the "Surface Water Quality" component; › Handling and storage of hydrocarbons, hazardous materials and waste.	› See the Impact Description of the "Surface Water Quality" component; › Groundwater contamination following a spill.	-	----------	› Surface water mitigation measures. › Waterproofing of the slag storage area. › Slag runoff water captured and directed into the storm water holding tank and treatment of metals by adding a coagulant. › Groundwater quality monitoring program. › Emergency action plan to be implemented in the event of a spill.	----
Hydrology of the receiving watershed	Discharge of industrial and sanitary water into the environment (16 m^3/h).	Increased flow of receiving streams: › In flood periods: 1.5% of the flow of sub-watershed; › In summer low-water Q10.7: 27% of the flow of the subwatershed.	-	----------	During the detailed engineering, evaluation of various options to reduce the final effluent's flow.	----
BIOLOGICAL ENVIRONMENT						
Aquatic wildlife Ichtyofauna	See the Impact Sources of the "Surface Water Quality" component.	See the Impact Description of the "Surface Water Quality" component;	-	Moderate	See mitigation measures for water quality.	Unspecified

Environmental Component	Impact Source	Impact Description	Impact +/-	Impact Significance of the Impact*	Prevention, Mitigation or Compensation Measure	Significance of the Residual Impact
Aquatic wildlife Marine mammals	Increased maritime traffic in a sensitive area to reach APS facilities.	Noise that can cause habitat degradation of through disturbance and noise.	-	Unspecified	Unspecified	Unspecified
HUMAN ENVIRONMENT						
Public infrastructure	Road network : › Trucking; › Traffic related to workers' movement; › Port facilities and maritime route. Port facilities: › Increased traffic at the Grande-Anse Terminal.	Increased traffic of: › trucks on the road (100 per day); › boats on the sea and at the dock (4-5 month).	- +	Low	None	Low (-) Low (+)
Greenhouse gas emission	› Natural gas combustion; › Reduction reaction of the pellets iron oxides.	GHG emissions of 328,000 t CO_2 eq/year.	-	Very high	Reduction of GHG emissions by 90,000 t of per year by changing its production technology and thus turning it into one of the most efficient pig iron production plants in the world, with an emission rate of 0.63 t GHG/t of pig iron.	High
Soundscape	Transportation by trucks and plant operation: › Baghouses; › Ventilators; › Cooling towers; › Pumps; › Transformers; › Engines.	Increased noise levels.	-	Low	Validation of the equipment's acoustic specifications at the detailed engineering stage. Monitoring of noise levels after the plant's commissioning to ensure compliance with the applicable criteria and make any adjustments, if necessary.	Low
Visual environment	New plant facilities (reactor tower with a height of 123 m).	Visibility of infrastructure resulting in degradation of the landscape.	-	Minor to moderate	Proposed measures: › Paint the storage domes and transfer building with a darker color fitting with the surrounding vegetation, which mainly consists of conifers; › Landscape developments will be included in the project near the administration building, hence along the Chemin du Quai Marcel Dionne. › Design lighting to limit the illumination intensity to the minimum required for safe operations of the site; › Use deflectors or other methods to direct the light only where needed and not outside of the site or towards the open sky (dark sky); › Use color surface or textures that reflect light very little.	Minor to moderate
Quality of life	Nuisances related to operating activities: › Sources of impact on air quality or health; › Vibration and noise caused by trucking; › Increased flow of workers and trucks.	Disturbance and decreased quality of life due to increased nuisance.	-	Low	See the Section "Prevention, Mitigation or Compensation" of the following components: › Air quality; › Public infrastructure - road network; › Soundscape.	Very low
Economic spin-offs	› Hiring workers at the plant. › Outsourcing of specialized companies. › Revenues for the provincial and federal governments.	Operating expenses of $ 141.3 million, including: › about one hundred direct jobs and 230 indirect jobs; › $ 2.2 million in annual revenue for Quebec; › $ 2.0 million annual revenue for Canada; › revenues in municipal taxes; › purchase of energy, raw materials, chemicals and maintenance costs.	+	High	None	High

Note : * for the biological and human environments only

7.6 Cumulative Environmental Impacts

According to the Canadian Environmental Assessment Agency (CEAA), a cumulative environmental effect is a “change to the environment that is caused by a human action in combination with other past, present and future human actions. A human action is a project or an activity of anthropogenic nature” (Hegmann et al., 1999). This definition means that an impact of a given project may interfere with an impact of a past, present or future project and thus have additional direct or indirect impacts on the Project area’s environmental components.

Section 7.6.1 identifies the projects or activities taken into consideration in the evaluation of cumulative impacts. These are all future projects announces in or near the study area.

Section 7.6.2 presents probable changes in the environmental components of the study area while taking into account the anticipated effects of the project and the potential environmental impacts associated with related projects and reasonably foreseeable activities. The cumulative environmental impacts have been determined based on the overlapping potential (temporal or spatial) of the impacts of each of these projects. Mitigation measures and a monitoring program are being proposed, if required, for each anticipated cumulative effect.

7.6.1 Projects Considered

Marine Terminal on the North Bank of the Saguenay River

This is a new maritime infrastructure of the Port of Saguenay to be used for the purpose of the Arianne Phosphate Project discussed below. The APS is planning to build and operate a new multi-user port terminal to serve the north bank of the Saguenay River near the municipality of Sainte-Rose-du-Nord located some 45 kilometers away from the City Saguenay. The planned infrastructures are a dock, a ship loader, silos, concentrate handling systems and related buildings as well as a 1 to 1.5 km path to the dock. The dock would be designed to accommodate bulk carriers with a minimum deadweight of 50,000 tons (http://www.ceaa.gc.ca/050/details-fra.cfm?evaluation=80103 CEAA; website consulted in July 2016). The new marine terminal will be located some 8 km east of the Grande-Anse Maritime Terminal, on the North Bank. A description of the Project was submitted to the Canadian Environmental Assessment Agency (CEAA) and the impact study is being conducted. The construction works, which were initially planned in autumn 2016, will probably be postponed because the environmental assessment has not been completed. The plant is due to be commissioned in 2018-2019. The Marine Terminal on the north bank could have cumulative impacts on traffic in the Saguenay.

Lac-à-Paul Apatite Mine – Arianne Phosphate Project

The Project proponent wishes to undertake the mining of an apatite (also known as phosphate rock) deposit. The mine is located near Lac-à-Paul, 200 km north of the city of Saguenay. The mine is not close to the NAIC plant. However, one its components (shipping via the new dock of the Port of Saguenay on the north bank) could generate a cumulative impact in terms of maritime traffic. Arianne plans to ship about 3 million tons of products every year using 50,000-ton bulk carriers, about 60 ships/year. Under the agreements between Arianne Phosphate and the APS, the handling of the products (from truck unloading to ship loading) will be the responsibility of the APS.

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Natural Gas Liquefaction Plant

GNL Québec is planning to build natural gas liquefaction, storage and transshipment facilities in the Grande-Anse port area, located east of the existing APS dock in order to export 11 million tons of liquefied natural gas (LNG) per year, from North American sources of supply. This plant should be operational by 2022 (http://energiesaguenay.com/fr/le-projet/description-du-projet/, website consulted in July 2016). A project description was submitted to the CEAA and the impact study is being conducted.

The cumulative impacts would be reflected in increased marine traffic on the Saguenay and potential increased road traffic if the two construction periods overlap, which seems unlikely.

Handling Activities at the Grande-Anse Maritime Terminal and Transportation of Pellets and Pig Iron between the Platform and the Plant

The APS will be responsible for the unloading and loading of iron pellet and pig iron ships and trucks at the Grande-Anse Terminal and their transportation between the plant and the Terminal. In the medium and long term, the APS plans to build a multi-user conveyor system between the Terminal and the industrial area. Since this conveyor project is not as advanced as the construction of the NAIC plant, the alternative is to load the equipment onto trucks that will go back and forth between the plant and the Terminal. Trucking operations are considered as the most realistic option in the short term. These activities are likely to generate noise and emissions into the atmosphere and will coincide with NAIC's operations and will affect the same close study area.

Construction of New Infrastructure

To serve the pig iron production plant, connections to the water, electricity and gas networks will need to be made:

- A new drinking water pipeline of approximately 15 km will be built by the city in the right-of-way of the corridor of the existing railway;
- A new power line of 8 to 22 km will be built by Hydro-Québec. Its route is yet to be determined;
- A new gas pipeline of about 16 km will be built by Gaz Metro. Its route has not been finalized. However, most of this route could follow the existing road and rail network up to the plant.

The construction of these facilities will coincide with the construction of the plant. Cumulative road trafic impacts are anticipated.

7.6.2 Cumulative Impacts Results Analysis

7.6.2.1 Construction

The Arianne Phosphate project is geographically too remote to be taken into consideration in the analysis of cumulative impacts for both the operation and the construction phases.

Works at the new Maritime Terminal on the North Bank of the Saguenay are too far from the proposed NAIC site to be considered in the analysis of cumulative impacts during the construction phase and the material handling activities do not require new fixed equipment at the Grande-Anse Terminal.

Based on the implementation schedule of the GNL Québec project presented in the project notice, the construction is planned for 2018. The start of the construction works could coincide with the end of the construction of the NAIC plant. There could be some cumulative impacts related to noise, dust emissions and increased traffic on the local network. Since the emissions of the GNL Québec project are not quantified, the cumulative impact is unknown.

Linear infrastructure (water, gas and electricity) construction works are not at a stage advanced enough for them to be assessed and there are no data available. However, these are small-scale projects in terms of the number of workers they employ and machinery required. The cumulative impact on traffic during the construction period will remain low.

7.6.2.2 Operation

Noise

Regarding the possible increase in noise emissions caused by the transportation of materials (pellets and pig iron) from the plant, 480 trucks are expected to go make round trips between the dock and the plant on the Chemin de Grande-Anse. The Port of Saguenay's 2014 and 2015 annual reports state that product handling at the Grande-Anse Terminal required around 10,000 trucks per year (30 to 40 trucks per day) on Chemin de Grande-Anse. The traffic of the dock employees' light vehicles is low, and required around 5 to 6 vehicles per day. The anticipated sound level generated by traffic between the port and the plant, which will be mainly composed of trucks, is equal to $L_{Ar\ dn}$: 65 dBA 30 m away from the center of the road. The anticipated sound level at the nearest receptor (R1), which is located over 400 m of the road is equal to $L_{Ar\ dn}$: 43 dBA. The initial noise level at R1 is equal to $L_{Ar\ dn}$: 57 dBA (Table 4.24). The impact of noise generated by goods transportation between the dock and the plant will be low. Even if this noise source is added to the plant's noise emission, the impact on the sound environment will be of **low** significance.

Air Quality

The Ariane Phosphate project is too geographically remote from the NAIC plant to generate significant cumulative impacts on air quality. There are no quantitative data available on the Saguenay Energy project's air emissions.

As indicated in Section 7.2.1, the maximum concentrations in ambient air generated by the project decrease rapidly as the distance increases distance and the concentrations calculated in residential areas are significantly lower than the MDDELCC's ambient air criteria and standards and the maximum values shown in Table 7.1.

The only other activities that may affect air quality in the study area are those related to the handling and transportation of raw material and finished products between the dock and the NAIC plant managed by the APS. The emission sources due to these activities are described in Appendix D1.

Table 7.16 presents the annual emissions of contaminants due to port loading and unloading operations and wind erosion from the pile of pellets, and to the transportation of materials between the terminal and the plant.

Table 7.16 Annual Emissions due to Materials Handling Activities by the APS

Contaminants	Trucking between the plant and the Terminal (t/an)	Loading/Unloading/Pile (t/year)
NOx	1.2	0
CO	0.3	0
SO_2	0.002	0
PMt	0.03	2.5
PM_{10}	0.03	1.2
$PM_{2,5}$	0.03	0.2
TOC	0.1	0
VOCs	0.1	0
CO_2	197.3	0
CH_4	0.01	0
N_2O	0.08	0
GHG CO_{2eq}	223	0

Table 7.17 shows the maximum concentrations of air contaminants resulting from the activities of the pig iron plant coupled with those generated by the handling and storage activities at the Grande-Anse dock and the transportation of materials from the dock to the plant. These results are also compared with RAA air quality standards, with and without the addition of the initial concentrations.

The results for particulate matters ($PM_{2.5}$ and PMt) over 24h (respectively 4.5 µg/m³, contributing up to 15% of the 30 µg/m³ standard; and 52 mg/m³, contributing 43.3 % of the 120 g/m³ standard) are the most significant ones. The figures in Appendix D2 (Figures D2.7 to D2.9) clearly show that there are really no additivity at the same receptors between the impacts of the proposed plant and the impacts of port activities because of the distance. The maximum impact zone is located immediately near the port operations area on the Saguenay River.

Table 7.17 Summary of the Results of the Atmospheric Dispersion Study on the Cumulative Impacts of the Plant's Operation and APS Handling Activities

Contaminant	Duration	Scenario 1+ Port Activities (with mitigation)		Initial concentrations (µg/m³)	Total concentrations (worst case scenario)		Standards (µg/m³)
		(µg/m³)	% Standard		(µg/m³)	% Standard	
SO_2	4 min	4.8	0.4 %	150	154.8	11.8 %	1310
	24 h	0.4	0.1 %	50	50.4	17.5 %	288
	year	0.06	0.1 %	20	20.06	38.6 %	52
NOx (in NO_2)	1h	17.6	4.2 %	150	167.6	40.5 %	414
	24 h	3.8	1.8 %	100	103.8	50 %	207
	year	0.6	0.6 %	30	30.6	29.7 %	103
CO	1 h	13.2	0.04 %	2,650	2,663.2	7.8 %	34,000
	8 h	4.2	0.03 %	1,750	1,754.2	13.8 %	12,700
PM_t	24 h	52	43.3 %	65	117	97.5 %	120
$PM_{2.5}$	24 h	4.5	15 %	19.3	23.8	79.3 %	30
NH_3	4 min	30.6	8.7 %	0	30.6	8.7 %	350

Increased Maritime Traffic

The raw material and finished products for the NAIC plant will be carried by ships. Depending on average and maximum capacities, 40 to 49 ships will add to traffic on the Saguenay. The Arianne Phosphate and GNL Québec projects would add respectively 60 and 160 ships per year. The cumulative increase will amount to 270 ships per year, i.e. about double the traffic level recorded on the Saguenay in recent years.

As mentioned above (Section 7.2.7) regarding the environmental impact study for the Marine Terminal project on the north bank of the Saguenay, the APS must provide a detailed analysis of cumulative impacts on the beluga population, including the noise impact associated with maritime traffic on the Saguenay due to increased port activities anticipated in its development plan. The results are not known at the time of drafting this report. The impact on marine mammals due to a cumulative increase in maritime traffic in the Saguenay remains unknown.

Chapter 8

Technological Risks

Table of Contents

8		Technological Risks	1
8.1		Introduction	1
8.2		Identification of the Sensitive Components of the Project's Environment	2
	8.2.1	Population	2
	8.2.2	Industrial Facilities	3
	8.2.3	Road and Rail Freight	3
	8.2.4	Pipeline	3
	8.2.5	Environmental Features	3
8.3		Identification of External Risks	3
	8.3.1	Earthquakes	4
	8.3.2	Floods	4
	8.3.3	Landslides	5
	8.3.4	Exceptional Weather Conditions	5
	8.3.5	Aerial Transport	6
	8.3.6	Industrial Activities	6
8.4		Hazard Identification	6
	8.4.1	Description of Hazardous Materials	6
	8.4.2	Transportation of Hazardous Materials	10
	8.4.3	Accidentology	11
8.5		Assessment of the Consequences of the Alternative and Standardized Scenarios	12
	8.5.1	Methodology	12
	8.5.2	Worst-Case Scenarios	17
	8.5.3	Alternative Scenarios	19
	8.5.4	Scenarios Not Assessed Quantitatively	22
	8.5.5	Summary of Potential Consequences	23
8.6		Protection and Prevention Measures	23
	8.6.1	Identification of Applicable Laws and Regulations	24
	8.6.2	Protection and Prevention Equipment	25
8.7		Risk Management Plan	27

List of Tables

Table 8.1	Main Sensitive Elements within the Study Area	2
Table 8.2	Climate Data from the National Building Code	6
Table 8.3	Identification of the Main Hazardous Materials	7
Table 8.4	Properties of the Main Hazardous Materials	7
Table 8.5	Thresholds Used to Evaluate Impact Zones Related to Fatality Risk	14
Table 8.6	Thresholds Used to Assess Potential Effects on Health	15
Table 8.7	DMDS Toxicity Thresholds Defined by MEEDDM	16
Table 8.8	Carbon Monoxide Toxicity Thresholds Defined by AEGL and ERPG Values	16
Table 8.9	Thresholds Used for Domino Effects and Material Damage	17
Table 8.10	Maximum Impact Distances under the Worst-Case Scenario Involving Natural Gas	18
Table 8.11	Maximum Effects Radius for the Diesel-Related Standardized Scenario	18
Table 8.12	Maximum Effects Radius for the Standardized Scenario Associated with the DMDS	19
Table 8.13	Maximum Effects Radius for a Natural Gas Leak Followed by a Jet Fire	20
Table 8.14	Maximum Effects Radius for a Major Natural Gas Leak Followed by an Explosion	20
Table 8.15	Maximum Effects Radius for a Major DMDS Leak	21
Table 8.16	Maximum Effects Radius for a Major Process Gas Leak (CO Toxicity)	21
Table 8.17	Maximum Effects Radius for a Major Process Gas Leak (Mixture Flammability)	22

List of Figures

Figure 8.1	Technological Risks – General Methodology	1

List of Maps

Map 8.1	Maximum Thermal Radiation Distances	30
Map 8.2	Maximum Distances of the Worst Case Scenario Related to DMDS	31

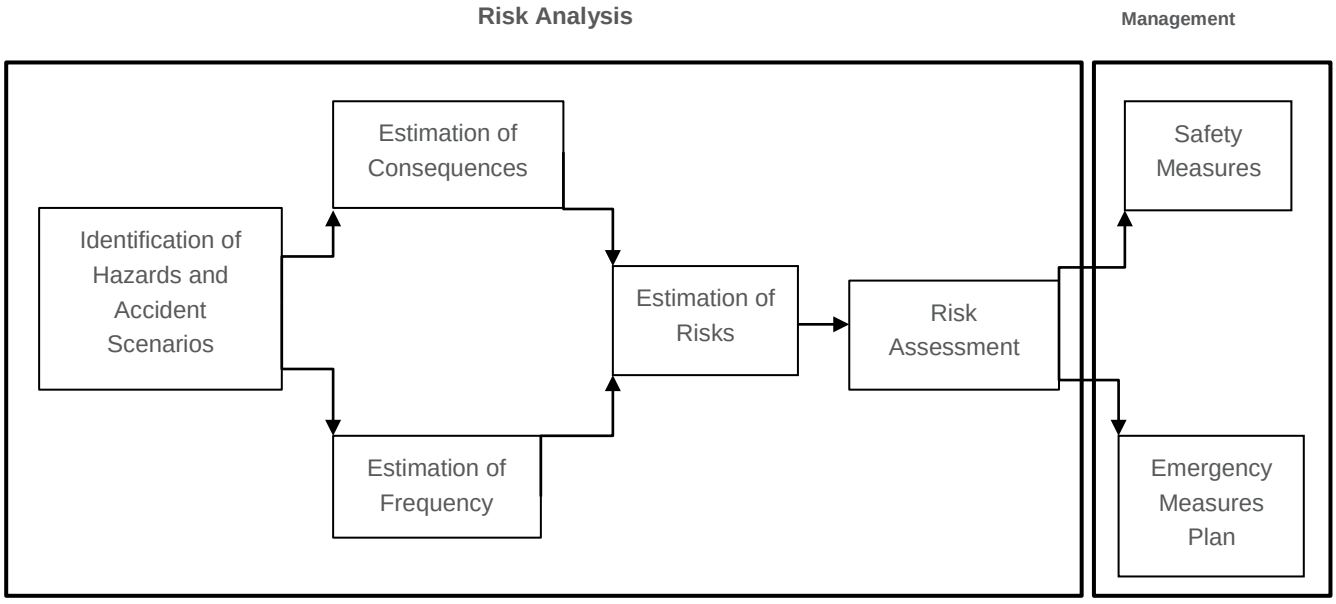
8 Technological Risks

8.1 Introduction

The purpose of analyzing the technological risks associated with the pig iron production facility is to identify accidents that are likely to occur, evaluate their possible consequences and determine the acceptability of the project in terms of its technological risks. Such an analysis is also performed to identify protection measures that prevent these potential accidents or reduce their frequency of occurrence and their consequences.

The risk analysis methodology addresses the requirements set out in the Guide to the Analysis of Technological Risks of the Ministry of the Environment (MENV, 2002). The first steps consist in identifying the sensitive components of the project's environmental and any external dangers, as well as establishing the history of accidents which have occurred in similar plants. Then, some potential consequences of worst-case and alternative accident scenarios are evaluated. If the accident scenarios can affect the surrounding population, an additional evaluation is performed to determine individual risks. Finally, the safety measures to be put in place in order to eliminate or reduce the risk of accidents are specified and a risk management plan is established, including an emergency response plan, with the goal of managing residual risks that cannot be eliminated. The methodology is summarized in Figure 8.1.

Figure 8.1 Technological Risks – General Methodology



Source MENV, 2002

8.2 Identification of the Sensitive Components of the Project's Environment

The sensitive elements of the project's environment are those which, because of their proximity to the project site, could be affected by the proposed plant. They mainly consist of the human population, buildings, public infrastructure and areas, industrial facilities, and sensitive or protected environmental components.

Table 8.1 lists the main sensitive environmental components present in the study area. The location of industries, infrastructure and the local population is illustrated in Map 4.5. Sections 8.3.6 to 8.3.9 provide a detailed description of transport infrastructure and industries near the proposed plant site.

Table 8.1 Main Sensitive Elements within the Study Area

Category	Description	Distance from the Project Site
Population	Isolated residences on Route de l'Anse-à-Benjamin	Approximately 2 km southwest
	Isolated residences on *Chemin* St. Martin	Approximately 900 m north and northwest
Industrial facilities	Grande-Anse Marine Terminal	Approximately 2 km east
Infrastructure	*Chemin* du Quai-Marcel-Dionne	Adjacent to the site
	Railway track and railway service	Opposite the site, on the other side of the road
	Gas pipeline (planned)	Adjacent to the site
Environmental features	Saguenay River	Approximately 1.5 km north and 2 km east
	Small tributaries of the Saguenay River near the site	Adjacent to the site for the closest tributary

8.2.1 Population

Only some isolated residences and farms scattered along local roads are found in a radius of less than 5 km away from the site. The nearest residences are located along the Chemin St-Martin, some 900 m north and northwest of the site and along the Route de l'Anse-à-Benjamin, approximately 2 km to the southwest.

8.2.2 Industrial Facilities

The only industrial facility to be found in the area is the Grande-Anse Maritime Terminal, which is located approximately 2 km east of the project site. The main materials handled there are wood pulp, paper, de-icing salt, caustic soda, liquid pitch and general cargo. Port facilities include tanks for bulk liquids and closed and open-air storage areas for dry bulk solids and general cargo.

There is no other industrial facility near the project site, with the exception of a storage building on the north side of the Quai-Marcel-Dionne Road. This storage building is used by Rio Tinto to manage goods in transit at the port terminal. However, the area is zoned for industrial purposes. Therefore, industrial facilities may be installed nearby the site in future.

8.2.3 Road and Rail Freight

The site is bordered by the *Chemin* du Quai-Marcel-Dionne which leads to the Grande-Anse Marine Terminal. The majority of goods passing through the marine terminal are transported on this single access road. Most of these goods, which are described in the previous section, are not dangerous.

Since 2014, the Grande-Anse Marine Terminal has been served by a railway network operated by the Roberval-Saguenay Rail Service (a Rio Tinto division). This railway network passes in front of the plant site, on the other side of the *Chemin* du Quai-Marcel-Dionne. In 2015, the service was limited to the transportation of aluminum ingots.

8.2.4 Pipeline

To supply the plant with natural gas, a pipeline of about 14 km will be built and connected to the Gaz Métro distribution network. This will be an underground pipeline up to the measurement station located on the plant site. Its route is yet to be established.

8.2.5 Environmental Features

The Saguenay River is the main environmental feature located nearby, at approximately 1.5 km north and 2 km east of the site. There are also some small tributaries of the Saguenay River near the site.

8.3 Identification of External Risks

External risks are natural or anthropogenic events, without any connection to the project, that are likely to affect the operation or integrity of the plant. External anthropogenic risks were identified using maps of the area and field inventories. It should be noted that certain elements can be both a sensitive environmental component and a source of external risk to the plant.

8.3.1 Earthquakes

The Eastern region of Canada (Ontario, Québec and the Maritime Provinces) is situated in a stable continental region of the North American tectonic plate where seismic activity is moderate (Landry, 2013). The majority of earthquakes the world over occur near borders between tectonic plates. No such borders are located in Eastern Canada, and any earthquakes in this region are most likely to be caused by the reactivation of pre-existing fractures or weakness in the earth crust.

In Quebec, there are four zones of relatively significant seismic activity:

› the west of Québec
› the Charlevoix-Kamouraska sector
› the lower St. Lawrence Valley
› the northern part of the Appalachian Mountains

According to Natural Resources Canada (2016), approximately 450 earthquakes occur in eastern Canada every year. On average, four of these exceed magnitude 4, thirty exceed magnitude 3, and about twenty-five are reported felt. Earthquake events of magnitude 5.0 will occur only three times each decade. A magnitude 3 event is sufficiently strong to be felt in the immediate area, and a magnitude 5 event is generally considered as the damage threshold.

A major earthquake with a magnitude of 6.2 on the Richter scale hit the Saguenay area on November 25, 1988. Its effects included liquefaction and rock falls in the epicentral region as well as landslides. Therefore, a correction was made to the building code of the Saguenay-Lac-Saint-Jean region.

Seismic hazard in Canada is defined in the National Building Code of Canada (NBC, 2010) which uses horizontal spectral acceleration values with a depreciation of 5% for various periods as well as the maximum horizontal ground motion value with a 2% probability of being exceeded in 50 years. The Saguenay site is located in an area with a peak ground acceleration velocity of 3.05 m/s^2, which is comparable to the peak velocity recorded in the entire St. Lawrence Valley, with the exception of the Charlevoix-Kamouraska region.

The buildings and facilities will be built in accordance with the national requirements laid down in the National Building Code of Canada, which establishes standards for each seismic zone in the country to ensure that buildings and installations are resistant to seismic loads.

8.3.2 Floods

Flooding normally occurs upstream of sills (raising of the river bed or narrowing of banks) that hinder water flow. The formation of ice jams can also contribute to flooding by obstructing water flow, in particular in places where water flow narrows down.

Drainage in the study area is considered good, moderate, or fast is some places (see Section 4.2.4). In addition, the majority of water streams closest to the plant site are small-size headwater. Therefore, the plant site is exposed to no risk of flooding.

8.3.3 Landslides

The instability of the land is generally attributed to its topography and geology (Landry et Mercier, 1992). Landslides may occur in sloped terrains where soil materials offer insufficient resistance to shearing. This phenomenon depends on slope inclination and soil composition. Other factors of land instability, such as soil flows, are especially linked to specific soil types, composed of plastic or heterogeneous materials. Additionally, sectors that are banked with heterogeneous materials can be subject to land instability after collapse, significant settlements or subsidence.

There is a ravine just south-east of the plant site. However, the plant site lies on rocky outcrops or near the rock formation. The local study area, however, is characterized by stress zones related to small-scale or non-retrogressive landslides.

8.3.4 Exceptional Weather Conditions

Exceptional weather conditions can occur during the summer. These include abundant rain, hail, violent winds and tornadoes. In winter, these conditions can take the form of abundant snow falls, violent winds or sleet. Each of these phenomena is attributable to specific conditions associated with temperature gradients and humidity between discrete masses of air.

The consequences of these exceptional weather conditions can be direct or indirect. Specifically, wind, precipitation, snow and ice can cause overloading and therefore directly affect the integrity of buildings or equipment. In addition, these weather events can provoke power outages, floods, terrain instability or falling objects.

For the Saguenay area, Table 8.2 summarizes some climate data extracted from the National Building Code (2010) - such as hourly wind pressure, maximum precipitation level, and maximum overload due to snow and combined rain fall - that must be considered in the design of buildings. Building and plant equipment design shall comply with the relevant codes and regulations in order to withstand overloads due to extreme weather conditions.

Table 8.2 Climate Data from the National Building Code

Parameter	Saguenay
Hourly Wind Pressure (kPa) [1]	0.29/0.38
Precipitation 15 minutes (mm) [2]	18
Precipitation 24 hours (mm) [3]	86
Overload snow/rain combined (kPa) [4]	2.8

1. With an exceedance probability of 10% and 2%, respectively.
2. Likely to be exceeded on average once in 10 years.
3. Likely to be exceeded on average once in 50 years.
4. With an exceedance probability of one in 50 years.

8.3.5 Aerial Transport

The Saguenay-Bagotville regional airport, which is located a dozen kilometers southwest of the project site, is the main airport in the area. The Saguenay-Bagotville airport is used for both civil air transportation and military purposes.

The risks of aircraft crashes are higher in the landing and takeoff areas. Apart from these areas, which cover the immediate vicinity of the airport, accident risks are higher in the corridors used for air traffic. Overall, the probability of a crash at one specific location is very small (IATA, 2014).

The plant will be located outside the landing and takeoff areas of the Saguenay-Bagotville airport. Considering the remoteness of the regional airport, air transportation does not pose any specific external risk to the proposed plant.

The stacks of the plant will be marked, if deemed necessary by Transport Canada. The marking required depends on various factors such as the height of the structures, the nature of neighboring structures, the proximity of airports and route of the flight corridors.

8.3.6 Industrial Activities

Industrial activities performed in the project area are described in Section 8.2.2. The marine terminal handles materials that are mostly non-hazardous. An accident involving some hazardous materials handled in the port would not affect the new plant.

The other industrial facilities nearby the site are limited to Rio Tinto Alcan rail track, rail service and storage building. Only non-hazardous materials are stored or handled there. Therefore, they do not represent a risk for the new plant.

8.4 Hazard Identification

8.4.1 Description of Hazardous Materials

Pig iron manufacturing consists of the reduction of the iron oxides contained in the raw material (iron ore pellets), metallic iron, the removal of impurities (gangue) by adding a flux during the melting of the material and in casting the iron. Pig iron manufacturing is a three-stage process; pellet screening, producing reduced iron in a reactor and its melting

in an electric arc furnace, followed by casting. Section 3.3 provides a detailed description of the process.

Table 8.3 shows the main hazardous materials that will be present at the plant and Table 8.4 summarizes some of their physico-chemical properties. The material safety data sheets of the main hazardous materials were presented at Appendix K.1.

Table 8.3 Identification of the Main Hazardous Materials

Hazardous Material	Storage
Natural gas	No storage, transportation by pipeline
Diesel fuel	An outdoor 200 m^3 tank
Dimethyl disulfide (DMDS)	An outdoor 30 m^3 tank
Activated methyl diethanolamine (aMDEA)	The equivalent of 1 t in drums or totes inside a building
Silicate solution	A 20 m^3 indoor tank

Table 8.4 Properties of the Main Hazardous Materials

Property	Natural Gas	Diesel Fuel	DMDS	aMDEA	Silicate solution
Boiling point	-161.5 °C	150 – 370 °C	109 °C	247 °C	n.av
Relative gas/steam density	0.58 (light gas)	4.5 (heavy steam)	3.25 (heavy steam)	4.1 (heavy steam)	Low volatility
Relative liquid density	na	0.85	1.05	1.04	1.4
Vapor pressure (20°C)	na	1 kPa	3.l8 kPa	0.0005 kPa	na
Flammable limits	5 - 15 %	0.7 – 6 %	na	1.4 – 10 %	na
Main danger	Flammable gas	Flammable liquid	Liquid emitting toxic fumes	Liquid toxic to aquatic life	Liquid toxic to aquatic life

na: Not applicable n.av:Not available

8.4.1.1 Natural Gas

Natural gas will be used to provide reducing elements such as carbon monoxide and hydrogen. It will also be used as fuel in the preheating furnace and boiler. The annual consumption of natural gas for the operation of the plant will be about 135 million Nm^3. Natural gas will be transported to the site by a pipeline connected to the existing Gaz

Métro network and will not be stored on the site. The natural gas pipeline will have a diameter of 10 inches and will be operated at a pressure of about 10 bar (g).

Natural gas consists approximately of the following: 95% methane, 1.8% ethane, 0.7% carbon dioxide, 1.9% nitrogen and small amounts of light hydrocarbons (propane, butane, and pentane). It is odorless and colorless. However, an odorant is added as a precautionary measure to facilitate detection. Natural gas is flammable and explosive (explosive limits of 5% to 15%) if stored in a confined/congested area. It is not toxic but like all gases, it can cause asphyxia in high concentrations.

8.4.1.2 Diesel Fuel

Diesel fuel will be used to fuel heavy equipment and the emergency generator. Diesel used as equipment fuel will be stored in a tank with a capacity of about 200,000 liters, while the emergency generator will have its own 3,000-liter tanks. The 200,000-liter tank will be located in a retention dam that can hold 110% of the tank's volume. The supply/unloading area will also be a confined area. As for the smaller 3,000-liter tank, it will be fitted with a closed retention container. The diesel fuel will be delivered by tanker-trucks.

Diesel fuel, which is produced from the distillation of petroleum, is composed of various hydrocarbons in the C10 length and upwards. It has the appearance of a clear amber liquid. It is not highly volatile at room temperature, but can release vapors that form an explosive mixture with air (explosive limits of 0.6% and 7.4%) when heated. Diesel is less dense than water (specific gravity of about 0.85) and is insoluble in it.

8.4.1.3 Dimethyldisulphide

Dimethyldisulphide (DMDS) will be used to generate H_2S, which will be added to the make-up gas (maximum concentration of 25 ppmvd) upstream from the preheating furnace to protect the internal surfaces of the preheating furnace against corrosion. A small molybdenum and cobalt catalyst bed will convert the H_2S. Dimethyldisulphide will be stored at room temperature in a 30 m^3 external tank, with a retention basin that can hold 110% of the tank's capacity. It will be delivered to the mill once a year by a tanker-truck.

Dimethyldisulphide is a liquid that releases toxic fumes at room temperature. The vapors are mainly characterized by a very unpleasant odor and a very low odor detection threshold (approximately 8-10 ppb). The half-life of DMDS in the air is 1 to 4 hours. Dimethyldisulphide is flammable and insoluble in water.

8.4.1.4 Activated Methyldiethanolamine

Activated methyldiethanolamine will be used in the process as a 50% solution to extract, by absorption, the acid gases (CO_2 and H_2S) accumulated in the process gas. The aMDEA solution (about 3.5 tons/year) must be replaced periodically. Activated methyldiethanolamine will be stored in concentrated form in drums or totes (maximum of 5 to 10) in a building. The drums will be trucked to the site once a year.

Concentrate methyldiethanolamine is a slightly volatile liquid with a faint ammonia odor. Used as an aqueous solution it is not flammable. It is slightly toxic to the aquatic fauna and biodegrades quickly. The acid gas removal area will be surrounded by a dike in order to confine any spills of the methyldiethanolamine solution.

8.4.1.5 Silicate Solution

The silicate solution will be used for fine particle briquetting. A 20 m^3 tank will be used to store it. This tank will be located inside a building with a waterproof floor, with trenches and sumps to collect potential spills.

This solution consists of sodium silicate at a concentration varying from 30 to 40% (mass). It is characterized by a pH of 11 to 11.5. A spill would therefore represent a danger for aquatic life.

8.4.1.6 Hydraulic Fluid, Insulators and Lubricants

Hydraulic fluid, insulators (oil transformers), and lubricants will be used at the plant. Hydraulic fluid and lubricants will be used and stored inside the buildings. Each oil transformer will be installed above a retention basin equipped with a fire-proof bed made of crushed stone.

These oils, like diesel, are hydrocarbons. They are derived from the heaviest fraction of petroleum, however. They are therefore more viscous and their flashpoints are higher.

8.4.1.7 Liquid Waste Management

Waste oil collected by the oil separators or from various plant equipment, together with all other liquid waste that could be the source of an accidental spill, will be placed in drums stored safely and transported outside by an authorized firm.

8.4.1.8 Other Materials

Other raw materials intended for various purposes will also be used at the plant (see Table 3.1):

- Raw materials (limestone, dolomitic limestone, bauxite, cement, bentonite);
- Graphite electrodes, a Mo-Co catalyst and activated carbon;
- A foaming agent for the amine solution;
- Raw water or wastewater treatment materials (flocculants, coagulants, acids and bases, etc.);
- Materials for conditioning the water cooling tower and boiler (biocides, dechlorinating agents, oxygen scavengers, corrosion inhibitors, etc.).

Due to their physico-chemical characteristics and/or small quantities stored, these materials present little danger. The bulk raw materials are stored in silos, hoppers or in a tank as far as the silicate solution is concerned. The others will be stored in drums,

plastic containers or bags. They will be stored safely inside buildings and incompatible products will be separated from each other.

8.4.1.9 Process Gas

Process gas is present in the circuit between the reactor and the CO_2 removal unit. This process gas consists mainly of carbon monoxide (41-55%) which, in the event of a leak, can form a toxic cloud. This process gas can also form a flammable gas cloud in the event of a leak, due to the presence of compounds such as carbon monoxide (41-55%), methane (12-16%), ethane (0.2%), C3+ and hydrogen (traces).

8.4.1.10 Explosive Dusts

When dispersed in the air in high concentrations, easily oxidizable fine metal dusts pose a significant risk of explosion. Metals that are less easily oxidizable (iron, bronze, silicon, etc.) also pose a risk when in the form of very fine particles. When contained in enclosures, such dusts can cause explosions due to a rapid increase in pressure. The dust transportation pipe networks and dust collection systems are the main pieces of equipment that pose such a risk. The accumulation of fine dust on horizontal surfaces inside buildings is also a risk situation.

8.4.2 Transportation of Hazardous Materials

With the exception of inert materials that will be transported by ships, and natural gas that will be transported to the plant by pipelines, the products needed to operate the plant will be transported by trucks. Table 3.1 indicates the frequency of delivery.

The transportation of hazardous materials by road in Québec is subject to the *Regulation Respecting the Transportation of Dangerous Substances* of the Québec Ministry of Transport. This regulation is supported by the norms of the *Transportation of Dangerous Goods Regulation* of Transport Canada.

The Regulation applies to the handling and transportation of hazardous materials on the roads of Québec, from the point of manufacturing or distribution to the point of delivery or unloading.

Regulations on the transport of hazardous materials require carriers to:

› classify hazardous materials;

› use shipping documents during transportation;

› indicate dangers relating to materials being transported;

› respect certain security norms and regulations.

The chemicals necessary for the operation of the plant will be transported by road as specified by this regulation.

8.4.3 Accidentology

The technology used in this project is relatively new and there have been no major accidents in plants using it. The integrated gas reforming stage in the reactor (without a reformer), rather than being performed in a separate unit, helps make the process safer. In addition, this direct iron reduction technology produces a high carbon product which is more stable than conventional processes. This helps prevent the kinds of accidents that occurred in the past during shipping.

In the iron and steel industry, major accidents generally have consequences that are usually limited to the plant site, whether these accidents result in equipment damage, injury to employees and sometimes even death. Dust explosions, carbon monoxide poisoning, molten metal explosions and splashes, and fuel gas explosions have occurred before.

The cases below are examples of accidents in the iron and steel industry. The processes used were different from those planned for this project. However, the hazardous materials involved will be used in this project.

Carbon Monoxide Leakage

In Kremikovtzi, Bulgaria (January 2004), the failure of a pipe connected to a furnace released a flammable and toxic process gas due to the presence of carbon monoxide. The accident resulted in three fatalities among workers and firefighters, in addition to poisoning 22 people at varying degrees. A similar accident occurred in Redcar in the UK (1999), with no casualties and in Bhilai, India (2014) where there were 6 victims.

Dust explosion - Elkem Metal Canada, City of Saguenay (1992)

When casting molten metal in a ladle, some explosive gases were trapped by the crust that formed on the metal in that ladle because of the moisture in the refractory. When the ladle was emptied into a mold, the trapped gases were released and formed an explosive mixture when they reached a sufficient concentration in ambient air. This mixture ignited probably as a result of the energy released by the molten metal. The first explosion shook the dust accumulated on surfaces nearby. A ferrosilicon dust cloud formed while the ambient air was still extremely hot after the first explosion. As soon as the dust concentrations were sufficient enough in the presence of intense heat, a second explosion occurred. A worker died in the accident.

The following accidents are other examples of iron dust explosions:

› Hoeganaes Corporation in Gallatin, USA (2011).
› Domfer Metal Powders in Lasalle (1990).

Explosion of a water/molten metal mixture

This type of accident occurs occasionally during casting (presence of water in the equipment) or melting in an electric furnace (failure of the water cooling system). The places where these accidents occurred include the following:

› Imphy in France (2013).
› Zenica in Bosnia-Herzegovina (2008).
› La Louviere in Belgium (2008).

8.5 Assessment of the Consequences of the Alternative and Standardized Scenarios

This section focuses on the potential consequences of an accident based on the scenarios required in the MDDELCC's methodological guide for technological risk analysis.

8.5.1 Methodology

8.5.1.1 Threshold Levels

The methodological guides for analyzing technological risks (MENV, 2002; CRAIM, 2007) include lists of hazardous substances and threshold levels to determine whether accident scenarios are to be analyzed. Natural gas is the only one of the hazardous materials at the plant that indirectly appears on the lists contained in these guides, as it consists mainly of methane. However, since no natural gas will be stored on the site, the threshold quantity of 4.5 tonnes specified in the lists will not be exceeded.

8.5.1.2 Hazardous Materials Selected for a Consequence Assessment

Since there are no hazardous materials exceeding the threshold quantities, the quantitative consequences assessment only covers materials that could be involved in an accident with off-site consequences. These materials are natural gas, diesel fuel and dimethyl disulfide. Accident scenarios have been established and assessed for each substance by considering the equipment presented in the previous sections.

Considering the small amounts present or their low hazard potential, the other hazardous materials have not been subject to a quantitative consequences assessment of a potential accident.

8.5.1.3 Model

The physical consequences of the accident scenarios were simulated with version 7.11 of the PHAST (Process Hazards Analysis Software Tools) software from the company DNV-GL (2014). DNV-GL is a global leader in the field of risk safety, environmental assessment and accident consequence calculations.

PHAST is integrated software used for the analysis of technological accident consequences using the following models:

› liquid, gaseous and biphasic discharges;
› jet and aerosol models;
› Gaussian dispersion, heavy and hybrid gases;
› pool formation and evaporation;
› thermal radiation for various types of fires

The physico-chemical and thermodynamic properties of the products are included in PHAST and were taken from the DIPPR (Design Institute for Physical Property) databank of the American Institute of Chemical Engineering.

8.5.1.4 Effects Thresholds

Effects thresholds are levels at which effects could be observed in persons exposed or on nearby structures. The thresholds used in this analysis to assess potential effects match the values recommended in the following references:

› Ministry of the Environment, 2002. Guide - Analysis of the Risks of Major Technological Accidents. Environmental Assessment Directorate, Ministry of the Environment (now MDDELCC).
› CRAIM (Council for the Reduction of Major Industrial Accidents), 2013. Reference values for effect thresholds to determine areas for planning emergency measures and land use planning.
› MEDD (Ministry of Ecology and Sustainable Development), 2004. Technical Guide to the Reference Values for the Thresholds Effects of Accidental Phenomena in Classified Installations. October 2004 Version, France.
› MEEDDM (Ministry of Ecology, Energy, Sustainable Development and the Sea), 2010. Acute Toxicity Threshold - Dimethyl Disulfide (DMDS). MEEDM Toxicologists Panel, France.

The areas associated with potential effects on life were assessed against the threshold levels indicated in Table 8.5. These thresholds represent a low probability of death, except for the lower flammable limit. As for the thresholds used for assessing the potential health effects radius, they are presented in Table 8.6.

Table 8.5 Thresholds Used to Evaluate Impact Zones Related to Fatality Risk

Event	Threshold	Definition
Pool fire and jet fire (thermal radiation)	13 kW/m^2 *	This threshold can result in death after a 30-second exposure. Second-degree burns start after a 10-second exposure.
Flash fire	LFL (lower flammable limit)	It is usually assumed that all persons caught in the flash fire may die. Half of the LFL is often used as a safety factor due to the limited accuracy of the dispersion models and the possible formation of gas flashes.
Explosion (overpressure)	13.8 kPa *	Threshold of lethal effects around the areas of serious hazards to human life. This threshold can cause considerable damage to houses. Deaths are caused by indirect effects, i.e. falling objects and the partial collapse of walls and roofs. The threshold for individuals outside is higher and corresponds to direct impact deaths (50% fatality at 50 kPa).
Toxicity	ERPG3 *	Maximum concentration below which nearly all individuals could be exposed up to one hour without experiencing or developing effects on their health that could be life- threatening.
	AEGL3 *	Concentration above which potentially lethal effects or deaths could occur in the general population, including susceptible individuals
	SELS	Significant Lethal Effects Threshold: airborne concentration, for a given exposure duration, above which 5% mortality can be observed in the exposed population
	SPEL	First Lethal Effects Threshold: airborne concentration, for a given exposure duration, above which 1% mortality can be observed in the exposed population.

* Criterion recommended in the MDDELCC guide

Table 8.6 Thresholds Used to Assess Potential Effects on Health

Event	Threshold	Definition
Pool fire and jet fire (thermal radiation)	5 kW/m^2 *	This threshold corresponds to possible second-degree burns after a 40-second exposure.
	3 kW/m^2	This threshold corresponds to injuries with irreversible effects.
Explosion (overpressure)	6,9 kPa *	Threshold for irreversible injuries caused by structural damage, including broken glass or falling debris.
	2 kPa	Threshold for minor injuries caused by breaking glass.
Toxicity	AEGL2 *	Concentration above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects
	ERPG2 *	Maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action
	ERPG1	Maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient health effects or perceiving a clearly defined objectionable odor
	SEI	Irreversible Effects Threshold: concentration, for a given exposure duration, above which the exposed population could experience irreversible effects.
	SER	Reversible Effects Threshold: concentration, for a given exposure duration, above which the exposed population could experience reversible effects.

* Criterion recommended in the MDDELCC guide

Steady heat fluxes were used with respect to jet and pool fires. The first fatalities may occur with a flux 13 kW/m^2 for 30 seconds, while irreversible injuries are defined with thresholds of 5 and 3 kW/m^2.

In a flash fire, the flame propagates at subsonic speed, so that damage caused by overpressure is generally negligible and most of the damage is caused by thermal radiation. Thermal radiation generated is very high for a short period, typically 3 seconds. Deaths occur by inhalation of hot gases or exposure to thermal radiation.

The effect of overpressures differs depending on the degree of protection offered by the absence or presence of buildings. For individuals inside the buildings, the effects are indirectly due to structural collapse, falling objects and flying debris/windows. For individuals outside and away from buildings or structures, the direct effect may take the form of pulmonary hemorrhage, ruptured eardrums, etc. The first fatalities caused by indirect effects are defined with a threshold of 13.8 kPa, while the irreversible injuries are defined with overpressures of 6.9 to 2 kPa.

Regarding DMDS toxicity, the thresholds selected correspond to Emergency Response Planning Guidelines (ERPG) values developed by the American Industrial Hygienist

Association (AIHA). These values, which are set for a 60-minute exposure, are as follows:

- ERPG3: 250 ppm;
- ERPG2: 50 ppm;
- ERPG1: 0.01 ppm (corresponds to the odor detection threshold).

The DMDS toxicity thresholds defined by MEEDDM (2010) were also used. These are specified in Table 8.7 for different exposure duration. It should be noted that there is no AEGLs values for this compound.

Table 8.7 DMDS Toxicity Thresholds Defined by MEEDDM

Exposure Time	Concentration (ppm)			
(min)	SELS	SPEL	SEI	SER
10	11 547	10 136	165	55
30	2 282	2 004	114	38
60	821	720	91	30
120	295	259	72	24

With respect to the toxicity of carbon monoxide, the thresholds used correspond to the AEGL (Acute Exposure Guideline Levels) values developed by the United States EPA (Environmental Protection Agency). AEGL values for carbon monoxide are summarized in Table 8.8. Since there is no AEGL1 value for carbon monoxide, the ERPG1 value was used instead.

Table 8.8 Carbon Monoxide Toxicity Thresholds Defined by AEGL and ERPG Values

Exposure Time	Concentration (ppm)		
(min)	AEGL3	AEGL2	ERPG1
10	1 700	420	na
30	600	150	na
60	330	83	200 ppm
240	150	33	na

The thresholds defining areas of potential domino effects and material damage that have been selected are those defined by the MEDD. These criteria are presented in Table 8.9.

Table 8.9 Thresholds Used for Domino Effects and Material Damage

Type of Effect	Threshold	Definition
Pool fire and fire jet (thermal radiation)	5 kW/m^2	Threshold of significant destruction of windows for prolonged exposure.
	8 kW/m^2	Threshold of domino effects.
	16 kW/m^2	Threshold for prolonged exposure of structures corresponding to the threshold of very serious damage on structures, except concrete structure.
Explosion (overpressure)	2 kPa	Threshold of significant destruction of glass.
	14 kPa	Threshold of serious damage on structures.
	20 kPa	Threshold of domino effects.

8.5.1.5 Weather Conditions

Simulations were performed using the following three weather conditions:

› Low wind speed of 1.5 m/s and a very stable atmosphere (Category F);
› Average wind speed of 3.5 m/s and a neutral atmosphere (Category D);
› Strong wind speed of 6.0 m/s and a neutral atmosphere (Class D).

The consequences of certain events such as jet fire or an explosion depend little on weather conditions. For these, the results are shown for the most limiting conditions.

8.5.2 Worst-Case Scenarios

A worst-case scenario is defined as the greatest release of a hazardous material with the greatest impact distance. These scenarios take management controls and passive protection systems into account, but not active protection systems, that is, systems that require mechanical or human intervention. According to the technological risk analysis guides, this definition applies to either a vessel (CRAIM, 2007; EPA, 1999), or to a group of interconnected vessels or vessels located in the impact zone of other vessels (MENV, 2002). Appendix K.2 shows the hypotheses used to evaluate the selected scenarios.

8.5.2.1 Natural Gas

The standardized scenario for natural gas involves a complete breakage of the natural gas supply pipeline, followed by immediate ignition which generates a jet fire. The pipe breakage is assumed to have occurred in its above-ground part after the metering station on the plant site.

This scenario would have immediate maximum impacts right after the breakage, but these would decrease rapidly due to rapid depressurization in the pipe at the breakage point. For this reason, the results summarized in Table 8.10 are presented for two different periods. The results also shown in Map 8.1 show that the potential

consequences would reach a maximum radius of 93 m for life effects and 144 m for health effects. In the event of a delayed ignition of the flammable gas cloud formed by the pipe breakage, a flash fire could occur up to a maximum radius of 100 m based on the LFL and 170 m based on half the LFL.

Table 8.10 Maximum Impact Distances under the Worst-Case Scenario Involving Natural Gas

Period	Effects on Life and Health			Material Damage and Domino Effects		
	13 kW/m^2 (life)	5 kW/m^2 (health)	3 kW/m^2 (health)	16 kW/m^2 (major damage)	8 kW/m^2 (domino effects)	5 kW/m^2 (minor damage)
During the first 10 seconds	93 m	123 m	144 m	88 m	107 m	123 m
After 10 seconds	47 m	60 m	69 m	44 m	53 m	60 m

* The consequences depend hardly on weather conditions. Results are reported for the most severe conditions.

8.5.2.2 Diesel Fuel

The standardized scenario for diesel fuel involves the largest tank losing its contents (200,000 liters) in 10 minutes and that pool formed by the leak ignites. The retention basin, which is a passive protection measure, is taken into account in this scenario.

The results are summarized in Table 8.11 and shown in Map 8.2. They show that the potential consequences would not exceed the boundaries of the site and would not affect the other critical areas of the plant. Diesel is not volatile enough to generate a flash fire.

Table 8.11 Maximum Effects Radius for the Diesel-Related Standardized Scenario

Weather Conditions	Effects on Life and Health			Material Damage and Domino Effects		
	13 kW/m^2 (life)	5 kW/m^2 (health)	3 kW/m^2 (health)	16 kW/m^2 (major damage)	8 kW/m^2 (domino effects)	5 kW/m^2 (minor damage)
Wind: 1.5 m/s Stability: F	16 m	32 m	41 m	13 m	25 m	32 m
Wind: 6 m/s Stability: D	21 m	38 m	45 m	16 m	32 m	38 m

8.5.2.3 Dimethyldisulphide

The standardized scenario for DMDS involves the full tank losing its contents (30,000 liters) in 10 minutes and that DMDS evaporates for 60 minutes from the pool and forms a toxic gas cloud. The retention basin is taken into account in this scenario as a passive protection measure.

The results shown in Table 8.12 and in Map 8.2 reflect the fact that DMDS is slightly toxic, but has a very low odor detection threshold. Thus, reversible effects defined by the SER criterion could occur up to a maximum distance of 451 m downwind. By contrast, the odor defined by the ERPG1 criterion could be felt over a very long distance downwind.

Table 8.12 Maximum Effects Radius for the Standardized Scenario Associated with the DMDS

Weather Conditions	Effects on Life			Effects on Health			
	ERPG3	SELS (1)	SPEL (1)	ERPG2	ERPG1	SEI (1)	SER (1)
Wind: 1.5 m/s Stability: F Temperature: 25ºC	78 m	24 m	27 m	309 m	≈ 50 km (2)	192 m	451 m

(1) Criterion for a 60-minute exposure
(2) Does not include the decomposition of the DMDS in the air (maximum half-life of 4 hours)

8.5.3 Alternative Scenarios

Alternative scenarios are plausible accidents, although their probability of occurrence can be low. These scenarios may take into account the active protection measures that have been implemented. Appendix K.2 presents the assumptions used for the evaluation of the selected scenarios.

8.5.3.1 Natural Gas

The first alternative scenario considered is a loss of natural gas from the feed line, followed by an immediate ignition which generates a jet fire. The scenario is similar to the standardized scenario, but considers a leak of an equivalent diameter of 50 mm (20% of the diameter of the feed line) rather than a less likely scenario of a complete breakage of the pipe. The leak pipe breakage is assumed to have occurred in its above-ground part after the metering station on the plant site.

The results show that the potential life effects would not be felt beyond a radius 26 m while the health effects would not be felt beyond 34 m (Table 8.13). In the event of a delayed ignition of the flammable gas cloud formed by the leak, a flash fire could occur up to a maximum radius of 17 m based on the LFT and 41 m based on half of the LFT.

Table 8.13 Maximum Effects Radius for a Natural Gas Leak Followed by a Jet Fire

Effects on Life and Health			Material Damage and Domino Effects		
13 kW/m^2 (life)	5 kW/m^2 (health)	3 kW/m^2 (health)	16 kW/m^2 (major damage)	8 kW/m^2 (domino effects)	5 kW/m^2 (minor damage)
26 m	31 m	34 m	24 m	28 m	31 m

* The consequences depend hardly on weather conditions. Results are reported for the most severe conditions.

The second alternative scenario assessed consists in a natural gas explosion following a major natural gas leak. As an upper bound approach, the scenario assumes a breakage in the above ground feed line, followed by the formation of a flammable cloud whose entire portion between the flammability limits is in a congested area of the plant.

As shown in Table 8.14, the potential consequences would not exceed a 51 m radius for the life effects and a 357 m radius for the health effects.

Table 8.14 Maximum Effects Radius for a Major Natural Gas Leak Followed by an Explosion

Effects on Life and Health			Material Damage and Domino Effects		
13 kPa (life)	6.9 kPa (health)	2 kPa (health)	20 kPa (domino effects)	14 kPa (major damage)	2 kPa (minor damage)
51 m	101 m	357 m	30 m	46 m	357 m

* The consequences depend hardly on weather conditions. Results are reported for the most severe conditions.

8.5.3.2 Dimethyldisulphide

The alternative scenario for DMDS is the same as the standardized scenario, but is assessed under different weather conditions. These conditions consist in an average wind speed and neutral atmospheric stability, which are most frequently observed than the requirements for the standardized scenario, or a colder ambient temperature of 0°C compared with a temperature of 25°C for the standardized scenario.

The results summarized in Table 8.15 show the wind effect conditions that are the most favorable to dispersion and an ambient temperature that is less favorable to evaporation. Under these conditions, reversible effects defined by the SER criterion could occur up to a maximum distance of 241 m downstream of the wind and smell defined by the ERPG1 criterion could be perceptible up to a 24 km radius.

Table 8.15 Maximum Effects Radius for a Major DMDS Leak

Weather Conditions	Effects on Life			Effects on Health			
	ERPG3	SELS (1)	SPEL (1)	ERPG2	ERPG1	SEI (1)	SER (1)
Wind: 3.5 m/s Stability: D Temperature: 25°C	44 m	20 m	22 m	114 m	13 km (2)	80 m	156 m
Wind: 3.5 m/s Stability: D Temperature: 0°C	21 m	14 m	16 m	56 m	5,1 km (2)	39 m	74 m
Wind: 1.5 m/s Stability: F Temperature: 0°C	49 m	15 m	17 m	170 m	24 km (2)	108 m	241 m

(1) Criterion for a 60-minute exposure
(2) Does not include the decomposition of the DMDS in the air (maximum half-life of 4 hours)

8.5.3.3 Process Gas

The scenario considered is that of a process gas leak from a process pipe. In the absence of precise information on the sizes of the process gas circuit pipes at this stage of the project, the diameter of the leak has been set at 50 mm. The duration of the leak has been limited to 10 minutes, assuming that the speed later slows down due to the depressurization process. The consequences were assessed from the point of view of carbon monoxide toxicity (no ignition and formation of a toxic cloud) and the flammability of the process gas (ignition and formation of a jet fire).

The results are summarized in Tables 8.16 and 8.17. The consequences of this scenario are limited mainly to the plant site, which is essentially a risk for employees.

Table 8.16 Maximum Effects Radius for a Major Process Gas Leak (CO Toxicity)

Weather Conditions	Effects on Life	Effects on Health	
	AEGL3 (1)	AEGL2 (1)	ERPG1
Wind: 1.5 m/s Stability: F	47 m	67 m	80 m
Wind: 6 m/s Stability: D	60 m	122 m	172 m

(1) Criterion for a 10-minute exposure

Table 8.17 Maximum Effects Radius for a Major Process Gas Leak (Mixture Flammability)

Effects on Life and Health			Material Damage and Domino Effects		
13 kW/m² (life)	5 kW/m² (health)	3 kW/m² (health)	16 kW/m² (major damage)	8 kW/m² (domino effects)	5 kW/m² (minor damage)
14 m	20 m	22 m	Not reached	18 m	20 m

* The consequences depend hardly on weather conditions. Results are reported for the most severe conditions.

8.5.4 Scenarios Not Assessed Quantitatively

8.5.4.1 Dust Explosion

Metal dust, including iron dust, could cause explosion under certain conditions. Metal iron dust explosions are potentially less harmful than explosions involving other types of dust. Thus, the maximum explosion pressure (P_{max}), one of the parameters used to characterize the danger potential of an explosion, is about 5 for iron dust, about 11 for aluminum dust and about 10 grain or wood dust (Eckhoff, 2003; NFPA 68). As for the pressure rise rate (K_{st}), another parameter that characterizes an explosion, it shows that iron dust ranks in the least dangerous category.

The potential consequences of such an explosion have not been assessed because they do not have a very large range and would be limited to the plant site. Plant workers would be most exposed in the event of this kind of accident.

Prevention and protection measures will be implemented: maintenance of premises to avoid dust deposits on horizontal surfaces inside buildings and installation of vents that prevent the equipment from bursting and will help direct the blast to a safe location.

8.5.4.2 Explosion in the Process Gas Boiler or Preheating Furnace

A small ancillary boiler with a heat capacity of 3.7 MW will be used to produce steam. The process also includes a preheater to increase the temperature of the process gas before it enters the reactor. Both pieces of equipment use natural gas as an energy source.

Accidental accumulation of natural gas in the combustion chamber followed by a delayed ignition could cause an explosion. This can occur, for example, in the event of a malfunction of the burners or bad startup of the procedure. This accident scenario would have limited consequences at the plant site considering the small size of the equipment.

8.5.4.3 Water/Molten Metal Explosion

An accidental contact of water and molten metal can cause steam explosions, which is a purely physical phenomenon resulting from the vaporization of water, with splashes of molten metal and a volume expansion creating a pressure wave. The plant's workers are the ones exposed to the consequences of this type of accident. Operating procedures

such as the heating and drying of the casting ladles will help avoid the presence of water during melting and casting.

8.5.4.4 Spills

A spill of oil or liquid chemical present in significant quantities (methydiethanolamine, DMDS, silicate solution, diesel, insulating transformer oil, etc.) that would reach the local water network could affect aquatic life. Various measures are in place to capture any potential spill: retention basin for tanks and unloading areas, contained CO_2 removal area, internal storage on impermeable surfaces for products stored in small containers. In addition, the entire site is drained towards the sewage holding tank that can be closed in an emergency, thus forming a secondary barrier.

8.5.5 Summary of Potential Consequences

8.5.5.1 Potential Effects on the Population

The human population lives too far away to be affected by an accident involving a flammable material. With respect to a major DMDS leak scenario, the nearest residences are located beyond the maximum distance defined by the SER criterion (reversible effects threshold), but within the maximum distance defined by the ERPG1 criterion which is defined in accordance with the odor threshold. Residents downwind would, therefore, not be subject to toxic concentrations, but would be exposed to a strong, unpleasant odor.

8.5.5.2 Potential Effects on the Employees of other Nearby Industries

Like with the population, the employees of the marine terminal are too far away to experience effects other than a strong unpleasant odor, in the event of a DMDS leakage.

In the event of major accidents involving natural gas, DMDS or process gas, employees of the nearby rail services and network could be evacuated. In addition, the Marcel-Dionne Road could be temporarily closed.

8.5.5.3 Potential Domino Effects

There is no external domino effect since port activities are too far away from the site and that only non-hazardous materials pass through the railway service and the railway track.

Potential internal domino effects are an explosion that could affect the integrity of the diesel tank, the DMDS tank or the process gas circuit. Potential domino effects would not result in consequences more severe than those described in the previous sections.

8.6 Protection and Prevention Measures

To ensure people and places are safe during the operation of the plant, the equipment and construction of the facilities will be designed in compliance with applicable laws,

regulations and codes. In addition, preventive or protective equipment will be put in place in order to eliminate or reduce the risk of accidents.

8.6.1 Identification of Applicable Laws and Regulations

The following laws, regulations and codes govern accident prevention and emergency measures.

Canada

- Transportation of Dangerous Goods Act:
  - Transportation of Dangerous Goods Regulations.
- Hazardous Products Act:
  - Controlled Products Regulation.
- Hazardous Materials Information Review Act:
  - Hazardous Materials Information Review Regulation

Quebec

- Civil Protection Act;
- Planning and Development Act and Draft Law on sustainable land and urban planning;
- Building Act:
  - Construction Code;
  - Safety Code.
- Occupational Health and Safety Act:
  - Safety Code for construction works;
  - Health and Safety Regulations;
  - Regulation Respecting Industrial and Commercial Establishments;
  - Regulation Respecting Information on Controlled Products;
  - Regulation Respecting the Application of the Building Code.
- Pressure Equipment Act:
  - Pressure Equipment Regulation.
- Environmental Quality Act:
  - Regulations Respecting Hazardous Materials.
- Petroleum Products Act:
  - Regulation Respecting Petroleum Products.
- Highway Safety Code:
  - Transportation of Dangerous Goods Regulations.

Municipality and RCM

- Civil Protection Plan of the City of Saguenay;
- RCM Development Plan.

Codes (the latest versions are in force)

- American Petroleum Institute:
  - Management of process hazards;
  - Welded steel tanks for oil storage;
  - Management of Hazards Associated with Location of Process Plant Buildings.
- Canadian Standards Association (CSA):
  - Boiler, Pressure Vessel and Pressure Piping Code;
  - Natural gas and propane installation code;
  - Occupational health and safety management;
  - Planning of emergency measures and response;
  - Emergency and continuity measures management programs.
- The National Fire Code of Canada (NFC);
- The National Building Code of Canada (NBC);
- The Quebec Electrical Code;
- Hydro-Québec:
  - Protection of substations and power plants against fire, accidental oil spills and oil leaks from transformers and inductors.
- National Fire Protection Association (NFPA):
  - Boiler and combustion systems hazards code;
  - Flammable and combustible liquid code;
  - Standard for Emergency and Standby Power Systems;
  - Standard on explosion protection by deflagration venting.
- Occupational Safety and Health Administration (OSHA):
  - Process safety management of highly hazardous chemicals.

8.6.2 Protection and Prevention Equipment

The main protective pieces of equipment to be put in place in order to eliminate or mitigate the risk of accidents are as follows:

General – Entire Plant

- Automated equipment for fire protection such as alarms, fire detectors, sprinklers and fixed mechanisms for fire extinguishment;
- Emergency generator with a diesel tank;

- Alarm system;
- Carbon monoxide detectors;
- Lightning conductors and marking of tall structures (if required);
- The melting and casting area will be designed to minimize human intervention and thereby risks of burns to workers, thanks to a high level of control and automation (*No-workers-on-the-floor* concept).

Storage Tanks (DMDS, diesel fuel)

- Retention Basin, with a capacity equivalent to 110% of the tank;
- Drainage of rain water into a sump with a valve in normal closed position;
- High level detector.

Storage tanks (silicate solution)

- Tank in a building with a waterproof floor with trenches and sumps to capture potential spills;
- High level detector.

Unloading areas (diesel fuel, DMDS, silicate solution)

- Impermeable surface with drainage towards a retention basin with a valve in normal closed position.

Other type of storage (bagged raw materials, drums, plastic containers)

- Safe storage inside the chemicals building (waterproof floor, segregation).

Natural Gas Feed Line

- Emergency stop valve at the entrance of the plant (remotely and manually operated)

Process units

- Process areas exposed to adverse weather conditions with drainage towards the oil separator and the storm water retention basin;
- Retention dike for the CO_2 removal area where amine is present;
- Automatic emergency shutdown valves at various points of the process;
- Flare for emergency process gas evacuation;
- Electrical equipment suitable for explosive atmospheres for high-risk locations;
- Redundancy of critical measurement and control systems.

Boiler

› Flame detectors in the combustion room connected to the fuel supply stop valve.

Oil transformers

› Retention Basins (110%) with fire breakers, equipped with valves in normal closed position.

Sectors or equipment with a risk of dust explosion

› Blast vents on high risk equipment;
› Maintenance of premises to avoid dust deposits on horizontal surfaces.

8.7 Risk Management Plan

In order to ensure worker, population and environmental safety during the plant operation activities, a risk management plan will be elaborated for those risks that cannot be eliminated using the anticipated protection measures. The main characteristics of this program are as follows:

1) Adoption of a health, safety and environmental protection policy;
2) Adherence to the social responsibility principles set out in ISO Standard 26000;
3) Establishment of a health and safety management;
4) Establishment of an environmental management system;
5) Allocation of human and material resources for the implementation and management of the program;
6) Environmental surveillance during construction and operation of the plant;
7) Development of safe operating procedures, including continuous monitoring of the processes by qualified technicians in the control room 24/7;
8) Implementation of an equipment maintenance program and a periodic inspection program, including a pre-start-up review;
9) Documentation and updating of information related to:
   - The hazards associated with operations activities, chemicals and technology used;
   - The design of equipment and their modifications;
   - The operating procedures, the normal operating conditions and the safety systems in place;
   - The electrical systems plan, instrumentation, etc.

10) Visual identification system for stored chemicals, piping as well as connections in loading and unloading areas;

11) Safety training given to all employees. This training will focus on the following key elements:

- Plant operation and organization;
- Risks inherent to the plant;
- Safe working methods;
- Personal protection available to workers.

12) Interventions by external services (delivery and maintenance service) subject to specific authorization. The person in charge shall ensure that safety instructions, among other things, are understood and respected, and that truck loading and unloading are monitored;

13) Take action to control activities carried out by contractors working at the plant:

- Knowledge of safety rules
- Competency verification (contractors accredited and familiar with all relevant codes)
- Inspection of work performed

14) Development of an emergency measures plan (see preliminary version in Appendix K.3). The final version of this plan will include the results of the risk analysis. In addition, the City of Saguenay, Quebec Public Security, the Quebec Ministry of Environment, the industries established in the vicinity of the proposed plant as well as the other public or private organizations that are possibly concerned will be consulted during the course of preparation of the final version of plan. This plan will be aligned with other existing emergency plans. The following measures will be applied:

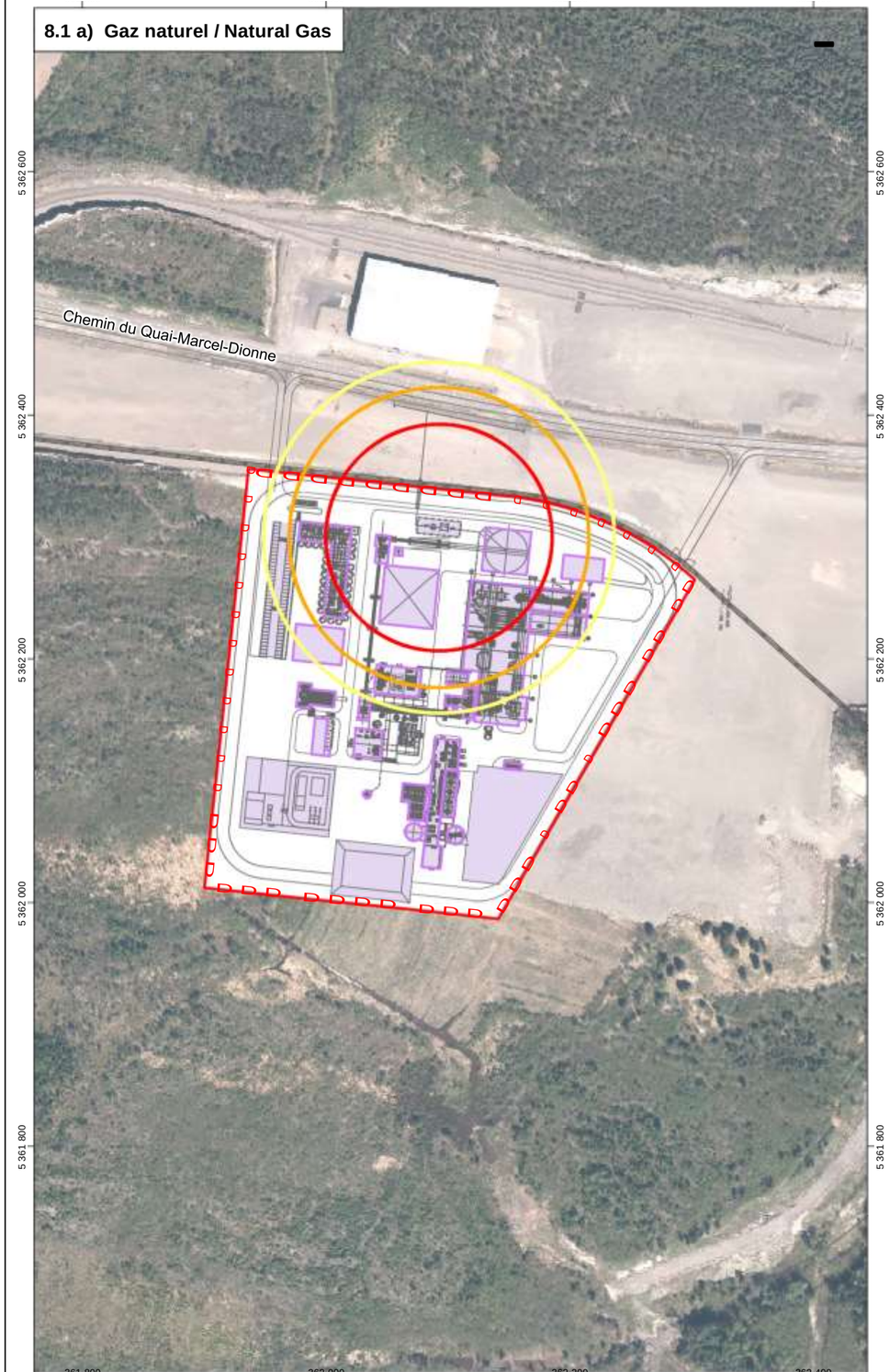
- an emergency measures plan coordinator will be identified
- an emergency brigade equipped with modern equipment that will be operating 24/7;
- intervention plan-related training in case of an emergency at the cogeneration will be offered to each employee;
- the personnel will be trained to use the fire extinguishers and first aid material;
- the evacuation plan and safety precautions will be clearly posted in the work areas;
- First-aid worker will be present within each work team.

15) Safe storage of chemicals;

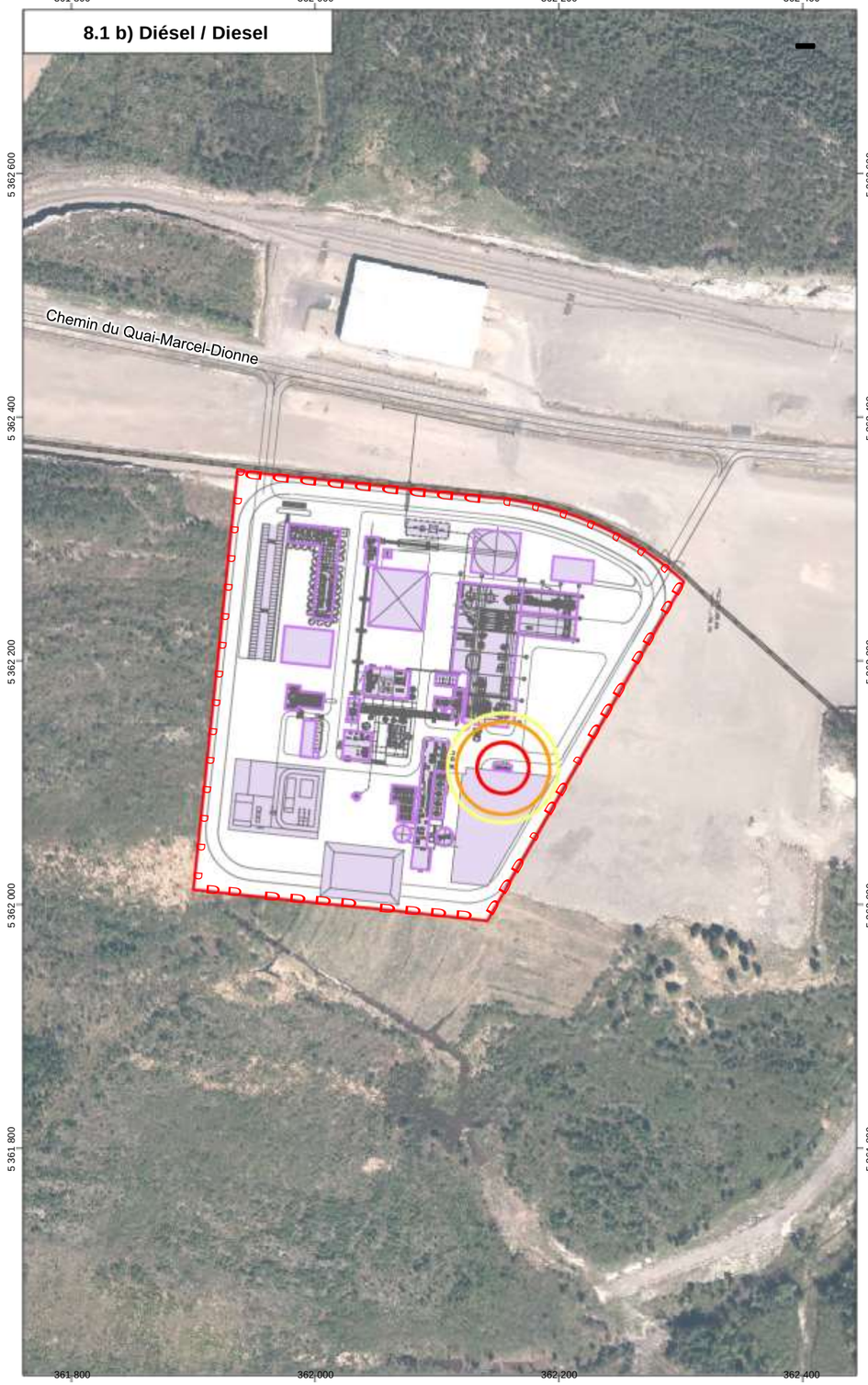
16) Sampling program in the work environment;

17) Accident and incident inquiries to determine their causes and implement corrective measures;
18) Internal and external verification of compliance to the safety management system;
19) Rigorous procedures for change management.

8.1 a) Gaz naturel / Natural Gas



8.1 b) Diésel / Diesel



Composantes du projet
Project Components

Aire de projet / Project Area

Distances maximales des radiations thermiques
Maximum Distances of Thermal Radiations

Effets sur la vie / Effects on Life
13 kW/m^2 - 93 m

Effets sur la santé / Health Effect
5 kW/m^2 - 123 m

Effets sur la santé / Health Effect
3 kW/m^2 - 144 m

NAIC

SNC·LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Carte 8.1 / Map 8.1

Distances maximales des radiations thermiques
Worst Case Scenario - Thermal Radiations

Sources :
Dessin CAD3786-TARG-X-LY-000-003 REDESIGN ALTERNATIVA II.dwg, Tenova, 2016
Ville de Saguenay, imagerie 2015

Projet / Project : 634451

Projection MTM, fuseau 7, NAD83

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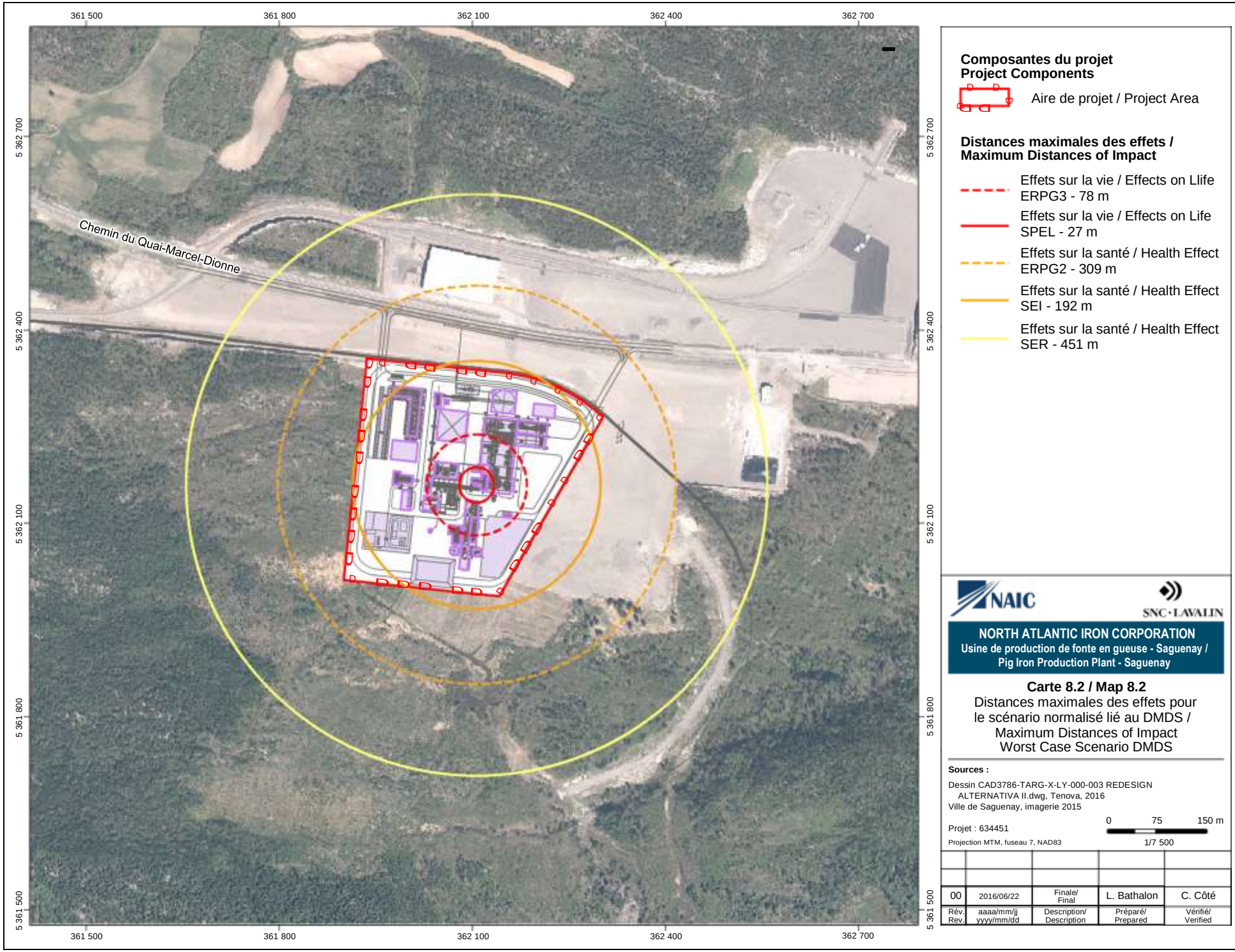

Composantes du projet
Project Components

Aire de projet / Project Area

Distances maximales des effets /
Maximum Distances of Impact

- Effets sur la vie / Effects on Llife ERPG3 - 78 m
- Effets sur la vie / Effects on Life SPEL - 27 m
- Effets sur la santé / Health Effect ERPG2 - 309 m
- Effets sur la santé / Health Effect SEI - 192 m
- Effets sur la santé / Health Effect SER - 451 m

NAIC

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NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Carte 8.2 / Map 8.2

Distances maximales des effets pour le scénario normalisé lié au DMDS /
Maximum Distances of Impact Worst Case Scenario DMDS

Sources :

Dessin CAD3786-TARG-X-LY-000-003 REDESIGN ALTERNATIVA II.dwg, Tenova, 2016
Ville de Saguenay, imagerie 2015

Projet : 634451

Projection MTM, fuseau 7, NAD83

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Chapter 9

Environmental Monitoring and Follow-up Program

Table of Contents

9		Environmental Monitoring and Follow-up Program	2
9.1		Emissions Monitoring Program During Construction	2
9.2		Emissions Monitoring Program – Operation Phase	3
	9.2.1	Atmospheric Emissions	3
	9.2.2	Consumption and Discharge of Water	6
	9.2.3	Solid and Semi-Solid Hazardous Waste	7
9.3		Environmental Monitoring – Operation Phase	9
	9.3.1	Ambient Air Quality	9
	9.3.2	Noise	9
	9.3.3	Groundwater	9
9.4		Reporting and Delivery of Results	10

List of Tables

Table 9.1	Measurement and Sampling of the Final Effluent (No. 3)	7

9 Environmental Monitoring and Follow-up Program

An environment and emissions monitoring program will be developed to ensure that the environmental protection measures planned for the construction and operation of the new facilities are applied.

The monitoring requirements to be applied include, but are not limited to, the following:

- Requirements specified in applicable laws and regulations;
- Applicable conditions set by Government Decree;
- NAIC's commitments and requirements stipulated in environmental permits issued by the MDDELCC;
- NAIC’s corporate requirements;
- Environmental impact mitigation measures proposed in the Impact Study.

An Environmental Management Program for the construction phase including all these elements will be developed and submitted as an appendix of the initial plant construction application.

The request for the certificate of authorization for the plant operation will include the monitoring program and all commitments and follow-ups to be made during the operation.

9.1 Emissions Monitoring Program During Construction

The Environmental Management Plan (EMP) will be included in the construction contractual documents. The mitigation measures provided for in the impact study will be included in the EMP and implemented.

The constructor will be responsible for work supervision during the construction period. The purpose of environmental monitoring is to make certain that concerns with respect to the following are taken into account during the construction of the new facilities:

- Conformity with drawings and specifications, particularly with regard to the implementation and effectiveness of mitigation measures;
- Construction noise level;
- Discharges (dust emissions, non-hazardous and hazardous waste) associated with construction activities;
- Control and treatment of site run-off water;
- Protection of water streams;
- Management of excavated soil;
- Protection against accidental spills;
- Management of fuel and hazardous materials;
- Proper operation of sanitary facilities.

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Any incidents or accidents that could have an impact on the environment will immediately be reported to the competent authorities. The constructor will also put in place for the employees from the beginning of the project, an environmental protection awareness program that must be applied.

The objectives of the MDDELCC and the applicable municipal regulations for noise emitted from a construction site will be incorporated into the project specifications. If exceedances of noise criteria cannot be avoided, the noisy activities in cause must be justified and reasonable mitigation measures and monitoring will be implemented to limit as much as possible the exceedances. Noise surveys will be conducted at representative sensitive points of reception during the work main phases of construction to determine compliance according to applicable criteria.

With regard to drainage water on the site, samples will be taken on a weekly basis for the entire duration of the construction period. The sample will be taken at the sedimentation pond outlet to check the concentration of total suspended solids (TSS) and petroleum hydrocarbon (C_{10}-C_{50}) content, and to apply mitigation measures, if needed, to keep such concentrations within the applicable limits. The targeted limits will be 25 mg/l for TSS and 2 mg/l for petroleum hydrocarbons. The verification of conformity with the standards is based on a grab sample. The location of the control point will be specified during the application for a Certificate of Authorization (CA) for construction activities.

Throughout the construction period, constant communication will be maintained with the main agencies concerned (MDDELCC, the municipality, and the Saguenay Port Authority). Regular media monitoring would allow the opinion of the population to be followed. The NAIC website will also allow information to be exchanged. Notably, all construction schedule changes will be indicated there. NAIC will evaluate at the appropriate time the need to create a construction-specific monitoring committee. The existing good neighbour committee would allow questions raised by citizens to be answered.

A report on the activities and results of the environmental monitoring program will be forwarded to the MDDELCC every four months until the plant's commissioning.

9.2 Emissions Monitoring Program – Operation Phase

The principal elements of the emissions monitoring program are described in the following sections. The program will be revised during the request for the certificate of authorization for the facility operation and will take into account the specific and detailed requirements of the industrial waste reduction and clean-up attestation program. The pig iron production facility is targeted by Decree 515-2002, in article 3.1, metallurgy.

9.2.1 Atmospheric Emissions

Sampling at the source (in other words at the point of emission) will be carried out according to the reference methods prescribed in Notebook No. 4 of the Sampling Guide for Environmental Analysis from the Center of Expertise on Environmental Analysis of Quebec. The source sampling will be carried out within one year from the plant commissioning date.

Process Gas Heater Stack

The process gas heater stack discharges combustion gas from the mixture of natural gas and process gas as well as residual gas from the thermal oxidation of the process gas. The nameplate capacity of the process gas heater is 64 MW.

This stack will be equipped with a monitoring device that will record and measure continuously the particle concentration or the opacity of gases emitted to the atmosphere as well as the concentration in oxygen, carbon monoxide and nitrogen oxides (article 72 of the Clean Air Regulation- CAR).

In order to validate that the continuous monitoring devices are functioning well, the chimney will be sampled every three years (article 74 of the CAR). In addition to parameters measured on a continuous basis (oxygen, carbon monoxide and nitrogen oxides), total particulate emissions, $PM_{2.5}$, SO_2 and H_2S will also be measured.

Package Boiler

The package boiler power varies from 0.8 to 4.0 MW depending on its operation mode (low load the majority of the time and high load during start-ups). The boiler is natural gas fed only.

The emissions of the boiler stack will be sampled and analyzed during the first year of operation for nitrogen oxides, carbon monoxide, total particulates, $PM_{2.5}$ and SO_2. Sampling will be carried out during the maximum load operation mode. Following the analysis of the results of the sampling, a sampling frequency will be established with the MDDELCC.

Flare

The quantity of natural gas consumed annually by the flare pilot will be recorded.

The gas flow from the degasser that is sent continuously to the flare will be measured and recorded.

The duration and quantities of gas sent to the flare, including an approximate composition of the burned gas, will be reported for each event.

Smelting and Casting (EAF) Baghouse

The EAF baghouse collects and treats emissions from the smelting and casting building. It will be equipped with a device that operates continuously and allows for the detection of any leaks and malfunction in order to insure the optimal condition of the equipment (article 151 of the CAR).

The baghouse stack will be sampled annually (article 152 of the CAR).

The points of emission of the smelting and casting building will be sampled every three years (article 152 of the CAR). The sampling will be carried out simultaneously or quasi-simultaneously and under conditions that are representative of the EAF operation. The points of emission of the building includes all the building opening (vents, windows, doors, etc.).

Concentrations in carbon monoxide, total dust, $PM_{2.5}$, sulfur dioxide, oxygen and nitrogen oxides will be measured during the annual sampling of the baghouse chimney while only total dust will be measured during the sampling carried out every three years at other points of emission.

Handling, Loading and Briquetting Baghouses

Each stack baghouse for the handling, loading and unloading and briquetting will be sampled every three years for total particulates and $PM_{2.5}$.

Because the wastewater treatment sludge and the briquettes will be dried with combustion devices located within the briquetting building, the emissions at the stack of the briquetting building baghouse will be also analyzed for concentrations in nitrogen oxides and in carbon monoxide.

Released Emissions

The dust emissions released will be controlled in such a way so that no dust emission will be visible at more than 2 meters from the drop, transfer or handling point (article 14 of the CAR). The majority of the points of emission of the matieral handling activities will be connected to a baghouse. Article 14 of the CAR will apply notably to the activities related to the handling of particles recovered by the dry baghouses as well as the handling of the slag and fines. These materials will be transported by truck inside the facility from their emission point to their point of reuse or storage. A surveillance procedure of these activities will be created. If needed, water will be sprayed on the internal roads of the facility as well as the slag storage area.

Acid Gas Scrubber

The sulfuric acid scrubber for ammonia emissions will be sampled every three years for concentrations in ammonia.

Greenhouse Gases and Annual Emissions

Greenhouse gas emissions and other atmospheric contaminants will be evaluated each year in conformity with the *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* (c. Q-2, r. 15) of the MDDELCC.

Registers

Registers will be kept to indicate:

- the monthly consumption of natural gas per use source;
- the monthly consumption of diesel by the refilling station as well as by the emergency generator;
- the monthly consumption of each solid and liquid material fed to the various processes;
- number of operation hours of the flares, the emergency generators and the package boiler (normal operation mode, shut-down and start-up).

9.2.2 Consumption and Discharge of Water

A water meter (or any device allowing the measurement of the volume of water sampled) will be installed in the potable water feed pipe.

Three control points will be installed at the plant final discharge points:

› Discharge of treated sanitary wastewater (No. 1);
› Run-off water discharge (No.2);
› Discharge of treated process wastewater (No. 3).

The exact location of the control points will be specified during the application for the certificate of authorization. Each control point will be equipped with a flowmeter.

9.2.2.1 Sanitary Wastewater (No. 1)

The proposed treatment of the sanitary wastewater being well known and proven, no monitoring other than the flowrate is proposed at this point of emission.

9.2.2.2 Run-off Water (No. 2)

For run-off water, the flowrate, the temperature and the pH will be measured and recorded continuously while at least four samples will be taken annually outside of the snow-melt period in order to measure concentrations in TSS, iron and petroleum hydrocarbons (C_{10}-C_{50}). Acute and chronic toxicity tests will be carried out on at least two samples (twice yearly).

The monitoring will be carried out only during the period of discharge to the storm ditch, no discharge during the winter period is expected.

The storm basin will be maintained at the lowest level before the winter period in order to be able to accommodate the snow melt.

9.2.2.3 Treated Process Water (No. 3)

Treated process water will be mostly recycled. A discharge flow of 16 m^3/h to water course No. 5 is expected. The monitoring program will be carried out on a monthly basis for all parameters, except for amines and bioassays more complex to analyze which will be carried out twice yearly, and will include the array of chemical additives for water conditioning as well as the parameters likely to be found in the final effluent because of the processes and materials used. Following the results obtained in the first year of operation of the plant, the parameters and the sampling frequency will be revised and established with the MDDELCC. The parameters to analyze will be confirmed during the application of the certificate of authorization as a function of the water chemical conditioning program and the products available at the time of the operation start-up that could be slightly different from those proposed in the impact study. Any modification of the chemical conditioning program will be submitted to the MDDELCC and the monitoring program can be subsequently adjusted.

Table 9.1 Measurement and Sampling of the Final Effluent (No. 3)

Parameters	Types of Measurement	Frequency
Flowrate	Primary and secondary flow elements with volume totalizer	Continuous
Temperature pH Conductivity Total Residual Chlorine	Thermometer pH-meter Conductivity meter Chlorine Analyzer	Continuous
Petroleum Hydrocarbons (C_{10}-C_{50}) TSS Total Ammonia Nitrogen (N) Nitates (NO_3) Chlorides Alkalinity ($CaCO_3$) Iron Total Phosphorous Total Dissolved Solids Sulfates Sulfites	Automated Sampler with Laboratory Analyses (24-hour composite)	Monthly
Cyclohexylamine Morpholine N,N Diethylhydroxylamine Dimethylaminopropylamine	Automated Sampler with Laboratory Analyses (24-hour composite)	4 times/year
Acute Toxicity - Rainbow Trout (ATU) - Daphnia/Water Flea (ATU)	Instantaneous	4 times/year
Chronic Toxicity - Fathead Minnow (CTU) - Algae (*P. subcapitata*) (CTU)	Instantaneous	4 times/year

As recommended in the *Guidelines for the use of environmental discharge objectives on industrial discharges into the aquatic environment*, the results of the toxicity test will be compared to the Environmental Discharge Objective (EDO) for acute toxicity and half of the EDO for chronic toxicity. Following two consecutive violations, NAIC will verify, by carrying out a minimum of two supplementary trials within a reasonable delay, if the violation remains. If this is the case, NAIC will look into evaluating the probable causes of violations and will research solutions to eliminate or reduce the toxicity.

9.2.3 Solid and Semi-Solid Hazardous Waste

A summary of the quantities of hazardous waste, solid waste and dry residue generated by the plant's activities including their disposal site will be carried out each year. The hazardous waste will be sent to a recovery center or an authorized disposal location. The production of hazardous

waste could exceed 100 kg per month and more than 200 kg will be stored on the facility site. The expected provisions on the Regulation Respecting Hazardous Materials will be respected.

The slag produced in the facility will be analyzed in conformity with the Regulation Respecting Hazardous Materials as well as the *Guide for Repurposing of Non-hazardous Inorganic Waste from Industrial Sources as Construction Material* in order to be able to declassify and repurpose it as aggregate. The production process is constant and the quality of slag will be homogeneous. As suggested by the Guide and Notebook 8, Sampling of Hazardous Waste, a minimum of five samples representing a different week of slag production will be sampled over a period of four days at a rate of five subsamples per day. Each sampling will take place at constant intervals. The sampling protocol will be validated by the MDDELCC and will aim to obtain representative samples.

To establish the non-hazardous classification according to the Regulation Respecting Hazardous Materials, the nature of the tests to carry out must be validated with the MDDELCC taking into consideration the preliminary characterization of the slag produced at Forks Specialty Metals whose results are presented in Appendix B. The slag does not have any characteristics associated with combustive, explosive, gaseous, flammable or radioactive materials. The results of the weight concentration of metals and metalloids indicate concentrations below the A criteria of the Soil Protection and Contaminated Sites Rehabilitation Policy, or less than natural concentrations, except for copper that slightly exceeded the A criterion but was less than the B criterion. The leachate tests show results below the potability limits.

The slag will be analyzed in accordance with the requirements and analysis methods of the MDDELCC for the following tests and parameters and according to the protocol specified in figure 5 of the Guide and reiterated in Appendix B.2:

- Deterioration Test;
- Granulometry;
- Total Organic Carbon;
- Sulfur Concentration;
- Acid generation potential is the total sulfur content is greater than 0.2%;
- pH on the solid component;
- Content in mg/kg (silver, arsenic, barium, cadmium, cobalt, total chromium, copper, tin, manganese, molybdenun, nickel, lead, selenium, zinc);
- Acid neutralization capacity: the results of this test will determine which leachate test is necessary;
- Water leaching with metals in the leachate;
- Leachability in acetic acid conditions;
- Leachability to simulate acid rain.

All of the analyses that determine the hazardous properties and those required to evaluate the repurposing potential will be carried out in accordance by an MDDELCC-accredited laboratory

as well as with methods prescribed in the List of Analytical Methods relative to the Application of the regulations arising from the Environmental Quality Act.

9.3 Environmental Monitoring – Operation Phase

Monitoring of the ambient environment involves measurements that will verify in the field the accuracy of the evaluation of certain impacts and the effectiveness of certain attenuation measures or specific compensation measures specified in the EIA, for which some uncertainty remains.

9.3.1 Ambient Air Quality

The quality of the air will be monitored at existing stations in La Baie and Chicoutimi. No particular air quality monitoring program is prescribed.

9.3.2 Noise

The acoustic power of equipment, the hypotheses and the attenuation measures envisioned must be validated and integrated in the project specifications. The constructor or the chosen supplier must guarantee the acoustic performance of the facility. They will make sure that the facility design and the proposed attenuation measures will be sufficient to meet the noise emission standards.

Noise measurements will be taken during the first year of operation, after the commissioning of the plant in order to verify that the facility is in compliance with noise limits. If exceedances occur because of facility activities, the sources will be identified and corrective actions will be enforced. The compliance with noise limits will be then re-checked, if needed, after the application of corrective actions.

9.3.3 Groundwater

The quality of groundwater will be periodically monitored. In total, nine monitoring wells will be installed: six at the perimeter of the facility (to cover upgradient and downgradient) as well as one upgradient and two downgradient of the slag storage site.

Groundwater will be sampled before plant start-up and in a regular fashion, or twice per year, in the spring and fall. The analytical results of the groundwater at the location of the project during the first sampling campaign showed concentrations under or near the limit of detection for PH C_{10}-C_{50}, PAHs and phenols; slight exceedances of criteria for water “destined for consumption” in dissolved manganese, total sulfur and toluene. A second round of sampling of the well where toluene was detected (MW-10A) was carried out on June 29 and the preliminary results confirmed the presence of toluene but in a lower concentration (12 µg/L). A supplementary sampling is planned on July 28, 2016 in the well in order to confirm the latest results. The last results will be presented in an addenda-report to the impact study.

Additionally, all materials will be contained, except for slag that will be stored outside. The results of the preliminary characterization indicate that the slag is not a hazardous material. The results of the leachate tests indicate concentrations below the potable limits.

Based on these results and on the activities designated for the site and neighboring sites, the monitoring parameters are the following:

› pH, electrical conductivity, chlorides, sulfates, sulfides, phosphorous, ammonia nitrogen, dissolved iron, total dissolved solids, petroleum hydrocarbons C_{10}-C_{50}, and monocyclic aromatic hydrocarbons (HAM).

The parameters to analyze may be adjusted following the results of the characterization of the slag produced at the facility.

9.4 Reporting and Delivery of Results

The results of analyses carried out in the Environment Monitoring and Follow-up Program will be conserved for at least five years. The results of the atmospheric emission sampling and the liquid discharge monitoring will be transmitted to the MDDELCC according to a schedule established with the Ministry. An annual report on hazardous waste will be transmitted to the MDDELCC as prescribed by the regulation.

A summary of the environmental monitoring program will be included in an annual report covering a calendar year (January 1st to December 31st) and will be transmitted to the MDDELCC the first of May of the following year. The annual report will include the entirety of the results obtained in the preceding five years for annual contaminant emissions. The results of the groundwater monitoring well samples will be recorded and transmitted annually. The report on the ambient noise measurements will be transmitted less than six months following their execution.

Notwithstanding the presentation of the results according to the established frequencies, the MDDELCC will be advised within 24 hours of any exceedance of any MDDELCC-specified standard or limit. The exceedance advisory will be accompanied by a short description of the event, immediate corrective measures if applicable, and within five days of the event, a proposed corrective action plan.

The results of the monitoring program will be made available to whomever makes the request. At the time of writing of the EIA, NAIC has not decided on a preferred mode of communication with the community. In the event where a liaison committee is created specifically for NAIC, the environment and emission monitoring program results will be made available to it. Otherwise, the results could be presented to the Good Neighbor Committee, depending on meeting agendas.

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Chapter 10

Sustainable Development

Table of Contents

10 Sustainable Development 1

10.1 NAIC Values and Core Principles 1

10.2 Proposed Sustainable Development Actions 2

10 Sustainable Development

NAIC is currently developing its social and environmental responsibility approach. While developing and implementing the project, the company will take into account the principles of sustainable development set out in the Quebec Sustainable Development Act. This section presents the values and core principles of the company before summarizing, for each of the 16 principles of the Quebec Sustainable Development Act, the actions proposed by NAIC to be implemented during the construction and operation of the project to comply with sustainable development principles.

Such principles also comply with two orientations stated in the *Livre vert* of the MERN on social acceptability[1]. One aims to ensure the existence of predictable information and the guidance of the consultation process during all phases of projects (orientation 3), and another is to encourage the sharing of benefit from energy and mining projects with receiving communities (orientation 4).

10.1 NAIC Values and Core Principles

NAIC will establish a social responsibility and commitment program in order to be an active member of the host community with regards to the environment, education, health and safety and will bring economic opportunities for goods, services and employment starting at the local level where qualified and competitive. This commitment program will be based on the company's values:

- Respect to employees, citizens and partners;
- Leadership in safety, environment, training and education.

This social responsibility program will enhance the work carried out by the company to meet and exceed, when possible, the sustainable development principles set out below. It will be formulated in accordance with NAIC's core operational principles:

- Consider safety and health protection, safety with regard to operations, risk management and mitigation, respect for the environment, community satisfaction and dialogue with stakeholders as paramount priorities.
- Act in compliance with applicable local laws and regulations, relevant industry standards and the principles and requirements of the Corporation, and supplements these, when appropriate, with its own specific requirements.
- Encourage a shared culture whose core components are skills management, incident feedback, information sharing and dialogue.
- Adopt a constructive attitude in matters of safety, security, health, environment and quality, based on an open dialogue with stakeholders and third parties.
- Monitor and control energy consumption, greenhouse gas emissions, production of final waste and impact on biodiversity and ecosystems, thus actively contributing to a sustainable future for all.

[1] Orientations of the Ministry of Energy and Natural Resources of the matter of social acceptability

10.2 Proposed Sustainable Development Actions

The Sustainable Development Act (RSQ, Chapter D-8.1.1), unanimously adopted by the members of the National Assembly on April 13, 2006, recognizes “the inseparability of the environmental, social and economic dimensions of development activities”. The Act also states that the pursuit of sustainable development requires a set of 16 sustainable development principles to be taken into account, all of which are listed below. The actions proposed by the project are presented after each principle. Some actions are repeated because they respond to more than one of the 16 principles.

a) *“HEALTH AND QUALITY OF LIFE”*: People, human health and improved quality of life are at the centre of sustainable development concerns. People are entitled to a healthy and productive life in harmony with nature.

In order to ensure the health and safety of its employees and the public, NAIC will develop an internal health and safety management system that takes into account all the specifics of the pig iron and metallurgy industry.

It should be noted that the plant will be automated in a way to minimize human intervention in sectors with high risks such as melting and casting building. In doing so, there will be, by default, a high level of control over health and safety in these sections of the plant. Tremendous engineering efforts have been taken to “design in” workforce safety measures prior to building the plant.

Prior to the beginning of operation, NAIC will develop a health and safety policy and management plan based on known principles.

This plan will be prepared and implemented. Proper communication mechanisms will be established and resource-persons identified.

NAIC will train and deploy its own response team, which will respond to any potential emergency at the plant. First responders in the City of Saguenay will be briefed on the specifics of the pig iron facility – hazards and emergency plan - to make sure appropriate action is taken in the event of an emergency. This team will reduce the response time and the consequences of an accident for employees, the public, the environment, and facilities. Moreover, a suitable emergency response plan will be developed and communicated to the competent authorities.

Finally, NAIC chose a project site in an industrial zone, where there is a buffer zone with the closest residences, avoiding any undue direct interactions with members of the public. NAIC have devoted considerable resources to ensuring this plant will be a global leader in managing the minimization of any emissions. Compared to other smelting types of operations, this plant will be in the lowest quartile globally for least amount of emissions.

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b) "*SOCIAL EQUITY AND SOLIDARITY*": Development must be undertaken in a spirit of intra- and inter-generational equity and social ethics and solidarity

NAIC will establish a social responsibility program that will be inclusive of employee's and key stakeholders' values and principles. This initiative is one that all employees must shape and then live by our collective commitment. The social responsibility program will respect local (Saguenay and Quebec) core values as well as First Nations'.

NAIC will ensure that opportunities are fairly considered and presented whereby women, youth and minorities are addressed.

It is NAIC's intention to join the existing Good Neighbor Committee to periodically consult with local communities to understand their views on expectations in terms of social engagement and support. NAIC will assess in due time the necessity to create a specific committee for the needs of its operation.

In addition, as the project advances, NAIC will consult with Saguenay organizations to understand their expectations in terms of communications and engagement. The establishment and maintenance of such relations, with both community members and organizations will form the basis for a corporate social responsibility program that will include implementation measures to be put in place during the construction and operation of the project.

The concept of equity and solidarity will also be an important part of the company's employment policy and working conditions, including compliance with the labor standards in force.

c) "ENVIRONMENTAL PROTECTION": To achieve sustainable development, environmental protection must constitute an integral part of the development process.

NAIC has adopted several measures in terms of environmental protection within the project design itself. These include:

- **Water systems**: The water systems in the facility are designed to minimize the amount of fresh water consumed from the municipal water supply as well as the amount discharged into the environment (see Section 3.6 for a detailed account). A variety of cooling strategies will be used to accomplish this goal, taking into account the limitations of the potable water supply, the minimization of the environmental discharge and the specific or particular needs of the equipment and gas to cool. The ultimate objective of the facility's water management strategy is to reuse 100% of the wastewater generated for a zero-discharge plant. Despite efforts to achieve this goal, a residual flow must be discharged equivalent to 18% of total process water. A more detailed analysis of the cooling water circuit will be carried out in order to optimize the consumed streams and the final discharge streams.
- **Direct feed from the bins:** Slight design modification to feed the EAF with hot DRI directly from the bins, eliminating the need for a conveyor and, as a consequence, avoiding undue loss of energy and thus reducing the CO_2 emission;
- **Exclusion of scrap iron**: NAIC has decided not to use scrap iron in its process. This decision was made to avoid using materials with various metals (concentration and type)

present in the scrap that can thus end up in the atmospheric emissions; make the production of high-purity pig iron more difficult; and, increase the production of slag. This high level of purity of the iron used in the process allows NAIC to recycle the dust, the sludge, as well as the slag from the production. This measure also avoids the contamination of dust by other metals that can potentially be polluting air, soil and water.

- **Reuse of fines, dust and sludge**: The design of the facility foresees that 100% of the fines from pellets, the sludge from the wastewater treatment plant (industrial and storm) and the dust captured by the baghouse are recovered in the briquettes that will be reinserted into the reactor. Approximately 23,000 t/y of fines, dust and sludge will be recovered (see Section 3.7.1).
- **Cooling systems:** Considering the small capacity of the receiving body of water and in order to minimize water emissions, NAIC has chosen to use a combination of the two cooling methods: air or water cooling (refer to Section 2.9.3). Air cooling has a low efficiency in the summer and a high efficiency in the winter. The use of air cooling will thus be maximized until a point where water cooling is deemed more efficient.
- **Potential reuse of slag**: It is highly probable that slag from the plant process will have a commercial value given their high quality and the fact that they do not possess any characteristics of a hazardous waste (see preliminary analysis results in Appendix B). NAIC hopes that the slag will be recovered by a local company and transformed, therein stimulating the economic development of small to medium enterprises (SME) in the region.
- **Change from a coal-based to a gas-based process**: The initial version of NAIC's project included the use of coal. The proposed project now relies on a gas-based process that allows reducing the energy requirements, ensuring a better quality of the product, and lowering CO_2, NOx and SO_2 emissions (refer to Table 2.6). This change also allowed to reduce the amount of slag produced and generally requires less energy (including electricity) when compared to a coal-based plant.

It should also be mentioned that NAIC has chosen an industrial zone for the project's implementation, more precisely an industrial-port zone, offering the possibility to share some infrastructure, and avoiding the need to build additional infrastructure. The deep water port is already in place, and the site has already been cleared and leveled. There will eventually be a multi-user conveyor that will link the jetty with the industrial zone. However, this infrastructure is not essential to the functioning of the plant, as pig iron may be transported by truck in the meantime.

In addition to these initiatives, NAIC will establish an environmental management system based on the principles laid down in ISO Standard 14000.

Through this environmental management system, NAIC will put in place a range of environmental measures, most of which are included as mitigation measures as a result of the impact assessment (see Chapter 7). It will be crucial to follow up on these measures to ensure the overall protection of the environment, and NAIC is determined to adjust these measures or implement new ones as required. Such measures will:

- Ensure that all personnel, at all levels of the organization, are conscious of their personal responsibility in the prevention of incidents, harm to health, environmental damage and

adverse impacts on operations quality. Vigilance and professionalism in these fields are important criteria in evaluating performance, particularly of those in positions of responsibility.

› Develop and use technologies to optimize its energy efficiency and reduce its environmental footprint.

d) "ECONOMIC EFFICIENCY": The economy of Quebec and its regions must be effective, geared toward innovation and economic prosperity that is conducive to social progress and respectful of the environment.

By choosing to implement its pig iron plant in the Saguenay Region, NAIC will support a region that has above average unemployment rates in Québec. NAIC will spur economic developments in two main ways: a) by creating quality careers, in the sense that the careers will require a range of qualifications and will provide meaningful sources of incomes for the workers, and b) by creating business opportunities for local entrepreneurs and SMEs, perhaps even for the recycling of the slag. It is noteworthy that there is available and qualified workforce, support service providers and educational institutions in the Saguenay region, knowledgeable of the metallurgical industry.

As the project advances further development and refinement of workforce requirements will be undertaken, in collaboration with relevant educational institutions and employment agencies. A Human Resource Plan will be developed at an early stage to ensure team members are fully trained and prepared prior to operations start-up. In particular, the technology provider has agreed to work closely with NAIC's Human Resources Team at an early stage to assist in defining specific skills required in conjunction with educational institutions to first prepare the educators/trainers so that they are well positioned to deliver well-founded training services.

NAIC will ensure economic benefits to the Saguenay region will be a priority. It will start out at the local level, and when necessary broaden out secondly to other regions of Quebec, and thirdly to Canada. The construction phase of the plant is estimated to create 400 fulltime equivalents (FTE's). NAIC estimates there will be a requirement of over 100 employees at the plant during operations, and that its manufacturing facility will provide a significant multiplier: for every direct career at the plant, a little bit more than 2 indirect jobs can be expected for local service providers, offering them the possibility to expand their business. In other words, as many as 230 indirect jobs could be created, for a total local impact of 335 new FTE's in Saguenay area. NAIC is determined to adopt a policy of purchasing goods and services locally when qualified and competitive.

Additionally, NAIC will establish a Corporate Office that will likely be based in Quebec with Montreal currently being evaluated. The office location will reflect a balance between plant location, Quebec government location, financial institutions and customers. The corporate functions will focus on leadership, financial, marketing and other support roles.

NAIC will also most likely be the first industry in the intermodal industrial zone of the Port of Saguenay installations. In addition, various infrastructure will be added to the zone (electricity, natural gas line, potable water) adding thus the power of attraction in the sector for other investment opportunities. The Port of Saguenay will ideally benefit from having their first lead

anchor tenant in attracting other opportunities to the Port. The APS aims at favoring the expansion of outside business as well as the industrialization and development of the inland region of Saguenay-Lac-Saint-Jean, and NAIC will help the APS in fulfilling these goals. The handling of material from port to plant for the iron ore pellets and the pig iron will be the responsibility of the, which will most likely recruit local sub-contractors.

Importantly, this project will provide a business opportunity for mines operating on the North Shore and in Northern Quebec by obtaining iron supplies in these regions. NAIC believes that potential suppliers in the above-mentioned regions will offer a superior quality iron ore pellet with competitive prices.

e) “PARTICIPATION AND COMMITMENT”: The participation and commitment of citizens and citizens' groups are needed to define a concerted vision of development and to ensure its environmental, social and economic sustainability.

For the purpose of the ESIA, NAIC has used a consultation approach designed to objectively inform and consult with stakeholders in order to take into account their concerns and expectations right from the design stage of the project. This two-step approach, which began with preliminary consultation and will continue with the presentation of the ESIA results, helped the project’s proponent better understand who the key stakeholders are and the issues specific to the Saguenay region.

NAIC will continue this engagement process by undertaking a second phase of consultation to present and validate the results of the ESIA (Chapter 5). This will provide an opportunity to continue the dialogue that began during the preliminary consultation.

Once the project is approved, NAIC will use existing permanent communication structures (in particular the Good Neighbor Committee) to maintain a regular, open and constructive dialogue. As mentioned above, NAIC will consider putting in place its own committee.

Overall, the social responsibility program will establish several communication and participation mechanisms, which will allow two-way sharing, that shall be further defined as the project advances and as expectations from community members or Saguenay organizations are better understood. These may include but will not be limited to:

› Regular communications through the Good Neighbor Committee;
› A complaint mechanism will be developed to address issues reported in a timely manner;
› The core principle of recruiting local people first means known community members are at the plant – these team members are already part of the local community;
› NAIC team members that form the NAIC Good Neighbor Committee will be expected to report regularly to the Direction/Management on the discussions and exchanges with the Committee.

f) "ACCESS TO KNOWLEDGE": Measures favorable to education, access to information and research must be encouraged in order to stimulate innovation, raise awareness and ensure effective participation of the public in the implementation of sustainable development.

NAIC intends to share knowledge in several ways. First, throughout the ESIA process, NAIC has attempted to answer questions from the public in a transparent manner, and will continue to do so throughout the second phase of the consultation process planned for Q3-Q4 of 2016.

Second, the reduction of iron requires a specific set of qualifications that will soon be known, and their availability in the Saguenay region will be assessed in due time. NAIC will take measures to ensure areas that are not readily available, consultations will be undertaken to see what measures must be put in place to ensure training of such skills sets are addressed and resolved.

A specific training program will be put in place to ensure that local workers are trained and prepared to work prior to the first day of operation. As noted above, NAIC will encourage the hiring of local workers and contractors when possible. In addition, the basic skills of the local workforce (engineers, process technicians, maintenance technicians, etc.) will need to be upgraded periodically to ensure safe plant operation.

Third, employees and first responders will benefit from a full-fledged health and safety training for the needs of the facility. First responders in the region will be briefed on the specifics of pig iron production and the intervention measures in the event of an emergency.

Generally, NAIC will invest in continuous training to its employees, in both operational procedures and health and safety. NAIC will develop in-house expertise on being able to offer end users (e.g. foundries) metallurgical expertise in assisting their efforts to use the pig iron being produced. This is a widely requested service and NAIC believes it is critical to customer fulfillment. This will require a level of expertise with associated research and development skills. This will be an important internal resource to ensure ongoing technical feedback is heard directly which will impact potential improvements to the plants.

g) "SUBSIDIARITY": Powers and responsibilities must be delegated to the appropriate level of authority. Decision-making centers should be adequately distributed and as close as possible to the citizens and communities concerned.

The participation of NAIC in various committees (for instance, the Good Neighbor Committee - *Comité intégré de bon voisinage*- and/or the *Association des entreprises du Haut Saguenay)* will allow the company to remain connected to issues of concern to the industries and the public in relation to the plant's activities and to ensure their integration into business plans, corporate responsibility strategy, and operations more generally.

h) "INTER-GOVERNMENTAL PARTNERSHIP AND COOPERATION": Governments must collaborate to ensure that development is sustainable from an environmental, social and economic standpoint. The external impact of actions in a given territory must be taken into consideration.

NAIC has developed relations with the three levels of governments (federal, provincial and municipal) and plans on pursuing these collaborations in the future.

The APS manages a territory which is under federal jurisdiction. NAIC considers the APS as a key partner as it will provide, among other services, handling services at port, and transportation of materials to and from the plant.

NAIC will engage regularly, as any serious export oriented company in Canada, with appropriate levels of government (for example, the Quebec Ministry of Economy, Science and Innovation and Industry Canada for exporting programs and initiatives). Proper communication with key economic authorities is critical to ensure the development and continuity of NAIC's business and associated employment and contractual engagement.

The Quebec Ministry of the Economy, Science and Innovation acted as a facilitator in NAIC's choice to be located in Quebec. Ministry officials have created an Inter-Ministerial Committee for this project and NAIC has been in dialogue with all key stakeholder Ministries. This dialogue will continue after the plant is in operation.

The NAIC project is also in line with Quebec's maritime policy (2015). Globally, industrial-port zones will allow Quebec exports to increase through an improved integration of manufacturing to global supply chains (Quebec government, Stratégie maritime, 2015). The APS plays a crucial role in the implementation of this policy. NAIC, by choosing this particular location concretizes these aspirations and in this sense, mutual support has been developed.

Emploi-Québec and local education institutions will obviously be important partners not only for the ramp up for construction and operations but for ongoing workforce development as well.

NAIC will continue to build on the value of a working relation with Saguenay Port Corporation and with Promotion Saguenay in mutually supporting all parties' agenda for cooperation and mutual support function. NAIC will respect any request that can enhance the economic benefit of the region or port.

In addition, NAIC will develop a relation with Aboriginal leadership, representing the three Innu communities (Essipit, Mashteuiatsh and Pessamit).

NAIC truly understands the significance of being a respectful corporate citizen and as such will nurture transparent and open relations with stakeholders.

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i) "PREVENTION": In the presence of a known risk, preventive, mitigating and corrective actions must be taken, with priority given to actions at the source.

As discussed above, NAIC has adopted several measures in terms of prevention to avoid negative environmental effects. The two main prevention measures, included within the optimized plant design, were:

a) The change from a coal-based to a gas-based process, which allows reducing the energy requirements, ensuring a better quality of the product, lowering CO_2, NOx and SO_2 emissions (refer to Table 2.6), and reducing the amount of slag produced.
b) The exclusion of scrap iron from the process which would have resulted in greater atmospheric emissions, but also would have prevented NAIC from recycling the dust, the sludge, as well as the slag from the production; and

c) During the detailed engineering phase, a risk review will be completed using the HAZOP (Hazard and Operability Study) method. The reason for this review lies in the identification and evaluation of situations that may pose a risk to staff, equipment or the environment, and the deployment of adequate prevention resources (processes, equipment) and control measures.

j) "PRECAUTION": When there are threats of serious or irreversible damage, lack of full scientific certainty must not be used as a reason for postponing the adoption of effective measures to prevent environmental degradation.

In addition to the prevention measures mentioned above, a precaution measure has been taken concerning the water systems. As discussed above, the water systems in the facility are designed to minimize the amount of fresh water consumed from the municipal water supply as well as the amount discharged into the environment. Overall, more than 80% of the wastewater produced will be recycled back into the process and the ultimate objective of the facility's water management strategy is to be a zero-discharge plant. In the meantime, a residual flow must be discharged.

k) "PROTECTION OF CULTURAL HERITAGE": Cultural heritage, which is made up of property, sites, landscapes, traditions and knowledge, reflects the identity of a society. Cultural heritage components must be identified, protected and enhanced, taking their intrinsic rarity and fragility in order to foster the sustainability of development.

In the context of the ESIA, the historical and archaeological heritage was considered by carrying out a study to identify archaeological sites and zones of archaeological potential (Section 4.4.5). This study was undertaken by the firm Subarctique Enr. The results were that a) there is no known archaeological site located within 5 km of the project site and b) based on analyses and direct observations, no potential archaeological zone was identified within the local study area.

The landscape of the project area will certainly be modified given that NAIC will be the first plant to be built in the industrial-port zone. Residents who live on the north shore of the Saguenay River will see changes to their current view on the south shore. NAIC will consult with the

community on those aesthetic aspects that can be modified to ensure a smooth insertion into the local landscape.

l) "BIODIVERSITY PRESERVATION": Biological diversity offers incalculable advantages and must be preserved for the benefit of present and future generations. The protection of species, ecosystems and the natural processes that maintain life is essential if quality of human life is to be maintained.

By choosing the industrial area of the APS, NAIC recognizes this principle of sustainable development. The APS Saguenay region had ensured that the zoning was adequate in order to spur economic development in the region, attracting NAIC among other future companies.

NAIC will follow closely the ongoing work on maritime transport and marine mammal protection in order to evaluate in what way that it can reasonably be implicated in this issue for the social and environmental community.

m) "RESPECT FOR ECOSYSTEM SUPPORT CAPACITY": Human activities must be respectful of the support capacity of ecosystems and ensure the perenniality of ecosystems.

As previously indicated, NAIC has taken several measures to respect the ecosystem support capacity. The main one is the choice of an industrial zone for the plant implementation where port and road infrastructure are already available, and a site that has already been cleared and optimized for industrial use. Other measures, explained above, include:

› The water treatment systems and the aim of achieving (eventually) a zero discharge process;
› Considering the small capacity of the receiving body of water and in order to minimize water emissions, NAIC has chosen to use a combination of the two cooling methods: air or water cooling (refer to Section 2.9.3). Air cooling has a low efficiency in the summer and a high efficiency in the winter. The use of air cooling will thus be maximized until a point where water cooling is deemed more efficient.

n) "RESPONSIBLE PRODUCTION AND CONSUMPTION": Production and consumption patterns must be changed in order to make production and consumption more viable and more socially and environmentally responsible, in particular through an eco-efficient approach that avoids waste and optimizes the use of resources.

Measures for a responsible production and consumption have been detailed above. They include:

› Recycling of process gas: The selection of a Zero-Reformer natural gas based technology will generate less CO_2 emissions than other similar reduction technologies. The ZR process takes advantage of the catalytic effect of metallic Fe in the DRI, combining carbon in the form of Fe_3C, higher levels of carbon are included in the product and thus less carbon is removed in the form of CO_2.The reduction process aims at recycling process gas as feedstock to the reactor and as fuel for the preheater. Consequently, the overall energy

efficiency of the direct reduction is optimized and most of the energy supplied to the process is absorbed by the product with minimal energy losses to the environment.

- Potential for CO_2 recovery: Space will be allocated within the facility to accommodate equipment to eventually recover a portion of the CO_2 generated at the reduction process should an off-taker be interested (see Section 2.9.7).
- Slag revaluation: The slag produced at the facility will be proven to be none hazardous and could be recovered as aggregate.
- The optimization of the plant design to recycle water, dust and sludge and thus minimize, in as much as possible, the production of waste materials;
- The choice of not using scrap metals as an input to the process to reduce atmospheric emissions;
- The change from a coal-based to a gas-based process to reduce needs in energy, atmospheric emissions, and to increase the quality of the end-product.

o) "*POLLUTER PAYS*": Those who generate pollution or whose actions otherwise degrade the environment must bear their share of the cost of measures to prevent, reduce, control and mitigate environmental damage.

NAIC is committed to the "polluter pays" principle by paying various fees required by the environmental regulation.

In the event of any accidental environmental impact, NAIC shall take the necessary steps to remedy the situation, whether the contamination affects soil, water and sensitive species.

The Regulation respecting the cap-and-trade system for GHG emission allowances defines the rules of the carbon market in Quebec. Since the plant's anticipated GHG emissions will exceed the 25,000 tons of CO_2eq/year, NAIC will be subject to this regulation. The procedures for implementing the Regulation in the case of NAIC will be defined before the plant is operational.

p) "INTERNALIZATION OF COSTS": The value of goods and services must reflect all the costs they generate for society during their whole life cycle, from their design to their final consumption and their disposal.

The lifetime of the project is planned for 50 years. NAIC management will work to adopt sound environmental management practices in order to keep to a minimum all environmental liabilities. NAIC will implement in all its operations, appropriate management policies on risks regarding safety, health, environment and quality, which are regularly assessed. No project may be developed without a risk assessment spanning its entire life cycle.

In addition, NAIC will assess the safety, health, environment and quality management systems on a regular basis to achieve continuous improvement. This assessment comprises performance measurement, setting milestones, formulating relevant action plans and instituting suitable control procedures. NAIC is also equipped to respond effectively and appropriately to incidents and has established emergency procedures that are reviewed, tested and practised regularly.

Additionally:

- Capital expenditure budgets will also be planned in order to conduct continuous improvement projects to keep the plant operational and profitable.
- Costs related to closure and decommissioning activities will also be planned in order to restore the site to its original condition and to comply with the regulations in force at the time of closure.
- The budget for the social responsibility program will be planned in the long term so that these costs can be internalized.
- The long-term budget will also include costs related to the health and safety management program and the environmental management system, including costs due to the environmental regulations.

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Chapter 11

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Pig Iron Facility Project - Saguenay

Appendices (English Version)

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List of Appendices

Appendix A - Water Chemical Conditioning Program

A1 - Chemical Products
A2 - Safety Data Sheets

Appendix B - Slag

B1 - Methodology for the Production of Slag with the same Characteristics (French only)
B2 - Decision Flow Chart for Repurposing (extract from the guide) (French only)
B3 - Slag Analytical Results Overview (French only)
B4 - Detailed Results and Certificates of Analyses (French only)

Appendix C - Potable Water Quality (French Only)

Appendix D - Atmospheric Emissions

D1 - Atmospheric Emission Calculations
D2 - Atmospheric Dispersion Study (English version beginning only at section 2.7)

Appendix E - Surface Water

E1 - Description of watercourses (French only)
E2 - Surface Water Quality – Analysis results (French only)
E3 - Surface Water Quality - Certificates of analyses (French only)

Appendix F - Soil and Groundwater

F1 - Soil Quality (French only)
F2 - Groundwater Quality (French only)
F3 - Calculation of DRASTIC Vulnerability Index (French only)

Appendix G - Biological Species (French only)

Appendix H - Noise

H1 - Noise Measurements (French only)
H2 - Administrative Codification of Regulation VS-R-2007-51 relative to Noise in the City of Saguenay (French only)
H3 - Handling of Noise Complaints and Requirements of Companies that Generate it (MDDELCC) (French only)
H4 - Guidelines on Noise Levels from the Industrial Construction Site (MDDELCC) (French only)
H5 - Noise Impact Intensity (French only)
H6 - Map H1 Predicted Noise Levels during Facility Operation

Appendix I - Visual Impact

I1 – Location of Photos and Visibility Analyses
I2 – Photographic Report
I3 – Visual Impact Variable Analysis

Appendix J - Consultations

J1 – Stakeholders Met (preliminary consultations)
J2 – Description of Targeted Stakeholders
J3 – Communication Tools Used during Preliminary Consultations

Appendix K - Technological Risks

K1 – Safety Data Sheets
K2 – Consequence Assessment Assumptions
K3 – Preliminary Emergency Response Plan

Appendix A

Water Chemical Conditioning Program

A1 – Chemical Products
A2 – Safety Data Sheets

Appendix A1 – Chemical Products

Product Name	Purpose	Main Component(s)	Required Feeding	Annual Use (kg/y)	Storage Container
Cooling Circuit (QCT and EAF)					
GenGard GN8020	Prevents clogging and scaling	› Carboxylic Polymer	100 ppm continuously	3400	Tote
FloGard MS6206	Corrosion Inhibitor	› Tetrapotassium pyrophosphate	20 ppm continuously	800	Drums
Spectrus BD1501E	Biodispersant to dissolve and remove all accumulation of organic matter	› Alcohol, C10, alkoxylated	25 ppm treatment once per week	600	Drums
Sodium Hypochlorite	Biocide, oxidizer	› Sodium hypochlorite	100 ppm continuously	3800	Tote or Tank
Sulfuric Acid	pH reduction and clogging prevention	› Sulfuric Acid	100 ppm continuously	3800	Tote or Tank
Package Boiler					
Solus AP24	Prevents deposits and scaling	› Not divulged	5 ppm continuously		
Steamate PAS6066	Oxygen removal and condensate treatment	› Cyclohexylamine › Morpholine › N,N Diethylhydroxylamine › Dimethylaminopropylamine (DMAPA)	10 ppm continuously		
Cortrol S3070	Nearly instantaneous oxygen removal from the condensate	› Sodium Bisulphite	During boiler shutdown	Less than 200 kg	Drums
Optisperse ADJ5050	Increase alkalinity	› Sodium Hydroxide	During boiler shutdown	Less than 200 kg	Drums
Wastewater Treatment					
Flocculant (NALCO 71605 or MagnaFlocLT25 or equivalent), 0.1%	Polymer for the flocculation of metals, notably iron (primary and lamellar clarifier).	› Not divulged	1.1 to 2 kg/h	9 to 20 tons	Bags and mixing tank
Ferric Chloride	Coagulant for the flocculation of metals to the lamellar clarifier and stormwater retention basin	› $FeCl_3$	0.3 to 0.6 kg/h	2 to 6 tons	Tank
NaOH	pH adjustment	› Sodium Hydroxide	As required		
Sulfuric Acid	pH adjustment	› Sulfuric Acid	As required		
Spectrus DT1404	Removal of residual chlorine	› Sodium Bisulfite	10 ppm continuously	1000	Drums

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Appendix A2 – Safety Data Sheets

Cooling Circuits (QCT and EAF)

- Gengard GN8020
- Flogard MS6206
- Spectrus BD1501E
- Sodium Hypochlorite
- Sulfuric Acid

Package Boiler

- Solus AP24
- Steamate PAS6066
- Cortrol IS3070
- Optisperse ADJ5050

Wastewater Treatment

- Flocculant (NALCO 71605 or MagnaFloc LT25 or equivalent)
- Ferric Chloride
- Sodium Hydroxide N/50 (0.02N)
- Sulfuric Acid
- Spectrus DT1404

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GE Power & Water
Water & Process Technologies

SAFETY DATA SHEET

GENGARD* GN8020

1. Product and Company Identification

Material name	**GENGARD GN8020**
Version #	3.0
Revision date	Aug-04-2015
Supersedes date	Feb-16-2015
Prepared by	This SDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).
Chemical description	Polymer solution
CAS #	Mixture

Company/undertaking identification

GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency telephone

(800) 877-1940

2. Hazards Identification

Emergency overview May cause moderate irritation to the skin. May cause moderate irritation to the eyes. Mists/aerosols may cause irritation to upper respiratory tract.

Potential health effects

Eyes	May cause moderate irritation to the eyes.
Skin	May cause moderate irritation to the skin.
Inhalation	Mists/aerosols cause irritation to the upper respiratory tract
Ingestion	May cause gastrointestinal irritation with possible nausea, vomiting, headache, dizziness, unconsciousness, and injury to the kidneys and liver.
Target organs	No evidence of potential chronic effects.
Signs and symptoms	Inhalation may cause irritation of respiratory tract. May cause redness or itching of skin.
Medical conditions aggravated by exposure	None known.

3. Composition / Information on Ingredients

Components	CAS #	Percent (wt/wt)
CARBOXYLIC ACID POLYMER	*	*

*HMIRA Trade Secret Registry #: 9385 Date Granted: 07-JUL-2015

Composition comments Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

4. First Aid Measures

First aid procedures

Inhalation	Move to fresh air. If breathing stops, provide artificial respiration. For breathing difficulties, oxygen may be necessary. Get medical attention immediately.
Skin contact	Wash off with soap and water. Get medical attention immediately. Take off contaminated clothing and wash before reuse.
Eye contact	Remove contact lenses, if present and easy to do. Get medical attention immediately. Immediately flush eyes with plenty of low-pressure water for at least 30 minutes while removing contact lenses.
Ingestion	If swallowed, rinse mouth with water (only if the person is conscious). Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. Get medical attention if symptoms occur.
Notes to physician	No specific antidotes are recommended.

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media	Dry chemical, CO2, water spray or regular foam.
Fire fighting equipment/instructions	Use standard firefighting procedures and consider the hazards of other involved materials.

Explosion data

Sensitivity to static discharge	Not available.
Sensitivity to mechanical impact	Not available.

6. Accidental Release Measures

Personal precautions	Wear appropriate protective equipment and clothing during clean-up. Avoid contact with spilled material. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground. Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements.
Methods for cleaning up	Ventilate the area. Flush with plenty of water. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Spread sand/grit.

7. Handling and Storage

Handling	No special precautions are necessary beyond normal good hygiene practices. See Section 8 of the MSDS for additional personal protection advice when handling this product.
Storage	Keep container tightly closed in a dry and well-ventilated place.

8. Exposure Controls / Personal Protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Engineering controls	Explosion-proof general and local exhaust ventilation.

Personal protective equipment

Eye/face protection	Splash proof chemical goggles.
Skin protection	Wear suitable protective clothing. Chemical resistant gloves. The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Chemical resistant apron. Glove selection must take into account any solvents and other hazards present.
Respiratory protection	If air-purifying respirator use is appropriate, use organic vapor cartridges and any of the following particulate respirators: R95, R99, R100, P95, P99 or P100.

9. Physical & Chemical Properties

Appearance

Physical state	Liquid
Color	Amber to brown
Odor	Slight sweet
Odor threshold	Not available.
pH (concentrated product)	2.6

pH in aqueous solution	3 (5% SOL.)
Vapor pressure	18 mm Hg
Vapor pressure temp.	70 °F (21 °C)
Vapor density	< 1 (Air = 1)
Boiling point	212 °F (100 °C)
Melting point/Freezing point	27 °F (-3 °C)
Solubility (water)	100 %
Specific gravity (70°F, 21°C)	1.17
Flash point	Not applicable.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Auto-ignition temperature	Not available.
Evaporation rate	< 1 (Water = 1)
Viscosity	36 cps
Viscosity temperature	70 °F (21 °C)
Percent volatile	0 (Estimated)
Pour point	32 °F (0 °C)

10. Chemical Stability & Reactivity Information

Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Not available.
Incompatible materials	Strong oxidizing substances.
Hazardous decomposition products	Oxides of carbon, nitrogen, and sulphur evolved in fire.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Product	Species	Test Results
GENGARD GN8020 (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	> 5000 mg/kg, (Calculated according to GHS additivity formula)
Oral		
LD50	Rat	> 5000 mg/kg, (Calculated according to GHS additivity formula)

Components	Species	Test Results
CARBOXYLIC ACID POLYMER (TSRN 9385*)		
Acute		
Oral		
LD50	Rat	4563 mg/kg

12. Ecological Information

Ecotoxicity

Product		Species	Test Results
GENGARD GN8020 (CAS Mixture)			
	LC50	Fathead Minnow	5814 mg/L, Static Renewal Bioassay, 96 hour, (pH adjusted)
	NOEL	Fathead Minnow	5000 mg/L, Static Renewal Bioassay, 96 hour, (pH adjusted)

Product		Species	Test Results
Aquatic			
Crustacea	LC50	Daphnia magna	3628 mg/L, Static Renewal Bioassay, 48 hour, (pH adjusted)
	NOEL	Daphnia magna	1250 mg/L, Static Renewal Bioassay, 48 hour, (pH adjusted)
Fish	LC50	Rainbow Trout	7071 mg/L, Static Renewal Bioassay, 96 hour, (pH adjusted)
	NOEL	Rainbow Trout	5000 mg/L, Static Renewal Bioassay, 96 hour, (pH adjusted)

Persistence and degradability

- COD (mgO2/g)	464 (calculated data)
- BOD 5 (mgO2/g)	30 (calculated data)
- BOD 28 (mgO2/g)	71 (calculated data)
- Closed Bottle Test (% Degradation in 28 days)	15 (calculated data)
- TOC (mgC/g)	142 (calculated data)

13. Disposal Considerations

Disposal instructions	Dispose of contents/container in accordance with local/regional/national/international regulations.
Waste from residues/unused products	Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner.
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport Information

TDG

Not regulated as dangerous goods.

DOT

Not regulated as a dangerous good.

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

IMDG

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

15. Regulatory Information

WHMIS status	Controlled
WHMIS classification	D2B - Other Toxic Effects-TOXIC

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other Information

List of abbreviations

CAS: Chemical Abstract Service Registration Number
NFPA: National Fire Protection Association
ACGIH: American Conference of Governmental Industrial Hygienists
TWA: Time Weighted Average
STEL: Short Term Exposure Limit
LD50: Lethal Dose, 50%
LC50: Lethal Concentration, 50%
NOEL: No Observed Effect Level
COD: Chemical Oxygen Demand
BOD: Biochemical Oxygen Demand
TOC: Total Organic Carbon
IATA: International Air Transport Association
IMDG: International Maritime Dangerous Goods Code
TSRN indicates a Trade Secret Registry Number is used in place of the CAS number.

HMIS® ratings

Health: 2
Flammability: 1
Physical hazard: 0
Personal protection: B

NFPA ratings

Health: 2
Flammability: 1
Instability: 0
Special hazards: NONE

This data sheet contains changes from the previous version in section(s):

Composition / Information on Ingredients: Disclosure Overrides
Composition / Information on Ingredients: Composition comments
Physical & Chemical Properties: Multiple Properties
Physical & Chemical Properties: Odor
Other Information: Recommended use
GHS: Classification

* Trademark of General Electric Company. May be registered in one or more countries.

GE
Water & Process Technologies

Material Safety Data Sheet

Issue Date: 12-MAR-2010
Supercedes: 30-SEP-2008

FLOGARD MS6206

1 Identification

Identification of substance or preparation
FLOGARD MS6206

Product Application Area
Water-based corrosion inhibitor.

Company/Undertaking Identification
GE Betz, Inc.
4636 Somerton Road
Trevose, PA 19053
T 215 355-3300, F 215 953 5524

Emergency Telephone
(800) 877-1940

Prepared by Product Stewardship Group: T 215-355-3300 Prepared on: 12-MAR-2010

2 Hazard(s) identification

****
EMERGENCY OVERVIEW

CAUTION

May cause slight irritation to the skin. May cause moderate irritation to the eyes. Mists/aerosols may cause irritation to upper respiratory tract.

DOT hazard: Corrosive to aluminum
Odor: None; Appearance: Colorless, Liquid

Fire fighters should wear positive pressure self-contained breathing apparatus(full face-piece type). Proper fire-extinguishing media: dry chemical, carbon dioxide, foam or water
****

POTENTIAL HEALTH EFFECTS

ACUTE SKIN EFFECTS:
Primary route of exposure; May cause slight irritation to the skin.

ACUTE EYE EFFECTS:
May cause moderate irritation to the eyes.

ACUTE RESPIRATORY EFFECTS:
Mists/aerosols may cause irritation to upper respiratory tract.

INGESTION EFFECTS:
May cause slight gastrointestinal irritation.

TARGET ORGANS:
No evidence of potential chronic effects.

MEDICAL CONDITIONS AGGRAVATED:
Not known.

SYMPTOMS OF EXPOSURE:
Inhalation of dust and/or vapors may cause eye, nose, throat and respiratory tract irritation.

3 Composition / information on ingredients

Information for specific product ingredients as required by the U.S. OSHA HAZARD COMMUNICATION STANDARD is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

HAZARDOUS INGREDIENTS:

Cas#	Chemical Name	Range(w/w%)
7320-34-5	TETRAPOTASSIUM PYROPHOSPHATE Corrosive to aluminum; severe eye irritant; skin irritant	7-13

This product contains 5-10% tetrapotassium pyrophosphate (TPPP) CAS# 7320-34-5. TPPP is listed by WHMIS as a hazardous ingredient. TPPP is corrosive to aluminum.

4 First-aid measures

SKIN CONTACT:
Wash thoroughly with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

EYE CONTACT:
Remove contact lenses. Hold eyelids apart. Immediately flush eyes with plenty of low-pressure water for at least 15 minutes. Get immediate medical attention.

INHALATION:
If nasal, throat or lung irritation develops - remove to fresh air and get medical attention.

INGESTION:
Do not feed anything by mouth to an unconscious or convulsive victim. Do not induce vomiting. Immediately contact physician. Dilute contents of stomach using 2-8 fluid ounces (60-240 mL) of milk or water.

NOTES TO PHYSICIANS:
No special instructions

5 Fire-fighting measures

FIRE FIGHTING INSTRUCTIONS:
Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).
EXTINGUISHING MEDIA:
dry chemical, carbon dioxide, foam or water
HAZARDOUS DECOMPOSITION PRODUCTS:
oxides of phosphorus
FLASH POINT:
> 200F > 93C P-M(CC)

6 Accidental release measures

PROTECTION AND SPILL CONTAINMENT:
Ventilate area. Use specified protective equipment. Contain and absorb on absorbent material. Place in waste disposal container. Flush area with water. Wet area may be slippery. Spread sand/grit.
DISPOSAL INSTRUCTIONS:
Water contaminated with this product may be sent to a sanitary sewer treatment facility,in accordance with any local agreement,a permitted waste treatment facility or discharged under a permit. Product as is - Incinerate or land dispose in an approved landfill.

7 Handling and storage

HANDLING:
Normal chemical handling.
STORAGE:
Keep containers closed when not in use. Reasonable and safe chemical storage.

8 Exposure controls / personal protection

EXPOSURE LIMITS

CHEMICAL NAME

TETRAPOTASSIUM PYROPHOSPHATE
PEL (OSHA): NOT DETERMINED
TLV (ACGIH): NOT DETERMINED

ENGINEERING CONTROLS:
adequate ventilation
PERSONAL PROTECTIVE EQUIPMENT:
Use protective equipment in accordance with 29CFR 1910 Subpart I
RESPIRATORY PROTECTION:
A RESPIRATORY PROTECTION PROGRAM THAT MEETS OSHA'S 29 CFR 1910.134 AND ANSI Z88.2 REQUIREMENTS MUST BE FOLLOWED WHENEVER WORKPLACE CONDITIONS WARRANT A RESPIRATOR'S USE.
USE AIR PURIFYING RESPIRATORS WITHIN USE LIMITATIONS ASSOCIATED WITH THE EQUIPMENT OR ELSE USE SUPPLIED AIR-RESPIRATORS.
If air-purifying respirator use is appropriate, use any of the following particulate respirators: N95, N99, N100, R95, R99, R100, P95, P99 or P100.
SKIN PROTECTION:
rubber, butyl, viton or neoprene gloves -- Wash off after

each use. Replace as necessary.

EYE PROTECTION:

splash proof chemical goggles

9 Physical and chemical properties

Spec. Grav.(70F,21C)	1.528	Vapor Pressure (mmHG)	~ 18.0
Freeze Point (F)	< < 0	Vapor Density (air=1)	< 1.00
Freeze Point (C)	< -18		
Viscosity(cps 70F,21C)	30	% Solubility (water)	100.0

Odor		None
Appearance		Colorless
Physical State		Liquid
Flash Point	P-M(CC)	> 200F > 93C
pH As Is (approx.)		8.8
Evaporation Rate (Ether=1)		< 1.00
Percent VOC:		0.0

NA = not applicable ND = not determined

10 Stability and reactivity

CHEMICAL STABILITY:

Stable under normal storage conditions.

POSSIBILITY OF HAZARDOUS REACTIONS:

INCOMPATIBILITIES:

May react with strong oxides.

DECOMPOSITION PRODUCTS:

oxides of phosphorus

11 Toxicological information

Oral LD50 RAT:	>2,000 mg/kg
NOTE - Estimated value	
Dermal LD50 RABBIT:	>2,000 mg/kg
NOTE - Estimated value	

12 Ecological information

AQUATIC TOXICOLOGY

Daphnia magna 48 Hour Static Renewal Bioassay
LC50= 1275; No Effect Level= 500 mg/L
Fathead Minnow 96 Hour Static Renewal Bioassay
LC50= 1740; No Effect Level= 1000 mg/L
Mysid Shrimp 48 Hour Static Renewal Bioassay
LC50= 724; No Effect Level= 155 mg/L
Rainbow Trout 96 Hour Acute Toxicity (Estimated)
LC50 Greater Than= 1000 mg/L

BIODEGRADATION

Product contains only inorganics that are not subject to typical biological degradation. Assimilation by microbes may occur in waste treatment or the environment.

13 Disposal considerations

If this undiluted product is discarded as a waste, the US RCRA hazardous waste identification number is :
Not applicable.

Please be advised; however, that state and local requirements for waste disposal may be more restrictive or otherwise different from federal regulations. Consult state and local regulations regarding the proper disposal of this material.

14 Transport information

Transportation Hazard: Corrosive to aluminum
DOT: CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.(TETRAPOTASSIUM PYROPHOSPHATE)
8, UN 3266, PG III
DOT EMERGENCY RESPONSE GUIDE #: 154
Note: Some containers may be DOT exempt, please check BOL for exact container classification
IATA: CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.(TETRAPOTASSIUM PYROPHOSPHATE)
8, UN 3266, PG III
IMDG: CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.(TETRAPOTASSIUM PYROPHOSPHATE)
8, UN 3266, PG III

15 Regulatory information

TSCA:
All components of this product are included on or are in compliance with the U.S. TSCA regulations.
CERCLA AND/OR SARA REPORTABLE QUANTITY (RQ):
No regulated constituent present at OSHA thresholds
FOOD AND DRUG ADMINISTRATION:
21 CFR 176.170 (components of paper and paperboard in contact with aqueous and fatty foods)
NSF Registered and/or meets USDA (according to 1998 Guidelines):
Registration number: Not Registered
SARA SECTION 312 HAZARD CLASS:
Immediate(acute)
SARA SECTION 302 CHEMICALS:
No regulated constituent present at OSHA thresholds
SARA SECTION 313 CHEMICALS:
No regulated constituent present at OSHA thresholds
CALIFORNIA REGULATORY INFORMATION

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):
No regulated constituents present

MICHIGAN REGULATORY INFORMATION

No regulated constituent present at OSHA thresholds

16 Other information

HMIS vII		**CODE TRANSLATION**
Health	1	Slight Hazard
Fire	1	Slight Hazard
Reactivity	0	Minimal Hazard
Special	NONE	No special Hazard
(1) Protective Equipment	B	Goggles,Gloves

(1) refer to section 8 of MSDS for additional protective equipment recommendations.

CHANGE LOG

	EFFECTIVE DATE	REVISIONS TO SECTION:	SUPERCEDES
MSDS status:	29-JAN-1997		** NEW **
	05-NOV-1997	2,3,8,16	29-JAN-1997
	10-DEC-1997	12	05-NOV-1997
	02-MAR-1998	12	10-DEC-1997
	21-NOV-2001	15	02-MAR-1998
	04-JAN-2002	2,3,4,8,16	21-NOV-2001
	13-JUN-2002	2	04-JAN-2002
	10-JUL-2002	12	13-JUN-2002
	19-NOV-2003	3,16	10-JUL-2002
	30-SEP-2008	3,4,5,8,10	19-NOV-2003
	12-MAR-2010	2,5,14	30-SEP-2008

GE Power & Water
Water & Process Technologies

SAFETY DATA SHEET

SPECTRUS* BD1501E

1. Product and Company Identification

Material name	**SPECTRUS BD1501E**
Version #	2.0
Revision date	Aug-17-2015
Supersedes date	Apr-20-2015
Prepared by	This SDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).
Chemical description	Blend of nonionic surfactants in aqueous solution
CAS#	Mixture
Product application	Biodispersant

Company/undertaking identification

GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency telephone

(800) 877-1940

2. Hazards Identification

Emergency overview	May cause moderate irritation to the skin. Severe irritant to the eyes. Mists/aerosols may cause irritation to upper respiratory tract.
Potential health effects	
Eyes	Severe irritant to the eyes.
Skin	Primary route of exposure May cause moderate irritation to the skin.
Inhalation	Mists/aerosols may cause irritation to upper respiratory tract.
Ingestion	May cause gastrointestinal irritation
Target organs	No evidence of potential chronic effects.
Signs and symptoms	May cause redness or itching of skin, tearing and pain in eyes (direct contact).
Medical conditions aggravated by exposure	None known.

3. Composition / Information on Ingredients

Components	CAS#	Percent (wt/wt)
Alcohols, C10, alkoxylated	166736-08-9	10 - 30

Composition comments Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

4. First Aid Measures

First aid procedures

Inhalation If nasal, throat or lung irritation develops - remove to fresh air and get medical attention.

Skin contact	Wash off with soap and water. Take off contaminated clothing and wash before reuse. Get medical attention if irritation develops and persists.
Eye contact	Immediately flush eyes with plenty of low-pressure water for at least 30 minutes while removing contact lenses. Keep eyelids apart. Get medical attention immediately.
Ingestion	If swallowed, rinse mouth with water (only if the person is conscious). Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. Immediately contact a physician. Dilute contents of stomach using 2-8 fluid ounces (60-240ml) of milk or water.
Notes to physician	No specific antidotes are recommended.

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media	Dry chemical, CO2, water spray or regular foam.

Protection of firefighters

Protective equipment for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray. Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).

Explosion data

Sensitivity to static discharge	Not available.
Sensitivity to mechanical impact	Not available.

6. Accidental Release Measures

Personal precautions	Wear appropriate protective equipment and clothing during clean-up. Avoid contact with spilled material. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground. Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements.
Methods for cleaning up	Ventilate area, use specified protective equipment. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Flush with plenty of water. Spread sand/grit.

7. Handling and Storage

Handling	Do not get this material in contact with eyes. Avoid breathing mist or vapor. Avoid contact with skin. Avoid prolonged exposure. Avoid contact with clothing. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.
Storage	Store in original tightly closed container. Store in cool, well ventilated area. Store away from oxidizers.

8. Exposure Controls / Personal Protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Engineering controls	Adequate ventilation to maintain air contaminants below exposure limits.

Personal protective equipment

Eye/face protection	Splash proof chemical goggles.
Skin protection	Wear suitable protective clothing. Chemical resistant gloves. The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Chemical resistant apron. Glove selection must take into account any solvents and other hazards present. Impervious gloves. Wash off after each use. Replace as necessary.
Respiratory protection	If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

9. Physical & Chemical Properties

Appearance

Physical state	Liquid
Color	Colorless
Odor	Mild

Odor threshold	Not available.
pH (concentrated product)	6.7
Vapor pressure	18 mm Hg
Vapor pressure temp.	70 °F (21 °C)
Vapor density	< 1 (Air = 1)
Boiling point	220 °F (104 °C)
Melting point/Freezing point	31 °F (-1 °C)
Solubility (water)	100 %
Specific gravity (70°F, 21°C)	1.02
Flash point	Not applicable.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Auto-ignition temperature	Not available.
Evaporation rate	< 1 (Ether = 1)
Viscosity	110 cps
Viscosity temperature	70 °F (21 °C)
Percent volatile	0 (Estimated)
Pour point	36 °F (2 °C)

10. Chemical Stability & Reactivity Information

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Avoid contact with strong oxidizers. Protect from freezing.
Incompatible materials	Strong oxidizing substances.
Hazardous decomposition products	Oxides of carbon evolved in fire.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use. Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Product	Species	Test Results
SPECTRUS BD1501E (CAS Mixture)		
Acute		
Oral		
LD50	Rat	3571 mg/kg, (Calculated according to GHS additivity formula (Category 5))

Components	Species	Test Results
Alcohols, C10, alkoxylated (CAS 166736-08-9)		
Acute		
Oral		
LD50	Rat	500 - 2000 mg/kg

12. Ecological Information

Ecotoxicity

Product		Species	Test Results
SPECTRUS BD1501E (CAS Mixture)			
	IC25	Ceriodaphnia	39.9 mg/l, Chronic Bioassay, 7 day
	LC50	Ceriodaphnia	200 mg/l, Static Renewal Bioassay, 48 hour

Product		Species	Test Results
		Fathead Minnow	82.5 mg/l, Static Renewal Bioassay, 96 hour
	NOEL	Ceriodaphnia	100 mg/l, Static Renewal Bioassay, 48 hour
			25 mg/l, Chronic Bioassay, 7 day
		Fathead Minnow	31.3 mg/l, Static Renewal Bioassay, 96 hour
Aquatic			
Crustacea	LC50	Daphnia magna	38.2 mg/l, Static Renewal Bioassay, 48 hour
	NOEL	Daphnia magna	12.5 mg/l, Static Renewal Bioassay, 48 hour
Fish	LC50	Rainbow Trout	141.4 mg/l, Static Renewal Bioassay, 96 hour
	NOEL	Rainbow Trout	100 mg/l, Static Renewal Bioassay, 96 hour

Persistence and degradability

No data available

- **COD (mgO2/g)** 647 (calculated data)
- **BOD 5 (mgO2/g)** 0 (calculated data)
- **BOD 28 (mgO2/g)** 0 (calculated data)
- **TOC (mgC/g)** 0 (calculated data)

13. Disposal Considerations

Disposal instructions Dispose of contents/container in accordance with local/regional/national/international regulations.

Waste from residues/unused products Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner.

Contaminated packaging Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport Information

TDG

Not regulated as dangerous goods.

DOT

Not regulated as a dangerous good.

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

IMDG

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

15. Regulatory Information

WHMIS status Controlled

WHMIS classification D2B - Other Toxic Effects-TOXIC

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other Information

List of abbreviations
Not available.

HMIS® ratings
Health: 2
Flammability: 1
Physical hazard: 0
Personal protection: B

NFPA ratings
Health: 2
Flammability: 1
Instability: 0
Special hazards: NONE

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

This data sheet contains changes from the previous version in section(s):
Product and Company Identification: Commercial Names
Composition / Information on Ingredients: Ingredients
Exposure Controls / Personal Protection: Respiratory protection
Physical & Chemical Properties: Multiple Properties
Chemical Stability & Reactivity Information: Incompatible materials
GHS: Classification

* Trademark of General Electric Company. May be registered in one or more countries.

GE Power
Water & Process Technologies

SAFETY DATA SHEET

SODIUM HYPOCHLORITE

1. Product and Company Identification

Material name	**SODIUM HYPOCHLORITE**
Version #	2.0
Revision date	Mar-30-2016
Supersedes date	Apr-30-2010
Prepared by	This SDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).
CAS #	Mixture
L code	L1228
Product application	Field test reagent

Company/undertaking identification

GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency telephone

(800) 877-1940

2. Hazards Identification

Emergency overview	Severe irritant to the skin. Corrosive to the eyes. Vapors, gases, mists and/or aerosols cause irritation to the upper respiratory tract.
Potential health effects	
Eyes	Corrosive to eyes
Skin	Primary route of exposure; Severe irritant to the skin.
Inhalation	Vapors, gases, mists or aerosols cause irritation to the upper respiratory tract.
Ingestion	May cause severe gastrointestinal irritation.
Target organs	Prolonged or repeated exposures may cause primary irritant dermatitis.
Signs and symptoms	May cause redness or itching of the skin, irritation and/or tearing of eyes (direct contact).
Medical conditions aggravated by exposure	None known.

3. Composition / Information on Ingredients

Components	CAS#	Percent (wt/wt)
Sodium Hypochlorite	7681-52-9	0.5 - 1.5

Composition comments Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

4. First Aid Measures

First aid procedures

Inhalation Move to fresh air. If breathing stops, provide artificial respiration. For breathing difficulties, oxygen may be necessary. Get medical attention immediately.

Skin contact	Wash off with soap and water. Take off contaminated clothing and wash before reuse. Get medical attention if irritation develops and persists.
Eye contact	Immediately flush eyes with plenty of low-pressure water for at least 30 minutes while removing contact lenses. Keep eyelids apart. Get medical attention immediately.
Ingestion	If swallowed, rinse mouth with water (only if the person is conscious). Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. Call a physician immediately. Dilute contents of stomach using 2-8 fluid ounces (60-240ml) of milk or water.
Notes to physician	No specific antidotes are recommended.

5. Fire Fighting Measures

Extinguishing media	
Suitable extinguishing media	Dry chemical, CO2, water spray or regular foam.
Unsuitable extinguishing media	Not available.
Protection of firefighters	
Protective equipment for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray. Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).
Explosion data	
Sensitivity to static discharge	Not available.
Sensitivity to mechanical impact	Not available.

6. Accidental Release Measures

Personal precautions	Wear appropriate protective equipment and clothing during clean-up. Avoid contact with spilled material. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground. Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements.
Methods for cleaning up	Ventilate area, use specified protective equipment. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Spill residue may be neutralized with soda ash.

7. Handling and Storage

Handling	Contains an oxidiser. Avoid all contact with reducing agents, oils, greases, organics and acids. Do not allow to dry.
Storage	Store in a cool, well-ventilated area, away from combustibles. Keep containers closed when not in use. Do not freeze. If frozen, thaw completely and mix thoroughly prior to use.

8. Exposure Controls / Personal Protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Engineering controls	Adequate ventilation to maintain air contaminants below exposure limits.
Personal protective equipment	
Eye/face protection	Splash proof chemical goggles.
Skin protection	Wear suitable protective clothing. Chemical resistant gloves. The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Glove selection must take into account any solvents and other hazards present. neoprene gloves Wash off after each use. Replace as necessary.
Respiratory protection	If air-purifying respirator use is appropriate, use a respirator with acid gas cartridges and dust/mist prefilters.

9. Physical & Chemical Properties

Appearance	
Physical state	Liquid
Color	Straw colored
Odor	Chlorine

Odor threshold	Not available.
pH (concentrated product)	9.5
Vapor pressure	Not available.
Vapor density	(Air = 1)
Boiling point	Not available.
Melting point/Freezing point	Not available.
Solubility (water)	Not available.
Specific gravity (70°F, 21°C)	Not available.
Flash point	> 200 °F (> 93 °C) P-M(CC)
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Auto-ignition temperature	Not available.
Viscosity temperature	70 °F (21 °C)

10. Chemical Stability & Reactivity Information

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Not available.
Incompatible materials	Decomposes dry (175-245°C) or wet (24°C) with release of chlorine. Reacts with oxidizers. Friction, heat or other sources of ignition may cause a violent reaction releasing heat and toxic fumes. Contact with reducing agents or flammable/combustible material may cause fire or explosion.
Hazardous decomposition products	Chlorine. and Hydrogen chloride.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Product	Species	Test Results
SODIUM HYPOCHLORITE (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	> 5000 mg/kg, (Calculated according to GHS additivity formula)
Inhalation		
LC50	Rat	> 5 mg/l, 4 Hours, (Calculated according to GHS additivity formula)
Oral		
LD50	Rat	> 5000 mg/kg, (Calculated according to GHS additivity formula)

Components	Species	Test Results
Sodium Hypochlorite (CAS 7681-52-9)		
Acute		
Dermal		
LD50	Rabbit	> 20000 mg/kg
Inhalation		
LC50	Rat	> 5.25 mg/L, 4 Hour
Oral		
LD50	Rat	8900 mg/kg

Carcinogenicity

IARC Monographs. Overall Evaluation of Carcinogenicity

Sodium Hypochlorite (CAS 7681-52-9) 3 Not classifiable as to carcinogenicity to humans.

Mutagenicity	Not available.
Reproductive effects	Not available.
Teratogenicity	Not available.

12. Ecological Information

Ecotoxicity	No ecotoxicity data noted for the ingredient(s).

13. Disposal Considerations

Disposal instructions	Dispose of contents/container in accordance with local/regional/national/international regulations.
Waste from residues / unused products	Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner.
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport Information

TDG

Not regulated as dangerous goods.

The goods described above have been classified using a combination of testing, technical data, calculations and manufacturer knowledge in accordance with Part 2, Classification.

DOT

Not regulated as a dangerous good.

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

IMDG

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

15. Regulatory Information

WHMIS status	Controlled
WHMIS classification	D2B - Other Toxic Effects-TOXIC

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other Information

List of abbreviations

CAS: Chemical Abstract Service Registration Number
TSRN indicates a Trade Secret Registry Number is used in place of the CAS number.
ACGIH: American Conference of Governmental Industrial Hygienists
TWA: Time Weighted Average
STEL: Short Term Exposure Limit
LD50: Lethal Dose, 50%
LC50: Lethal Concentration, 50%
NOEL: No Observed Effect Level
COD: Chemical Oxygen Demand
BOD: Biochemical Oxygen Demand
TOC: Total Organic Carbon
IATA: International Air Transport Association

	IMDG: International Maritime Dangerous Goods Code
HMIS® ratings	Health: 3 Flammability: 0 Physical hazard: 0 Personal protection: B
NFPA ratings	Health: 2 Flammability: 1 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
This data sheet contains changes from the previous version in section(s):	Product and Company Identification: Physical States Toxicological Information: Toxicological Data HazReg Data: North America GHS: Classification

GE
Water & Process Technologies

Material Safety Data Sheet

Issue Date: 11-MAY-2006
Supercedes: 11-MAY-2006

SULFURIC ACID, CONCENTRATED

1 Identification

Identification of substance or preparation
SULFURIC ACID, CONCENTRATED

Reagent Application Area
Field test reagent

Reagent Code
L273

Company/Undertaking Identification
GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency Telephone
(800) 877-1940

Prepared by Product Stewardship Group: T 215-355-3300 Prepared on: 11-MAY-2006

2 Hazard(s) identification

****
EMERGENCY OVERVIEW

Corrosive to skin. Corrosive to the eyes. Mists/aerosols cause irritation to the upper respiratory tract.

Odor: None; Appearance: Colorless To Brown, Liquid

Fire fighters should wear positive pressure self-contained breathing apparatus(full face-piece type). Proper fire-extinguishing media: dry chemical, carbon dioxide or foam--Avoid water if possible.
****

POTENTIAL HEALTH EFFECTS

ACUTE SKIN EFFECTS:
Primary route of exposure; Corrosive to skin.

ACUTE EYE EFFECTS:
Corrosive to the eyes.

ACUTE RESPIRATORY EFFECTS:
Mists/aerosols cause irritation to the upper respiratory tract.

INGESTION EFFECTS:
May cause severe irritation or burning of mouth, throat, and gastrointestinal tract with severe chest and abdominal pain, nausea, vomiting, diarrhea, lethargy and collapse. Possible death when ingested in very large doses.

TARGET ORGANS:
Prolonged or repeated exposures may cause tissue necrosis.

MEDICAL CONDITIONS AGGRAVATED:
Not known.

SYMPTOMS OF EXPOSURE:
Causes severe irritation, burns or tissue ulceration with subsequent scarring.

3 Composition / information on ingredients

Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

HAZARDOUS INGREDIENTS:

Cas#	Chemical Name	Range(w/w%)
7664-93-9	SULFURIC ACID Corrosive ORAL LD50-RAT: 2,140 MG/KG DERMAL LD50: NO DATA. INHL. LC50-RAT: 510 MG/M3/2HR	60-100

4 First-aid measures

SKIN CONTACT:
URGENT! Wash thoroughly with soap and water. Remove contaminated clothing. Get immediate medical attention. Thoroughly wash clothing before reuse.

EYE CONTACT:
URGENT! Immediately flush eyes with plenty of low-pressure water for at least 20 minutes while removing contact lenses. Hold eyelids apart. Get immediate medical attention.

INHALATION:
Remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get immediate medical attention.

INGESTION:
Do not feed anything by mouth to an unconscious or convulsive victim. Do not induce vomiting. Immediately contact physician. Dilute contents of stomach using 2-8 fluid ounces (60-240 mL) of milk or water.

NOTES TO PHYSICIANS:
Material is corrosive. It may not be advisable to induce vomiting. Possible mucosal damage may contraindicate the use of gastric lavage.

5 Fire-fighting measures

FIRE FIGHTING INSTRUCTIONS:
Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).
EXTINGUISHING MEDIA:
dry chemical, carbon dioxide or foam--Avoid water if possible.
HAZARDOUS DECOMPOSITION PRODUCTS:
elemental oxides
FLASH POINT:
> 200F > 93C P-M(CC)

6 Accidental release measures

PROTECTION AND SPILL CONTAINMENT:
Ventilate area. Use specified protective equipment. Contain and absorb on absorbent material. Place in waste disposal container. Flush area with water. Wet area may be slippery. Spread sand/grit.
DISPOSAL INSTRUCTIONS:
The waste characteristics of the absorbed material, or any contaminated soil, should be determined in accordance with provincial regulations. Water contaminated with this product may be sent to a sanitary sewer treatment facility, in accordance with any local agreement or discharged under provincial regulations.
Incinerate or land dispose in an approved landfill.

7 Handling and storage

HANDLING:
Acidic. Corrosive to skin and eyes. Do not breathe mist or vapor. Do not mix with alkaline material.
STORAGE:
Keep containers closed when not in use. Use approved containers only. Store in cool, well-vented area. Contact with metals may release flammable hydrogen gas.

8 Exposure controls / personal protection

EXPOSURE LIMITS
Consult local authorities for acceptable provincial values.

CHEMICAL NAME

SULFURIC ACID
PEL (OSHA): 1 MG/M3
TLV (ACGIH): 0.2 MG/M3

ENGINEERING CONTROLS:
Adequate ventilation to maintain air contaminants below exposure limits.
RESPIRATORY PROTECTION:
If air-purifying respirator use is appropriate, use a respirator with acid gas cartridges and dust/mist prefilters.
SKIN PROTECTION:

gauntlet-type neoprene gloves, chemical resistant apron-- Wash off after each use. Replace as necessary.

EYE PROTECTION:

splash proof chemical goggles, face shield

9 Physical and chemical properties

Specific Grav.(70F,21C)	1.838	Vapor Pressure (mmHG)	~ 4.0
Freeze Point (F)	< -30	Vapor Density (air=1)	< 0.10
Freeze Point (C)	< -34		
Viscosity(cps 70F,21C)	50	% Solubility (water)	100.0

Odor		None
Appearance		Colorless To Brown
Physical State		Liquid
Flash Point	P-M(CC)	> 200F > 93C
pH As Is (approx.)		< 1.0
Evaporation Rate (Ether=1)		< 1.00
Percent VOC:		ND

NA = not applicable ND = not determined

10 Stability and reactivity

STABILITY:

Stable under normal storage conditions.

HAZARDOUS POLYMERIZATION:

Will not occur.

INCOMPATIBILITIES:

May react with bases or strong oxidizers.

DECOMPOSITION PRODUCTS:

elemental oxides

11 Toxicological information

Oral LD50 RAT:	2,140 mg/kg
Dermal LD50 RABBIT:	>1,000 mg/kg
NOTE - Estimated value	
Inhalation LC50 RAT:	510 mg/m3/2hr
Skin Irritation Score RABBIT:	CORROSIVE
NOTE - Based on testing of similar product	
Eye Irritation Score RABBIT:	CORROSIVE
NOTE - Estimated value	

12 Ecological information

AQUATIC TOXICOLOGY

No Data Available.

BIODEGRADATION

No Data Available.

13 Disposal considerations

Incinerate or bury in approved landfill. Please be advised that there may be additional local or provincial requirements relating to the disposal of waste. Consult provincial and local regulations regarding the proper disposal of this material.

14 Transport information

Transportation of Dangerous Goods:

SULPHURIC ACID
8, UN 1830, PG II

DOT EMERGENCY RESPONSE GUIDE #: 137

15 Regulatory information

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

CEPA:

All components of this product comply with substance notification requirements under CEPA.

WHMIS CLASSIFICATION:

E

NSF Registered and/or meets USDA (according to 1998 Guidelines):

16 Other information

HMIS vII		**CODE TRANSLATION**
Health	3	Serious Hazard
Fire	0	Minimal Hazard
Reactivity	0	Minimal Hazard
Special	CORR	DOT corrosive
(1) Protective Equipment	D	Goggles,Face Shield,Gloves,Apron

(1) refer to section 8 of MSDS for additional protective equipment recommendations.

CHANGE LOG

	EFFECTIVE DATE	REVISIONS TO SECTION:	SUPERCEDES
MSDS status:	03-MAY-1996	REVISED FORMAT	** NEW **
	17-JAN-1997	14	03-MAY-1996
	08-JUN-1998	15;EDIT:9	17-JAN-1997
	05-JAN-1999	10	08-JUN-1998
	10-DEC-2001		05-JAN-1999
	21-FEB-2002	4	10-DEC-2001
	25-JAN-2005	16	21-FEB-2002
	11-MAY-2006	8	25-JAN-2005

GE Power & Water
Water & Process Technologies

SAFETY DATA SHEET

SOLUS AP24

1. Product and Company Identification

Material name	**SOLUS AP24**
Version #	5.1
Revision date	06/03/2014
Supersedes date	06/03/2014
CAS #	Mixture
Product application	Internal boiler water treatment

Company/undertaking identification

GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency telephone

(800) 877-1940

2. Hazards Identification

Emergency overview	CAUTION May cause slight irritation to the eyes. Mists/aerosols may cause irritation to upper respiratory tract. Non-hazardous to skin.
Potential health effects	
Eyes	May cause slight irritation to the eyes.
Skin	Primary route of exposure Non-hazardous to skin.
Inhalation	Mists/aerosols may cause irritation to upper respiratory tract.
Ingestion	May cause slight gastrointestinal irritation with possible nausea, vomiting, abdominal discomfort and diarrhea.
Target organs	No evidence of potential chronic effects.
Signs and symptoms	Inhalation may cause irritation of respiratory tract. May cause redness or itching of skin.
Medical conditions aggravated by exposure	None known.

3. Composition / Information on Ingredients

The components are not hazardous or are below required disclosure limits.

Composition comments	Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

4. First Aid Measures

First aid procedures

Eye contact	Rinse immediately with plenty of water for at least 15 minutes. If easy to do remove contact lenses. Hold eyelids apart. Get medical attention immediately.
Skin contact	Wash thoroughly with soap and water. Remove contaminated clothing. Get medical attention if irritation develops and persists. Wash clothing separately before reuse.

Inhalation	Remove to fresh air. Get medical attention if symptoms occur.
Ingestion	Do not feed anything by mouth to an unconscious or convulsive victim. Do NOT induce vomiting! Immediately contact a physician. If vomiting occurs naturally have victim lean forward to reduce risk of aspiration.
Notes to physician	No other instruction than the ones already informed.

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media	Foam. Dry chemical powder. Carbon dioxide (CO2). Water.

Protection of firefighters

Protective equipment for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	Not available.

Explosion data

Sensitivity to static discharge	Not available.
Sensitivity to mechanical impact	Not available.
Hazardous combustion products	Oxides of carbon Oxides of nitrogen. Oxides of sulphur. Oxides of phosphorus

6. Accidental Release Measures

Personal precautions	Avoid inhalation of vapors and spray mists. Please refer also to section no. 8 'Exposure controls' for further information.
Methods for containment	Stop the flow of material, if this is without risk. Absorb spillage to prevent material damage. Scoop up used absorbent into drums or other appropriate container. If sweeping of a contaminated area is necessary use a dust suppressant agent which does not react with the product.
Methods for cleaning up	Contain and recover by physical means. Absorb onto inert material and dispose of according to Hazardous Waste Regulations. Clean with water. Spread sand/grit.

7. Handling and Storage

Handling	Normal chemical handling.
Storage	Store in tightly closed original container in a dry, cool and well-ventilated place. Store away from strong oxidizers.

8. Exposure Controls / Personal Protection

Occupational exposure limits

No exposure limits noted for ingredient(s).

Engineering controls	Adequate ventilation to maintain air contaminants below exposure limits.

Personal protective equipment

Eye / face protection	Splash proof chemical goggles.
Skin protection	Rubber, butyl, viton or neoprene gloves. Wash off after each use. Replace as necessary.
Respiratory protection	If air-purifying respirator use is appropriate, use any of the following particulate respirators: N95, N99, N100, R95, R99, R100, P95, P99 or P100.

9. Physical & Chemical Properties

Appearance

Physical state	Liquid
Color	Amber
Odor	Slight ammonia
Odor threshold	Not available.
pH (concentrated product)	12.3
pH in aqueous solution	11 (5% SOL.)
Vapor pressure	18 mm Hg
Vapor pressure temp.	70 °F (21 °C)
Vapor density	< 1 (Air = 1)
Boiling point	220 °F (104 °C)

Melting point/Freezing point	28 °F (-2 °C)
Solubility (water)	100 %
Specific gravity (70 °F, 21 °C)	1.087
Flash point	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Auto-ignition temperature	Not available.
Evaporation rate	< 1 (Ether = 1)
Viscosity	22 cps
Viscosity temperature	70 °F (21 °C)
Percent volatile	0 (Estimated)
Pour point	33 °F (1 °C)

10. Chemical Stability & Reactivity Information

Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Not available.
Incompatible materials	Strong oxidizing substances.
Hazardous decomposition products	Oxides of carbon, nitrogen, phosphorus, and sulphur evolved in fire.

11. Toxicological Information

Toxicological information	Mild eye irritation score estimated based upon ingredient data.
Acute effects	This product contains no known ingredients that exhibit hazards that are required by the U.S. OSHA HAZARD COMMUNICATION STANDARD or WHMIS to be listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

12. Ecological Information

Ecotoxicity

Product		Species	Test Results
SOLUS AP24 (CAS Mixture)			
	LC50	Fathead Minnow	> 5000 mg/l, Static Bioassay with 48-Hour Renewal, 96 hour, (pH adjusted)
	NOEL	Fathead Minnow	5000 mg/l, Static Bioassay with 48-Hour Renewal, 96 hour, (pH adjusted)
Crustacea	LC50	Daphnia magna	3674 mg/l, Static Acute Bioassay, 48 hour, (pH adjusted)
	NOEL	Daphnia magna	2500 mg/l, Static Acute Bioassay, 48 hour, (pH adjusted)
Other	LC50	Rainbow Trout	> 5000 mg/l, Static Bioassay with 48-Hour Renewal, 96 hour, (pH adjusted)
	NOEL	Rainbow Trout	5000 mg/l, Static Bioassay with 48-Hour Renewal, 96 hour, (pH adjusted)

13. Disposal Considerations

Disposal instructions	Via an authorized waste disposal contractor to an approved waste disposal site, observing all local and national regulations.

14. Transport Information

TDG

Not regulated as dangerous goods.

DOT

Not regulated as a dangerous good.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory Information

WHMIS status Non-controlled

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

16. Other Information

List of abbreviations

CAS: Chemical Abstract Service Registration Number
TSRN indicates a Trade Secret Registry Number is used in place of the CAS number.
ACGIH: American Conference of Governmental Industrial Hygienists
NOEL: No Observed Effect Level
STEL: Short Term Exposure Limit
LC50: Lethal Concentration, 50%
TWA: Time Weighted Average
BOD: Biochemical Oxygen Demand
COD: Chemical Oxygen Demand
TOC: Total Organic Carbon
IATA: International Air Transport Association
IMDG: International Maritime Dangerous Goods Code
LD50: Lethal Dose, 50%
NFPA: National Fire Protection Association

HMIS® ratings

Health: 1
Flammability: 1
Physical hazard: 0
Personal protection: B

NFPA ratings

Health: 1
Flammability: 1
Instability: 0
Special hazards: NONE

This data sheet contains changes from the previous version in section(s):

Handling and Storage: Handling
Chemical Stability & Reactivity Information: Conditions to avoid

Prepared by

This MSDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).

GE Power & Water
Water & Process Technologies

SAFETY DATA SHEET

STEAMATE* PAS6066

1. Product and Company Identification

Material name	**STEAMATE PAS6066**
Version #	2.0
Revision date	Jun-03-2015
Supersedes date	Aug-30-2013
Prepared by	This SDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).
CAS#	Mixture
Product application	Condensate return line treatment

Company/undertaking identification

GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency telephone

(800) 877-1940

2. Hazards Identification

Potential health effects

Eyes	Corrosive to eyes
Skin	Primary route of exposure Corrosive to skin May be absorbed by skin. Skin sensitizer.
Inhalation	Primary route of exposure Vapors, gases, mists or aerosols may cause irritation to the upper respiratory tract. Prolonged exposure may cause dizziness and headache.
Ingestion	Toxic if swallowed. May cause severe irritation or burning of mouth, throat, and gastrointestinal tract with severe chest and abdominal pain, nausea, vomiting, diarrhea, lethargy and collapse. Possible death when ingested in very large doses.
Target organs	Prolonged or repeated exposures may cause primary irritant dermatitis, skin sensitization, and/or toxicity to the liver, kidney, and lung.
Signs and symptoms	Causes severe irritation or burns, and skin sensitization.
Medical conditions aggravated by exposure	Asthma, allergies, skin disorders, and chronic respiratory disease.

3. Composition / Information on Ingredients

Components	CAS #	Percent (wt/wt)
Cyclohexylamine	108-91-8	15 - 40
Morpholine	110-91-8	10 - 30
N,N Diethylhydroxylamine	3710-84-7	10 - 30
Dimethylaminopropylamine (DMAPA)	109-55-7	3 - 7

Composition comments Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

4. First Aid Measures

First aid procedures

Inhalation Move to fresh air. If breathing stops, provide artificial respiration. For breathing difficulties, oxygen may be necessary. Get medical attention immediately.

Skin contact Wash off with soap and water. Get medical attention immediately. Take off contaminated clothing and wash before reuse.

Eye contact Remove contact lenses, if present and easy to do. Get medical attention immediately. Immediately flush eyes with plenty of low-pressure water for at least 30 minutes while removing contact lenses. Keep eyelids apart.

Ingestion If swallowed, rinse mouth with water (only if the person is conscious). Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. Get medical attention if symptoms occur. Dilute contents of stomach using 2-8 fluid ounces (60-240ml) of milk or water.

Notes to physician No specific antidotes are recommended.

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media Foam. Dry chemical powder. Dry chemical, CO2, water spray or regular foam.

Protection of firefighters

Protective equipment for firefighters Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

Fire fighting equipment/instructions In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray.

Explosion data

Sensitivity to static discharge Not available.

Sensitivity to mechanical impact Not available.

6. Accidental Release Measures

Personal precautions Wear appropriate protective equipment and clothing during clean-up. Avoid inhalation of vapors and spray mists. Avoid contact with spilled material. See Section 8 of the MSDS for Personal Protective Equipment. Please refer also to section no. 8 'Exposure controls' for further information.

Environmental precautions Avoid discharge into drains, water courses or onto the ground. Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements.

Methods for containment Stop the flow of material, if this is without risk. Absorb spillage to prevent material damage. Scoop up used absorbent into drums or other appropriate container. If sweeping of a contaminated area is necessary use a dust suppressant agent which does not react with the product.

Methods for cleaning up Ventilate the area. Flush with plenty of water. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Spread sand/grit. Contain and recover by physical means. Absorb onto inert material and dispose of according to Hazardous Waste Regulations. Clean with water.

7. Handling and Storage

Handling Combustible. Avoid heat, sparks, open flames and other ignition sources. Ground and bond containers when transferring material. No special precautions are necessary beyond normal good hygiene practices. See Section 8 of the MSDS for additional personal protection advice when handling this product.

Storage Keep container tightly closed in a dry and well-ventilated place. Store away from strong oxidizers. Keep away from all sources of ignition. Store in tightly closed original container in a dry, cool and well-ventilated place.

8. Exposure Controls / Personal Protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Cyclohexylamine (CAS 108-91-8)	TWA	10 ppm
Morpholine (CAS 110-91-8)	TWA	20 ppm
N,N Diethylhydroxylamine (CAS 3710-84-7)	TWA	2 ppm

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
Cyclohexylamine (CAS 108-91-8)	TWA	41 mg/m3
		10 ppm
Morpholine (CAS 110-91-8)	TWA	71 mg/m3
		20 ppm

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
Cyclohexylamine (CAS 108-91-8)	TWA	10 ppm
Morpholine (CAS 110-91-8)	TWA	20 ppm

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value
Cyclohexylamine (CAS 108-91-8)	TWA	10 ppm
Morpholine (CAS 110-91-8)	TWA	20 ppm
N,N Diethylhydroxylamine (CAS 3710-84-7)	TWA	2 ppm

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
Cyclohexylamine (CAS 108-91-8)	TWA	10 ppm
Dimethylaminopropylamine (DMAPA) (CAS 109-55-7)	TWA	2 mg/m3
		0.5 ppm
Morpholine (CAS 110-91-8)	STEL	105 mg/m3
		30 ppm
	TWA	70 mg/m3
		20 ppm

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
Cyclohexylamine (CAS 108-91-8)	TWA	41 mg/m3
		10 ppm
Morpholine (CAS 110-91-8)	TWA	71 mg/m3
		20 ppm

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Morpholine (CAS 110-91-8)	PEL	70 mg/m3
		20 ppm

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines

Canada - Alberta OELs: Skin designation

Morpholine (CAS 110-91-8) Can be absorbed through the skin.

Canada - British Columbia OELs: Skin designation

Morpholine (CAS 110-91-8) Can be absorbed through the skin.

Canada - Manitoba OELs: Skin designation

Morpholine (CAS 110-91-8) Can be absorbed through the skin.

Canada - Ontario OELs: Skin designation

Dimethylaminopropylamine (DMAPA) (CAS 109-55-7) Can be absorbed through the skin.
Morpholine (CAS 110-91-8) Can be absorbed through the skin.

Canada - Quebec OELs: Skin designation

Morpholine (CAS 110-91-8) Can be absorbed through the skin.

Canada - Saskatchewan OELs: Skin designation

Morpholine (CAS 110-91-8) Can be absorbed through the skin.

US. ACGIH Threshold Limit Values

Morpholine (CAS 110-91-8) Can be absorbed through the skin.

Engineering controls	Explosion-proof general and local exhaust ventilation. Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Adequate ventilation to maintain air contaminants below exposure limits.
Personal protective equipment	
Eye/face protection	Splash proof chemical goggles. Face shield.
Skin protection	Wear suitable protective clothing. Chemical resistant gloves. The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Chemical resistant apron. Glove selection must take into account any solvents and other hazards present.
Respiratory protection	If air-purifying respirator use is appropriate, use organic vapor cartridges and any of the following particulate respirators: R95, R99, R100, P95, P99 or P100.

9. Physical & Chemical Properties

Appearance	
Physical state	Liquid
Color	Light yellow to amber
Odor	Strong amine
Odor threshold	Not available.
pH in aqueous solution	11.8 (5% SOL.)
Vapor pressure	18 mm Hg
Vapor pressure temp.	70 °F (21 °C)
Vapor density	> 1 (Air = 1)
Boiling point	212 °F (100 °C)
Melting point/Freezing point	-13 °F (-25 °C)
Solubility (water)	100 %
Specific gravity (70°F, 21°C)	0.97
Flash point	121 °F (49 °C) P-M(CC)
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Auto-ignition temperature	Not available.
Evaporation rate	< 1 (Ether = 1)
Viscosity	27 cps
Viscosity temperature	70 °F (21 °C)
Percent volatile	60 (Calculated)
Pour point	-8 °F (-22 °C)

10. Chemical Stability & Reactivity Information

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Avoid heat, sparks, open flames and other ignition sources.
Incompatible materials	Strong oxidizing substances.
Hazardous decomposition products	Elemental Oxides
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Product	Species	Test Results
STEAMATE PAS6066 (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	770 mg/kg, (Estimated value)
Oral		
LD50	Rat	565 mg/kg, (Estimated value)

Components	Species	Test Results
Cyclohexylamine (CAS 108-91-8)		
Acute		
Dermal		
LD50	Rabbit	277 mg/kg
Oral		
LD50	Rat	156 mg/kg
Dimethylaminopropylamine (DMAPA) (CAS 109-55-7)		
Acute		
Inhalation		
LC50	Rat	> 4.3 mg/l, 4 Hour
Oral		
LD50	Rat	410 mg/kg
Morpholine (CAS 110-91-8)		
Acute		
Dermal		
LD50	Rabbit	504 mg/kg
Inhalation		
LC50	Rat	8 mg/l, 4 Hour
Oral		
LD50	Rat	1680 mg/kg
N,N Diethylhydroxylamine (CAS 3710-84-7)		
Acute		
Dermal		
LD50	Rabbit	1300 mg/kg
Inhalation		
LC50	Rat	11.4 mg/L, 4 Hour
Oral		
LD50	Rat	2190 mg/kg

Carcinogenicity

ACGIH Carcinogens

Cyclohexylamine (CAS 108-91-8)	A4 Not classifiable as a human carcinogen.
Morpholine (CAS 110-91-8)	A4 Not classifiable as a human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Morpholine (CAS 110-91-8)	3 Not classifiable as to carcinogenicity to humans.

12. Ecological Information

Ecotoxicity

Product	Species	Test Results
STEAMATE PAS6066 (CAS Mixture)		
LC50	Fathead Minnow	110 mg/L, Acute Toxicity, 96 hour, (Estimated)

Product		Species	Test Results
	NOEL	Fathead Minnow	64 mg/L, Acute Toxicity, 96 hour, (Estimated)
Aquatic			
Crustacea	LC50	Daphnia magna	39 mg/L, Acute Toxicity, 48 hour, (Estimated)

Partition coefficient

Cyclohexylamine	1.49
Morpholine	-0.86

Persistence and degradability

- COD (mgO2/g)	1488 (calculated data)
- BOD 5 (mgO2/g)	7 (calculated data)
- BOD 28 (mgO2/g)	282 (calculated data)
- Closed Bottle Test (% Degradation in 28 days)	24 (calculated data)
- Zahn-Wellens Test (% Degradation in 28 days)	47 (calculated data)
- TOC (mgC/g)	368 (calculated data)

13. Disposal Considerations

Disposal instructions	Dispose of contents/container in accordance with local/regional/national/international regulations. Via an authorized waste disposal contractor to an approved waste disposal site, observing all local and national regulations.
Waste from residues/unused products	Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner.
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport Information

TDG

UN number	UN2734
UN proper shipping name	AMINES, LIQUID, CORROSIVE, FLAMMABLE, N.O.S. (CYCLOHEXYLAMINE, MORPHOLINE)
Transport hazard class(es)	
Class	8
Subsidiary risk	3
Packing group	II
Environmental hazards	Not available.

DOT

UN number	UN2734
UN proper shipping name	AMINES, LIQUID, CORROSIVE, FLAMMABLE, N.O.S. (CYCLOHEXYLAMINE RQ = 447 LBS, MORPHOLINE RQ = 668 LBS)
Transport hazard class(es)	
Class	8
Subsidiary risk	3
Packing group	II
ERG number	132

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

IMDG

UN number	UN2734
UN proper shipping name	AMINES, LIQUID, CORROSIVE, FLAMMABLE, N.O.S. (CYCLOHEXYLAMINE, MORPHOLINE)
Transport hazard class(es)	
Class	8
Subsidiary risk	3
Packing group	II

Environmental hazards	
Marine pollutant	No.
EmS	Not available.
Special precautions for user	Not available.

IATA

UN number	UN2734
UN proper shipping name	AMINES, LIQUID, CORROSIVE, FLAMMABLE, N.O.S. (CYCLOHEXYLAMINE, MORPHOLINE)
Transport hazard class(es)	
Class	8
Subsidiary risk	3
Packing group	II
Environmental hazards	No.
Special precautions for user	Not available.

DOT

IATA; IMDG; TDG

15. Regulatory Information

WHMIS status	Controlled
WHMIS classification	B3 - Combustible Liquids D1B - Immediate/Serious-TOXIC D2B - Other Toxic Effects-TOXIC E - Corrosive

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other Information

List of abbreviations	Not available.

HMIS® ratings	Health: 3 Flammability: 2 Physical hazard: 0 Personal protection: D
NFPA ratings	Health: 3 Flammability: 2 Instability: 0 Special hazards: CORR
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
This data sheet contains changes from the previous version in section(s):	Composition / Information on Ingredients: Ingredients

* Trademark of General Electric Company. May be registered in one or more countries.

GE Power & Water
Water & Process Technologies

SAFETY DATASHEET

CORTROL* IS3070

1. Product and Company Identification

Material name	**CORTROL IS3070**
Version #	1.1
Revision date	Oct-10-2014
Supersedes date	Nov-01-2011
Prepared by	This MSDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).
CAS#	Mixture
Product application	Oxygen scavenger

Company/undertaking identification

GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency telephone

(800) 877-1940

2. Hazards Identification

Emergency overview	May cause moderate irritation to the skin. Potential skin sensitizer. Severe irritant to the eyes. Dusts or mists are irritating to mucous membranes. Repeated exposure may result in respiratory sensitization.
Potential health effects	
Eyes	Severe irritant to the eyes.
Skin	Primary route of exposure May cause moderate irritation to the skin. Potential sensitizer to the skin.
Inhalation	Primary route of exposure Dusts or mists are irritating to mucous membranes. Repeated exposure may result in respiratory sensitization.
Ingestion	May cause gastrointestinal irritation
Target organs	Prolonged or repeated exposures may cause primary irritant dermatitis, skin sensitization, and/or allergic respiratory reactions.
Signs and symptoms	Inhalation of mists or aerosols may cause asthma-like symtoms. Skin contact may cause itching, redness, dermatitis or skin sensitisation.
Medical conditions aggravated by exposure	None known.

3. Composition / Information on Ingredients

Components	CAS#	Percent (wt/wt)
Sodium Bisulfite	7631-90-5	10 - 30

Composition comments Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

4. First Aid Measures

First aid procedures

Eye contact	Immediately flush eyes with plenty of low-pressure water for at least 30 minutes while removing contact lenses. Keep eyelids apart. Get medical attention immediately.
Skin contact	Wash off with soap and water. Take off contaminated clothing and wash before reuse. Get medical attention if irritation develops and persists.
Inhalation	Move to fresh air. If breathing stops, provide artificial respiration. For breathing difficulties, oxygen may be necessary. Get medical attention immediately.
Ingestion	If swallowed, rinse mouth with water (only if the person is conscious). Never give anything by mouth to a victim who is unconscious or is having convulsions. Do not induce vomiting. Call a physician immediately. Dilute contents of stomach using 2-8 fluid ounces (60-240ml) of milk or water.
Notes to physician	No specific antidotes are recommended.

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media	Dry chemical, CO2, water spray or regular foam.

Protection of firefighters

Protective equipment for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray. Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).

Explosion data

Sensitivity to static discharge	Not available.
Sensitivity to mechanical impact	Not available.

6. Accidental Release Measures

Personal precautions	Wear appropriate protective equipment and clothing during clean-up. Avoid contact with spilled material. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	Avoid discharge into drains, water courses or onto the ground. Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements.
Methods for cleaning up	Ventilate the area. Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Flush with plenty of water. Spread sand/grit. Wet area may be slippery.

7. Handling and Storage

Handling	No special precautions are necessary beyond normal good hygiene practices. See Section 8 of the MSDS for additional personal protection advice when handling this product.
Storage	Keep container tightly closed in a dry and well-ventilated place. Shelf life 270 days. Keep container tightly closed. Protect from freezing. Do not store at elevated temperatures.

8. Exposure Controls / Personal Protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Engineering controls Explosion-proof general and local exhaust ventilation. Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Personal protective equipment

Eye / face protection Chemical goggles are recommended. Splash proof chemical goggles.

Skin protection Wear suitable protective clothing. Chemical resistant gloves. The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Glove selection must take into account any solvents and other hazards present. Rubber, butyl, viton or neoprene gloves. Wash off after each use. Replace as necessary.

Respiratory protection If air-purifying respirator use is appropriate, use organic vapor cartridges and any of the following particulate respirators: R95, R99, R100, P95, P99 or P100.

9. Physical & Chemical Properties

Appearance

Physical state Liquid

Color Pink

Odor Strong

Odor threshold Not available.

pH (concentrated product) 6.2

Vapor pressure 18 mm Hg

Vapor pressure temp. 70 °F (21 °C)

Vapor density < 1 (Air = 1)

Boiling point 212 °F (100 °C)

Melting point/Freezing point 25 °F (-4 °C)

Solubility (water) 100 %

Specific gravity (70°F, 21°C) 1.28

Flash point > 200 °F (> 93 °C) P-M(CC)

Flammability limits in air, upper, % by volume Not available.

Flammability limits in air, lower, % by volume Not available.

Auto-ignition temperature Not available.

Evaporation rate < 1 (Ether = 1)

Viscosity 10 cps

Viscosity temperature 70 °F (21 °C)

Percent volatile 0 (Calculated)

Pour point 30 °F (-1 °C)

10. Chemical Stability & Reactivity Information

Conditions to avoid Not available.

Incompatible materials	Strong oxidizing substances.
Hazardous decomposition products	Oxides of phosphorus. Oxides of carbon evolved in fire. Sulfur oxides.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Product	Species	Test Results
CORTROL IS3070 (CAS Mixture)		
Acute		
Oral		
LD50	Rat	> 5000 mg/kg, (Calculated according to GHS additivity formula)

Components	Species	Test Results
Sodium Bisulfite (CAS 7631-90-5)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg
Inhalation		
LC50	Rat	> 5.5 mg/l, 4 Hour
Oral		
LD50	Rat	1420 mg/kg

Carcinogenicity

ACGIH Carcinogens

Sodium Bisulfite (CAS 7631-90-5)	A4 Not classifiable as a human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Sodium Bisulfite (CAS 7631-90-5)	3 Not classifiable as to carcinogenicity to humans.

12. Ecological Information

Ecotoxicity

Product		Species	Test Results
CORTROL IS3070 (CAS Mixture)			
	LC50	Fathead Minnow	379 mg/L, Static Renewal Bioassay, 96 hour
	NOEL	Fathead Minnow	250 mg/L, Static Renewal Bioassay, 96 hour
Crustacea	0% Mortality	Daphnia magna	62.5 mg/L, Static Renewal Bioassay, 48 hour
	LC50	Daphnia magna	354 mg/L, Static Renewal Bioassay, 48 hour

Persistence and degradability

- COD (mgO2/g)	41 (calculated data)

13. Disposal Considerations

Disposal instructions	Dispose of contents/container in accordance with local/regional/national/international regulations.
Waste from residues/unused products	Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner.
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport Information

TDG

Not regulated as dangerous goods.

DOT

Basic shipping requirements:

UN number	UN3082
Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (SODIUM BISULFITE SOLUTION), RQ
Hazard class	9
Packing group	III

Additional information:

ERG code 171

Some containers may be DOT exempt, please check BOL for exact container classification.

IMDG

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

DOT

15. Regulatory Information

WHMIS status	Controlled
WHMIS classification	D2A - Other Toxic Effects-VERY TOXIC D2B - Other Toxic Effects-TOXIC

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other Information

List of abbreviations	Not available.
HMIS® ratings	Health: 2 Flammability: 0 Physical hazard: 0 Personal protection: B
NFPA ratings	Health: 2 Flammability: 0 Instability: 0 Special hazards: NONE

Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
This data sheet contains changes from the previous version in section(s):	Product and Company Identification: Commercial Names GHS: Classification

* Trademark of General Electric Company. May be registered in one or more countries.

GE Power
Water & Process Technologies

SAFETY DATA SHEET

OPTISPERSE* ADJ5050

1. Product and Company Identification

Material name	**OPTISPERSE ADJ5050**
Version #	2.0
Revision date	Mar-21-2016
Supersedes date	Dec-30-2014
Prepared by	This SDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).
Chemical description	Alkaline solution
CAS #	Mixture
Product application	Water based internal boiler treatment chemical.

Company/undertaking identification

GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency telephone

(800) 877-1940

2. Hazards Identification

Emergency overview	May be corrosive to metals. Causes severe skin burns and eye damage. Harmful if swallowed.
Potential health effects	
Eyes	Corrosive to eyes
Skin	Primary route of exposure Corrosive to skin
Inhalation	Mists/aerosols cause irritation to the upper respiratory tract
Ingestion	Toxic if swallowed. May cause severe irritation or burning of mouth, throat, and gastrointestinal tract with severe chest and abdominal pain, nausea, vomiting, diarrhea, lethargy and collapse. Possible death when ingested in very large doses.
Target organs	Prolonged or repeated exposures may cause tissue necrosis. Prolonged or repeated exposures may cause primary irritant dermatitis.
Signs and symptoms	Causes severe irritation, burns or tissue ulceration with subsequent scarring.

3. Composition / Information on Ingredients

Components	CAS#	Percent (wt/wt)
Sodium Hydroxide	1310-73-2	40 - 70

Composition comments Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

4. First Aid Measures

First aid procedures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.

Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.
Ingestion	Call a physician or poison control center immediately. Do not feed anything by mouth to an unconscious or convulsive victim. Do not induce vomiting. Rinse mouth. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Notes to physician	Corrosive material It may not be advisable to induce vomiting. Possible mucosal damage may contraindicate the use of gastric lavage.
General advice	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire Fighting Measures

Extinguishing media	
Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Not available.
Protection of firefighters	
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Protective equipment for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
Explosion data	
Sensitivity to static discharge	Not available.
Sensitivity to mechanical impact	Not available.

6. Accidental Release Measures

Environmental precautions	Avoid discharge into drains, water courses or onto the ground.
Methods for containment	Stop the flow of material, if this is without risk. Absorb spillage to prevent material damage. Prevent entry into waterways, sewer, basements or confined areas.
Methods for cleaning up	Ventilate the contaminated area. Wear appropriate protective equipment and clothing during clean-up. Stop the flow of material, if this is without risk. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the MSDS. Absorb onto inert material and dispose of according to Hazardous Waste Regulations. Remove small spills with plenty of water. Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements. Wet area may be slippery.

7. Handling and Storage

Handling	Alkaline. Do not mix with acidic material. Do not get in eyes, on skin, or on clothing. When using, do not eat, drink or smoke. Do not breathe mist or vapor. Provide adequate ventilation. Observe good industrial hygiene practices. Avoid prolonged exposure. Wear appropriate personal protective equipment. Wash contaminated clothing before reuse. Do not taste or swallow. Wash hands thoroughly after handling. Use care in handling/storage.
Storage	Do not freeze. If frozen, thaw completely and mix thoroughly prior to use. Store locked up. Store in corrosive resistant container with a resistant inner liner. Store in a cool, dry place out of direct sunlight. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the MSDS). Store in accordance with local/regional/national/international regulation.

8. Exposure Controls / Personal Protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	Ceiling	2 mg/m3

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Sodium Hydroxide (CAS 1310-73-2)	PEL	2 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles) and a face shield.

Skin protection Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

Hand protection Wear appropriate chemical resistant gloves. The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Suitable gloves can be recommended by the glove supplier. Glove selection must take into account any solvents and other hazards present.

9. Physical & Chemical Properties

Appearance

Physical state Liquid

Color Colorless

Odor Mild

Odor threshold Not available.

pH in aqueous solution	13.4 (5% SOL.)
Vapor pressure	18 mm Hg
Vapor pressure temp.	70 °F (21 °C)
Vapor density	< 1 (Air = 1)
Boiling point	Not available.
Melting point/Freezing point	50 °F (10 °C)
Solubility (water)	100 %
Specific gravity (70°F, 21°C)	1.53
Flash point	> 200 °F (> 93 °C) SETA(CC)
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Auto-ignition temperature	Not available.
Evaporation rate	< 1 (Ether = 1)
Viscosity	124 cps
Viscosity temperature	70 °F (21 °C)
Percent volatile	0 (Estimated)
Pour point	55 °F (13 °C)

10. Chemical Stability & Reactivity Information

Reactivity	May be corrosive to metals.
Chemical stability	Material is stable under normal conditions.
Conditions to avoid	Avoid contact with strong acids. Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong acids. Strong oxidizing agents. Metals.
Hazardous decomposition products	Elemental oxides
Possibility of hazardous reactions	Contact with strong acids may cause a violent reaction releasing heat.

11. Toxicological Information

Toxicological data

Product	Species	Test Results
OPTISPERSE ADJ5050 (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	2700 mg/kg, (Calculated according to GHS additivity formula)
Oral		
LD50	Rat	1000 mg/kg, (Calculated according to GHS additivity formula)

Acute effects	Harmful if swallowed.
Chronic effects	Prolonged or repeated contact may cause tissue necrosis, dermatitis and/or skin sensitisation. Prolonged inhalation may be harmful.
Carcinogenicity	Not classified.
Skin corrosion/irritation	Causes severe skin burns and eye damage.
Mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Reproductive effects	This product is not expected to cause reproductive or developmental effects.
Teratogenicity	Not available.

12. Ecological Information

Ecotoxicity

Product		Species	Test Results
OPTISPERSE ADJ5050 (CAS Mixture)			
	0% Mortality	Fathead Minnow	5000 mg/L, Static Bioassay with 48-Hour Renewal, 96 hour, (pH adjusted)
			50 mg/L, Static Bioassay with 48-Hour Renewal, 96 hour
	10% Mortality	Ceriodaphnia	1785 mg/L, Static Acute Bioassay, 48 hour, (pH adjusted)
	100% Mortality	Fathead Minnow	200 mg/L, Static Bioassay with 48-Hour Renewal, 96 hour
	45% Mortality	Fathead Minnow	10000 mg/L, Static Bioassay with 48-Hour Renewal, 96 hour, (pH adjusted)
	LC50	Ceriodaphnia	2480 mg/L, Static Acute Bioassay, 48 hour, (pH adjusted)
Aquatic			
Crustacea	100% Mortality	Daphnia magna	500 mg/L, Static Screen, 48 hour
	5% Mortality	Daphnia magna	5000 mg/L, Static Screen, 48 hour, (pH adjusted)
			100 mg/L, Static Screen, 48 hour
Fish	0% Mortality	Rainbow Trout	10000 mg/L, Static Bioassay with 48-Hour Renewal, 96 hour, (pH adjusted)

13. Disposal Considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.
Waste from residues/unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions). Avoid discharge into water courses or onto the ground.
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport Information

TDG

UN number	UN1824
UN proper shipping name	SODIUM HYDROXIDE SOLUTION
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	II
Environmental hazards	Not available.

The goods described above have been classified using a combination of testing, technical data, calculations and manufacturer knowledge in accordance with Part 2, Classification.

DOT

UN number	UN1824
UN proper shipping name	SODIUM HYDROXIDE SOLUTION, RQ
Transport hazard class(es)	
Class	8
Packing group	II
ERG number	154

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

IMDG

UN number	UN1824
UN proper shipping name	SODIUM HYDROXIDE SOLUTION, RQ

Transport hazard class(es)

Class	8
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	No.
EmS	F-A,S-B
Special precautions for user	Not available.

IATA

UN number	UN1824
UN proper shipping name	SODIUM HYDROXIDE SOLUTION
Transport hazard class(es)	
Class	8
Subsidiary risk	-
Packing group	II
Environmental hazards	No.
ERG Code	154
Special precautions for user	Not available.

DOT

IATA; IMDG; TDG

15. Regulatory Information

WHMIS status	Controlled
WHMIS classification	D1B - Immediate/Serious-TOXIC E - Corrosive

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other Information

List of abbreviations

CAS: Chemical Abstract Service Registration Number
ACGIH: American Conference of Governmental Industrial Hygienists
TWA: Time Weighted Average
STEL: Short Term Exposure Limit
LD50: Lethal Dose, 50%
LC50: Lethal Concentration, 50%
NOEL: No Observed Effect Level
COD: Chemical Oxygen Demand
BOD: Biochemical Oxygen Demand
TOC: Total Organic Carbon
IATA: International Air Transport Association
IMDG: International Maritime Dangerous Goods Code

HMIS® ratings

Health: 3
Flammability: 0
Physical hazard: 1
Personal protection: D

NFPA ratings

Health: 3
Flammability: 0
Instability: 1
Special hazards: CORR

Disclaimer

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This data sheet contains changes from the previous version in section(s):

This document has undergone significant changes and should be reviewed in its entirety.

* Trademark of General Electric Company. May be registered in one or more countries.

1. Identification

Product identifier used on the label

Magnafloc® LT25

Recommended use of the chemical and restriction on use
Recommended use*: flocculation agent

* The “Recommended use” identified for this product is provided solely to comply with a Federal requirement and is not part of the seller's published specification. The terms of this Safety Data Sheet (SDS) do not create or infer any warranty, express or implied, including by incorporation into or reference in the seller's sales agreement.

Details of the supplier of the safety data sheet

Company:
BASF CORPORATION
100 Park Avenue
Florham Park, NJ 07932, USA

Telephone: +1 973 245-6000

Emergency telephone number

CHEMTREC: 1-800-424-9300
BASF HOTLINE: 1-800-832-HELP (4357)

Other means of identification
Chemical family: polyacrylamide, anionic

2. Hazards Identification

According to Regulation 2012 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

Classification of the product

No need for classification according to GHS criteria for this product.

Label elements

The product does not require a hazard warning label in accordance with GHS criteria.

Hazards not otherwise classified

Very slippery when wet.

Labeling of special preparations (GHS):
This product is not combustible in the form in which it is shipped by the manufacturer, but may form a combustible dust through downstream activities (e.g. grinding, pulverizing) that reduce its particle size.

According to Regulation 1994 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

Emergency overview

Contact with the eyes or skin may cause mechanical irritation.
Use with local exhaust ventilation.
Avoid dust formation.
Wear protective clothing.
Caution - Slippery when wet!

3. Composition / Information on Ingredients

According to Regulation 2012 OSHA Hazard Communication Standard; 29 CFR Part 1910.1200

This product does not contain any components classified as hazardous under the referenced regulation.

4. First-Aid Measures

Description of first aid measures

General advice:
Remove contaminated clothing.

If inhaled:
If difficulties occur after dust has been inhaled, remove to fresh air and seek medical attention.

If on skin:
Wash thoroughly with soap and water.

If irritation develops, seek medical attention.

If in eyes:
Wash affected eyes for at least 15 minutes under running water with eyelids held open.

Seek medical attention.

If swallowed:
Rinse mouth and then drink plenty of water. Do not induce vomiting. Immediate medical attention required.

Most important symptoms and effects, both acute and delayed

Symptoms: The most important known symptoms and effects are described in the labelling (see section 2) and/or in section 11., Further important symptoms and effects are so far not known.
Hazards: No hazard is expected under intended use and appropriate handling.

Indication of any immediate medical attention and special treatment needed

Note to physician
Treatment: Treat according to symptoms (decontamination, vital functions), no known specific antidote.

5. Fire-Fighting Measures

Extinguishing media

Suitable extinguishing media:
dry powder, foam

Unsuitable extinguishing media for safety reasons:
water jet

Additional information:
If water is used, restrict pedestrian and vehicular traffic in areas where slip hazard may exist.

Special hazards arising from the substance or mixture

Hazards during fire-fighting:
carbon oxides, nitrogen oxides
The substances/groups of substances mentioned can be released in case of fire. Very slippery when wet.

Advice for fire-fighters

Protective equipment for fire-fighting:
Wear a self-contained breathing apparatus.

Further information:
Dusty conditions may ignite explosively in the presence of an ignition source causing flash fire.

6. Accidental release measures

Further accidental release measures:
Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Avoid the formation and build-up of dust - danger of dust explosion. Dust in sufficient concentration can result in an explosive mixture in air. Handle to minimize dusting and eliminate open flame and other sources of ignition. Forms slippery surfaces with water.

Personal precautions, protective equipment and emergency procedures

Use personal protective clothing.

Environmental precautions

Do not discharge into drains/surface waters/groundwater.

Methods and material for containment and cleaning up

Nonsparking tools should be used.

7. Handling and Storage

Precautions for safe handling

Breathing must be protected when large quantities are decanted without local exhaust ventilation. Handle in accordance with good industrial hygiene and safety practice. Forms slippery surfaces with water.

Protection against fire and explosion:
Avoid dust formation. Dust in sufficient concentration can result in an explosive mixture in air. Handle to minimize dusting and eliminate open flame and other sources of ignition. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres. Refer to NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids (2013 Edition) for safe handling.

Conditions for safe storage, including any incompatibilities

Further information on storage conditions: Store in unopened original containers in a cool and dry place. Avoid wet, damp or humid conditions, temperature extremes and ignition sources.

Storage stability:
Avoid extreme heat.

8. Exposure Controls/Personal Protection

No occupational exposure limits known.

Advice on system design:
It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling of this product contain explosion relief vents or an explosion suppression system or an oxygen deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.

Personal protective equipment

Respiratory protection:
Wear a NIOSH-certified (or equivalent) organic vapour/particulate respirator.

Hand protection:
Chemical resistant protective gloves

Eye protection:
Safety glasses with side-shields.

Body protection:
light protective clothing

General safety and hygiene measures:
Wear protective clothing as necessary to minimize contact. Handle in accordance with good industrial hygiene and safety practice. No eating, drinking, smoking or tobacco use at the place of work.

9. Physical and Chemical Properties

Form:	powder
Odour:	odourless
Odour threshold:	No data available.
Colour:	off-white
pH value:	6 - 8 (10 g/l) The product has not been tested. The statement has been derived from substances/products of a similar structure or composition.
Melting point:	The substance / product decomposes therefore not determined.
Boiling point:	not applicable
Sublimation point:	No data available.
Flash point:	not applicable
Flammability:	not flammable
Lower explosion limit:	No data available.
Upper explosion limit:	No data available.
Autoignition:	No data available.
Vapour pressure:	The product has not been tested.
Relative density:	No data available.
Bulk density:	approx. 750 kg/m3
Vapour density:	No data available.
Partitioning coefficient n-octanol/water (log Pow):	Study scientifically not justified.
Self-ignition temperature:	not self-igniting
Viscosity, dynamic:	not applicable, the product is a solid
% volatiles:	not determined
Solubility in water:	Forms a viscous solution.
Solubility (quantitative):	No data available.
Solubility (qualitative):	No data available.
Evaporation rate:	The product is a non-volatile solid.
Other Information:	If necessary, information on other physical and chemical parameters is indicated in this section.

10. Stability and Reactivity

Reactivity
No hazardous reactions if stored and handled as prescribed/indicated.

Corrosion to metals:
No corrosive effect on metal.

Oxidizing properties:
not fire-propagating

Chemical stability
The product is stable if stored and handled as prescribed/indicated.

Possibility of hazardous reactions
The product is not a dust explosion risk as supplied; however the build-up of fine dust can lead to a risk of dust explosions.
Stable under normal conditions.

No hazardous reactions known.

Conditions to avoid
Avoid extreme temperatures. Avoid humidity.

Incompatible materials
strong acids, strong bases, strong oxidizing agents

Hazardous decomposition products

Decomposition products:
No hazardous decomposition products if stored and handled as prescribed/indicated.

11. Toxicological information

Primary routes of exposure

Routes of entry for solids and liquids are ingestion and inhalation, but may include eye or skin contact. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquefied gases.

Acute Toxicity/Effects

Acute toxicity
Assessment of acute toxicity: No known acute effects.

Oral
Type of value: LD50
Species: rat
Value: > 5,000 mg/kg (OECD Guideline 401)

Irritation / corrosion
Assessment of irritating effects: Not irritating to eyes and skin.

Skin
Species: rabbit
Result: non-irritant
Method: OECD Guideline 404

Eye
Species: rabbit
Result: non-irritant

Sensitization
Assessment of sensitization: Based on the ingredients, there is no suspicion of a skin-sensitizing potential.

Aspiration Hazard
No aspiration hazard expected.

Chronic Toxicity/Effects

Repeated dose toxicity
Assessment of repeated dose toxicity: Based on our experience and the information available, no adverse health effects are expected if handled as recommended with suitable precautions for designated uses. The product has not been tested. The statement has been derived from the properties of the individual components.

Genetic toxicity
Assessment of mutagenicity: Based on the ingredients, there is no suspicion of a mutagenic effect.

Carcinogenicity
Assessment of carcinogenicity: The whole of the information assessable provides no indication of a carcinogenic effect.
None of the components in this product at concentrations greater than 0.1% are listed by IARC; NTP, OSHA or ACGIH as a carcinogen.

Reproductive toxicity
Assessment of reproduction toxicity: Based on the ingredients, there is no suspicion of a toxic effect on reproduction.

Teratogenicity
Assessment of teratogenicity: Based on the ingredients, there is no suspicion of a teratogenic effect.

Other Information
The product has not been tested. The statements on toxicology have been derived from products of a similar structure and composition.

Symptoms of Exposure

The most important known symptoms and effects are described in the labelling (see section 2) and/or in section 11., Further important symptoms and effects are so far not known.

12. Ecological Information

Toxicity

Toxicity to fish
LC50 (96 h) > 100 mg/l, Oncorhynchus mykiss (static)
(under static conditions in the presence of 10 mg/L humic acid)

Aquatic invertebrates
LC50 (48 h) > 100 mg/l, Daphnia magna

Persistence and degradability

Assessment biodegradation and elimination (H2O)
Not readily biodegradable (by OECD criteria).

Bioaccumulative potential

Assessment bioaccumulation potential
Based on its structural properties, the polymer is not biologically available. Accumulation in organisms is not to be expected.

Mobility in soil

Assessment transport between environmental compartments

Information on: Anionic polyacrylamide

Adsorption to solid soil phase is expected.

Additional information

Other ecotoxicological advice:
The product has not been tested. The statements on ecotoxicology have been derived from products of a similar structure and composition.

13. Disposal considerations

Waste disposal of substance:
Must be disposed of or incinerated in accordance with local regulations.

Container disposal:
Dispose of in a licensed facility. Recommend crushing, puncturing or other means to prevent unauthorized use of used containers.

RCRA:
Not a hazardous waste under RCRA (40 CFR 261).

14. Transport Information

Land transport
USDOT

Not classified as a dangerous good under transport regulations

Sea transport
IMDG

Not classified as a dangerous good under transport regulations

Air transport
IATA/ICAO

Not classified as a dangerous good under transport regulations

15. Regulatory Information

VOC content:

not determined

Federal Regulations

Registration status:
Chemical TSCA, US released / listed

EPCRA 311/312 (Hazard categories): Not hazardous;

CA Prop. 65:
WARNING: THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

NFPA Hazard codes:

Health : 0 Fire: 1 Reactivity: 0 Special:

HMIS III rating
Health: 0 Flammability: 1 Physical hazard: 0

16. Other Information

SDS Prepared by:
BASF NA Product Regulations
SDS Prepared on: 2015/07/17

We support worldwide Responsible Care® initiatives. We value the health and safety of our employees, customers, suppliers and neighbors, and the protection of the environment. Our commitment to Responsible Care is integral to conducting our business and operating our facilities in a safe and environmentally responsible fashion, supporting our customers and suppliers in ensuring the safe and environmentally sound handling of our products, and minimizing the impact of our operations on society and the environment during production, storage, transport, use and disposal of our products.

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END OF DATA SHEET

GE
Water & Process Technologies

Material Safety Data Sheet

Issue Date: 06-MAY-2011
Supercedes: 18-FEB-2008

FERRIC CHLRIDE-40% LQCMD

1 Identification

Identification of substance or preparation
FERRIC CHLRIDE-40% LQCMD

Product Application Area
Commodity chemical

Company/Undertaking Identification
GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency Telephone
(800) 877-1940

Prepared by Product Stewardship Group: T 215-355-3300 Prepared on: 06-MAY-2011

2 Hazard(s) identification

****
EMERGENCY OVERVIEW

Severe irritant to the skin. Corrosive to the eyes. Mists/aerosols cause irritation to the upper respiratory tract.

Odor: Acid; Appearance: Red-Brown, Liquid

Fire fighters should wear positive pressure self-contained breathing apparatus(full face-piece type). Proper fire-extinguishing media: dry chemical, carbon dioxide, foam or water
****

POTENTIAL HEALTH EFFECTS

ACUTE SKIN EFFECTS:
Primary route of exposure; Severe irritant to the skin.

ACUTE EYE EFFECTS:
Corrosive to the eyes.

ACUTE RESPIRATORY EFFECTS:
Mists/aerosols cause irritation to the upper respiratory tract.

INGESTION EFFECTS:
May cause gastrointestinal irritation with possible nausea,

vomiting, abdominal discomfort and diarrhea.

TARGET ORGANS:
No evidence of potential chronic effects.

MEDICAL CONDITIONS AGGRAVATED:
Not known.

SYMPTOMS OF EXPOSURE:
Causes irritation of the skin, eyes, and/or respiratory system.

3 Composition / information on ingredients

Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

HAZARDOUS INGREDIENTS:

Cas#	Chemical Name	Range(w/w%)
7705-08-0	FERRIC CHLORIDE Irritant (eyes, skin, and respiratory) ORAL LD50-RAT: 1,872 MG/KG DERMAL LD50: NO DATA. INHL. LC50: NO DATA.	30-60

4 First-aid measures

SKIN CONTACT:
Wash thoroughly with soap and water. Remove contaminated clothing. Thoroughly wash clothing before reuse. Get medical attention if irritation develops or persists.

EYE CONTACT:
URGENT! Immediately flush eyes with plenty of low-pressure water for at least 20 minutes while removing contact lenses. Hold eyelids apart. Get immediate medical attention.

INHALATION:
If nasal, throat or lung irritation develops - remove to fresh air and get medical attention.

INGESTION:
Do not feed anything by mouth to an unconscious or convulsive victim. Do not induce vomiting. Immediately contact physician. Dilute contents of stomach using 2-8 fluid ounces (60-240 mL) of milk or water.

NOTES TO PHYSICIANS:
No special instructions

5 Fire-fighting measures

FIRE FIGHTING INSTRUCTIONS:
Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).
EXTINGUISHING MEDIA:
dry chemical, carbon dioxide, foam or water
HAZARDOUS DECOMPOSITION PRODUCTS:
hydrogen chloride
FLASH POINT:
> 200F > 93C P-M(CC)

6 Accidental release measures

PROTECTION AND SPILL CONTAINMENT:
Ventilate area. Use specified protective equipment. Contain and absorb on absorbent material. Place in waste disposal container. Flush area with water. Wet area may be slippery. Spread sand/grit.
DISPOSAL INSTRUCTIONS:
The waste characteristics of the absorbed material, or any contaminated soil, should be determined in accordance with provincial regulations. Water contaminated with this product may be sent to a sanitary sewer treatment facility, in accordance with any local agreement or discharged under provincial regulations.
Incinerate or land dispose in an approved landfill.

7 Handling and storage

HANDLING:
Acidic. Corrosive(Eyes). Do not mix with alkaline material.
STORAGE:
Shelf life = 270 days. Keep containers closed when not in use. Store in cool ventilated location. Store away from oxidizers. Store away from bases.

8 Exposure controls / personal protection

EXPOSURE LIMITS

CHEMICAL NAME

FERRIC CHLORIDE
PEL (OSHA): LIMITS HAVE NOT BEEN ESTABLISHED BY US OSHA.
TLV (ACGIH): 1 MG/M3(AS Fe)

8) EXPOSURE CONTROLS/PERSONAL PROTECTION

EXPOSURE LIMITS
Consult local authorities for acceptable provincial values.

CHEMICAL NAME

FERRIC CHLORIDE
PEL (OSHA): LIMITS HAVE NOT BEEN ESTABLISHED BY US OSHA.
TLV (ACGIH): 1 MG/M3(AS Fe)

ENGINEERING CONTROLS:
Adequate ventilation to maintain air contaminants below exposure

limits.

RESPIRATORY PROTECTION:

If air-purifying respirator use is appropriate, use any of the following particulate respirators: N95, N99, N100, R95, R99, R100, P95, P99 or P100.

SKIN PROTECTION:

rubber, butyl, viton or neoprene gloves -- Wash off after each use. Replace as necessary.

EYE PROTECTION:

splash proof chemical goggles

9 Physical and chemical properties

Spec. Grav.(70F,21C)	1.452	Vapor Pressure (mmHG)	~ 18.0
Freeze Point (F)	< -30	Vapor Density (air=1)	< 1.00
Freeze Point (C)	< -34		
Viscosity(cps 70F,21C)	10	% Solubility (water)	100.0

Odor		Acid
Appearance		Red-Brown
Physical State		Liquid
Flash Point	P-M(CC)	> 200F > 93C
pH As Is (approx.)		1.0
Evaporation Rate (Ether=1)		< 1.00
Percent VOC:		0.0

NA = not applicable ND = not determined

10 Stability and reactivity

CHEMICAL STABILITY:

Stable under normal storage conditions.

POSSIBILITY OF HAZARDOUS REACTIONS:

Contact with strong bases may cause a violent reaction releasing heat. Contact with water reactive compounds may cause fire or explosion.

INCOMPATIBILITIES:

May react with acids.

DECOMPOSITION PRODUCTS:

hydrogen chloride

11 Toxicological information

Oral LD50 RAT:	>1,000 mg/kg
NOTE - Estimated value	
Dermal LD50 RABBIT:	>1,000 mg/kg
NOTE - Estimated value	

12 Ecological information

AQUATIC TOXICOLOGY
No Data Available.

BIODEGRADATION
No Data Available.

13 Disposal considerations

Incinerate or bury in approved landfill. Please be advised that there may be additional local or provincial requirements relating to the disposal of waste. Consult provincial and local regulations regarding the proper disposal of this material.

14 Transport information

Transportation of Dangerous Goods:
FERRIC CHLORIDE SOLUTION
8 , UN 2582, PG III
DOT EMERGENCY RESPONSE GUIDE #: 154

15 Regulatory information

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.
CEPA:
All components of this product comply with substance notification requirements under CEPA.
WHMIS CLASSIFICATION:
D2B E

16 Other information

HMIS vII		**CODE TRANSLATION**
Health	3	Serious Hazard
Fire	0	Minimal Hazard
Reactivity	0	Minimal Hazard
Special	ACID	pH below 2.1
(1) Protective Equipment	B	Goggles,Gloves

(1) refer to section 8 of MSDS for additional protective equipment recommendations.

CHANGE LOG

	EFFECTIVE DATE	REVISIONS TO SECTION:	SUPERCEDES
MSDS status:	03-APR-2000		** NEW **
	01-FEB-2002	4,15	03-APR-2000

10-JAN-2005	16	01-FEB-2002
18-FEB-2008	4,5,7,8,10,15,16	10-JAN-2005
06-MAY-2011	7,10	18-FEB-2008

GE
Water & Process Technologies

Material Safety Data Sheet

Issue Date: 03-OCT-2011
Supercedes: 30-OCT-2008

SODIUM HYDROXIDE 50%

1 Identification

Identification of substance or preparation
SODIUM HYDROXIDE 50%

Reagent Application Area
Field test reagent.

Reagent Code
L1624

Company/Undertaking Identification
GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency Telephone
(800) 877-1940

Prepared by Product Stewardship Group: T 215-355-3300 Prepared on: 03-OCT-2011

2 Hazard(s) identification

****
EMERGENCY OVERVIEW

Corrosive to skin. Corrosive to the eyes. Mists/aerosols cause irritation to the upper respiratory tract.

Odor: None; Appearance: Colorless, Liquid

Fire fighters should wear positive pressure self-contained breathing apparatus(full face-piece type). Proper fire-extinguishing media: dry chemical, carbon dioxide, foam or water
****

POTENTIAL HEALTH EFFECTS

ACUTE SKIN EFFECTS:
Primary route of exposure; Corrosive to skin.

ACUTE EYE EFFECTS:
Corrosive to the eyes.

ACUTE RESPIRATORY EFFECTS:
Mists/aerosols cause irritation to the upper respiratory tract.

INGESTION EFFECTS:
Toxic;
May cause severe irritation or burning of mouth, throat, and gastrointestinal tract with severe chest and abdominal pain, nausea, vomiting, diarrhea, lethargy and collapse. Possible death when ingested in very large doses.

TARGET ORGANS:
Prolonged or repeated exposures may cause primary irritant dermatitis and/or tissue necrosis.

MEDICAL CONDITIONS AGGRAVATED:
Not known.

SYMPTOMS OF EXPOSURE:
Causes severe irritation, burns or tissue ulceration with subsequent scarring.

3 Composition / information on ingredients

Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

HAZARDOUS INGREDIENTS:

Cas#	Chemical Name	Range(w/w%)
1310-73-2	SODIUM HYDROXIDE Corrosive; toxic (by ingestion) ORAL LD50-RAT: 140 MG/KG DERMAL LD50-RABBIT: 1,350 MG/KG INHL. LC50: NO DATA.	40-70

4 First-aid measures

SKIN CONTACT:
URGENT! Wash thoroughly with soap and water. Remove contaminated clothing. Get immediate medical attention. Thoroughly wash clothing before reuse.

EYE CONTACT:
URGENT! Immediately flush eyes with plenty of low-pressure water for at least 20 minutes while removing contact lenses. Hold eyelids apart. Get immediate medical attention.

INHALATION:
Remove to fresh air. Get medical attention if irritation persists.

INGESTION:
Do not feed anything by mouth to an unconscious or convulsive victim. Do not induce vomiting. Immediately contact physician. Dilute contents of stomach using 2-8 fluid ounces (60-240 mL) of milk or water.

NOTES TO PHYSICIANS:
Material is corrosive. It may not be advisable to induce vomiting. Possible mucosal damage may contraindicate the use of gastric lavage.

5 Fire-fighting measures

FIRE FIGHTING INSTRUCTIONS:
Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).
EXTINGUISHING MEDIA:
dry chemical, carbon dioxide, foam or water
HAZARDOUS DECOMPOSITION PRODUCTS:
elemental oxides
FLASH POINT:
> 200F > 93C P-M(CC)

6 Accidental release measures

PROTECTION AND SPILL CONTAINMENT:
Ventilate area. Use specified protective equipment. Contain and absorb on absorbent material. Place in waste disposal container. Flush area with water. Wet area may be slippery. Spread sand/grit.
DISPOSAL INSTRUCTIONS:
The waste characteristics of the absorbed material, or any contaminated soil, should be determined in accordance with provincial regulations. Water contaminated with this product may be sent to a sanitary sewer treatment facility, in accordance with any local agreement or discharged under provincial regulations.
Incinerate or land dispose in an approved landfill.

7 Handling and storage

HANDLING:
Alkaline. Corrosive(Skin/eyes). Do not mix with acidic material.
STORAGE:
Keep containers closed when not in use. Do not freeze. If frozen, thaw and mix completely prior to use.

8 Exposure controls / personal protection

EXPOSURE LIMITS

Consult local authorities for acceptable provincial values.

CHEMICAL NAME

SODIUM HYDROXIDE
PEL (OSHA): 2 MG/M3
TLV (ACGIH): TWA (Ceiling) = 2 MG/M3

ENGINEERING CONTROLS:
Adequate ventilation to maintain air contaminants below exposure limits.
RESPIRATORY PROTECTION:
If air-purifying respirator use is appropriate, use any of the following particulate respirators: N95, N99, N100, R95, R99, R100, P95, P99 or P100.
SKIN PROTECTION:

gauntlet-type rubber gloves, chemical resistant apron-- Wash off after each use. Replace as necessary.

EYE PROTECTION:

splash proof chemical goggles, face shield

9 Physical and chemical properties

Spec. Grav.(70F,21C)	1.500	Vapor Pressure (mmHG)	18.0
Freeze Point (F)	10	Vapor Density (air=1)	< 1.00
Freeze Point (C)	-12		
Viscosity(cps 70F,21C)	ND	% Solubility (water)	ND

Odor		None
Appearance		Colorless
Physical State		Liquid
Flash Point	P-M(CC)	> 200F > 93C
pH 5% Sol. (approx.)		13.1
Evaporation Rate (Ether=1)		< 1.00
Percent VOC:		ND

NA = not applicable ND = not determined

10 Stability and reactivity

CHEMICAL STABILITY:

Stable under normal storage conditions.

POSSIBILITY OF HAZARDOUS REACTIONS:

INCOMPATIBILITIES:

May react with acids.

DECOMPOSITION PRODUCTS:

elemental oxides

11 Toxicological information

Oral LD50 RAT:	300 mg/kg
NOTE - Supplier Estimated	
Dermal LD50 RABBIT:	>2,000 mg/kg
NOTE - Supplier Estimated	

12 Ecological information

AQUATIC TOXICOLOGY

No Data Available.

BIODEGRADATION

No Data Available.

13 Disposal considerations

Incinerate or bury in approved landfill. Please be advised that there may be additional local or provincial requirements relating to the disposal of waste. Consult provincial and local regulations regarding the proper disposal of this material.

14 Transport information

Transportation of Dangerous Goods:
SODIUM HYDROXIDE SOLUTION
8, UN 1824, PG II
DOT EMERGENCY RESPONSE GUIDE #: 154

15 Regulatory information

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

CEPA:
All components of this product comply with substance notification requirements under CEPA.

WHMIS CLASSIFICATION:
D1B E

16 Other information

HMIS vII		**CODE TRANSLATION**
Health	3	Serious Hazard
Fire	0	Minimal Hazard
Reactivity	0	Minimal Hazard
Special	CORR	DOT corrosive
(1) Protective Equipment	D	Goggles,Face Shield,Gloves,Apron

(1) refer to section 8 of MSDS for additional protective equipment recommendations.

CHANGE LOG

	EFFECTIVE DATE	REVISIONS TO SECTION:	SUPERCEDES
MSDS status:	30-JUN-1998		** NEW **
	01-JUN-2001		30-JUN-1998
	24-SEP-2001	4	01-JUN-2001
	03-SEP-2004	16	24-SEP-2001
	26-MAY-2006	8	03-SEP-2004
	30-OCT-2008	14	26-MAY-2006
	03-OCT-2011	16	30-OCT-2008

GE
Water & Process Technologies

Material Safety Data Sheet

Issue Date: 11-MAY-2006
Supercedes: 11-MAY-2006

SULFURIC ACID, CONCENTRATED

1 Identification

Identification of substance or preparation
SULFURIC ACID, CONCENTRATED

Reagent Application Area
Field test reagent

Reagent Code
L273

Company/Undertaking Identification
GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency Telephone
(800) 877-1940

Prepared by Product Stewardship Group: T 215-355-3300 Prepared on: 11-MAY-2006

2 Hazard(s) identification

****
EMERGENCY OVERVIEW

Corrosive to skin. Corrosive to the eyes. Mists/aerosols cause irritation to the upper respiratory tract.

Odor: None; Appearance: Colorless To Brown, Liquid

Fire fighters should wear positive pressure self-contained breathing apparatus(full face-piece type). Proper fire-extinguishing media: dry chemical, carbon dioxide or foam--Avoid water if possible.
****

POTENTIAL HEALTH EFFECTS

ACUTE SKIN EFFECTS:
Primary route of exposure; Corrosive to skin.

ACUTE EYE EFFECTS:
Corrosive to the eyes.

ACUTE RESPIRATORY EFFECTS:
Mists/aerosols cause irritation to the upper respiratory tract.

INGESTION EFFECTS:
May cause severe irritation or burning of mouth, throat, and gastrointestinal tract with severe chest and abdominal pain, nausea, vomiting, diarrhea, lethargy and collapse. Possible death when ingested in very large doses.

TARGET ORGANS:
Prolonged or repeated exposures may cause tissue necrosis.

MEDICAL CONDITIONS AGGRAVATED:
Not known.

SYMPTOMS OF EXPOSURE:
Causes severe irritation, burns or tissue ulceration with subsequent scarring.

3 Composition / information on ingredients

Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

HAZARDOUS INGREDIENTS:

Cas#	Chemical Name	Range(w/w%)
7664-93-9	SULFURIC ACID Corrosive ORAL LD50-RAT: 2,140 MG/KG DERMAL LD50: NO DATA. INHL. LC50-RAT: 510 MG/M3/2HR	60-100

4 First-aid measures

SKIN CONTACT:
URGENT! Wash thoroughly with soap and water. Remove contaminated clothing. Get immediate medical attention. Thoroughly wash clothing before reuse.

EYE CONTACT:
URGENT! Immediately flush eyes with plenty of low-pressure water for at least 20 minutes while removing contact lenses. Hold eyelids apart. Get immediate medical attention.

INHALATION:
Remove to fresh air. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get immediate medical attention.

INGESTION:
Do not feed anything by mouth to an unconscious or convulsive victim. Do not induce vomiting. Immediately contact physician. Dilute contents of stomach using 2-8 fluid ounces (60-240 mL) of milk or water.

NOTES TO PHYSICIANS:
Material is corrosive. It may not be advisable to induce vomiting. Possible mucosal damage may contraindicate the use of gastric lavage.

5 Fire-fighting measures

FIRE FIGHTING INSTRUCTIONS:
Fire fighters should wear positive pressure self-contained breathing apparatus (full face-piece type).
EXTINGUISHING MEDIA:
dry chemical, carbon dioxide or foam--Avoid water if possible.
HAZARDOUS DECOMPOSITION PRODUCTS:
elemental oxides
FLASH POINT:
> 200F > 93C P-M(CC)

6 Accidental release measures

PROTECTION AND SPILL CONTAINMENT:
Ventilate area. Use specified protective equipment. Contain and absorb on absorbent material. Place in waste disposal container. Flush area with water. Wet area may be slippery. Spread sand/grit.
DISPOSAL INSTRUCTIONS:
The waste characteristics of the absorbed material, or any contaminated soil, should be determined in accordance with provincial regulations. Water contaminated with this product may be sent to a sanitary sewer treatment facility, in accordance with any local agreement or discharged under provincial regulations.
Incinerate or land dispose in an approved landfill.

7 Handling and storage

HANDLING:
Acidic. Corrosive to skin and eyes. Do not breathe mist or vapor. Do not mix with alkaline material.
STORAGE:
Keep containers closed when not in use. Use approved containers only. Store in cool, well-vented area. Contact with metals may release flammable hydrogen gas.

8 Exposure controls / personal protection

EXPOSURE LIMITS
Consult local authorities for acceptable provincial values.

CHEMICAL NAME

SULFURIC ACID
PEL (OSHA): 1 MG/M3
TLV (ACGIH): 0.2 MG/M3

ENGINEERING CONTROLS:
Adequate ventilation to maintain air contaminants below exposure limits.
RESPIRATORY PROTECTION:
If air-purifying respirator use is appropriate, use a respirator with acid gas cartridges and dust/mist prefilters.
SKIN PROTECTION:

gauntlet-type neoprene gloves, chemical resistant apron-- Wash off after each use. Replace as necessary.

EYE PROTECTION:

splash proof chemical goggles, face shield

9 Physical and chemical properties

Specific Grav.(70F,21C)	1.838	Vapor Pressure (mmHG)	~ 4.0
Freeze Point (F)	< -30	Vapor Density (air=1)	< 0.10
Freeze Point (C)	< -34		
Viscosity(cps 70F,21C)	50	% Solubility (water)	100.0

Odor		None
Appearance		Colorless To Brown
Physical State		Liquid
Flash Point	P-M(CC)	> 200F > 93C
pH As Is (approx.)		< 1.0
Evaporation Rate (Ether=1)		< 1.00
Percent VOC:		ND

NA = not applicable ND = not determined

10 Stability and reactivity

STABILITY:

Stable under normal storage conditions.

HAZARDOUS POLYMERIZATION:

Will not occur.

INCOMPATIBILITIES:

May react with bases or strong oxidizers.

DECOMPOSITION PRODUCTS:

elemental oxides

11 Toxicological information

Oral LD50 RAT:	2,140 mg/kg
Dermal LD50 RABBIT:	>1,000 mg/kg
NOTE - Estimated value	
Inhalation LC50 RAT:	510 mg/m3/2hr
Skin Irritation Score RABBIT:	CORROSIVE
NOTE - Based on testing of similar product	
Eye Irritation Score RABBIT:	CORROSIVE
NOTE - Estimated value	

12 Ecological information

AQUATIC TOXICOLOGY

No Data Available.

BIODEGRADATION

No Data Available.

13 Disposal considerations

Incinerate or bury in approved landfill. Please be advised that there may be additional local or provincial requirements relating to the disposal of waste. Consult provincial and local regulations regarding the proper disposal of this material.

14 Transport information

Transportation of Dangerous Goods:

SULPHURIC ACID
8, UN 1830, PG II

DOT EMERGENCY RESPONSE GUIDE #: 137

15 Regulatory information

This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

CEPA:

All components of this product comply with substance notification requirements under CEPA.

WHMIS CLASSIFICATION:

E

NSF Registered and/or meets USDA (according to 1998 Guidelines):

16 Other information

HMIS vII		**CODE TRANSLATION**
Health	3	Serious Hazard
Fire	0	Minimal Hazard
Reactivity	0	Minimal Hazard
Special	CORR	DOT corrosive
(1) Protective Equipment	D	Goggles,Face Shield,Gloves,Apron

(1) refer to section 8 of MSDS for additional protective equipment recommendations.

CHANGE LOG

	EFFECTIVE DATE	REVISIONS TO SECTION:	SUPERCEDES
MSDS status:	03-MAY-1996	REVISED FORMAT	** NEW **
	17-JAN-1997	14	03-MAY-1996
	08-JUN-1998	15;EDIT:9	17-JAN-1997
	05-JAN-1999	10	08-JUN-1998
	10-DEC-2001		05-JAN-1999
	21-FEB-2002	4	10-DEC-2001
	25-JAN-2005	16	21-FEB-2002
	11-MAY-2006	8	25-JAN-2005

GE Power
Water & Process Technologies

SAFETY DATA SHEET
SPECTRUS* DT1404

1. Product and Company Identification

Material name	**SPECTRUS DT1404**
Version #	3.0
Revision date	Apr-07-2016
Supersedes date	Mar-15-2016
Prepared by	This SDS has been prepared by GE Water & Process Technologies Regulatory Department (1-215-355-3300).
Chemical description	Sodium bisulphite, aqueous solution
CAS #	Mixture
Product application	Chemical cleaning compound

Company/undertaking identification

GE Water & Process Technologies Canada
3239 Dundas Street West
Oakville, Ontario, L6M 4B2
T 905-465-3030

Emergency telephone

(800) 877-1940

2. Hazards Identification

Emergency overview	Causes eye irritation. May cause irritation to the respiratory system.
Potential health effects	
Eyes	May cause slight irritation to the eyes.
Skin	Primary route of exposure; May cause slight irritation to the skin.
Inhalation	Dusts or mists are irritating to mucous membranes.
Ingestion	May cause gastrointestinal irritation
Target organs	Eyes. Skin. Respiratory system.
Signs and symptoms	Irritation of eyes. May cause respiratory irritation. Exposed individuals may experience eye tearing, redness, and discomfort.

3. Composition / Information on Ingredients

Components	CAS#	Percent (wt/wt)
Sodium Bisulfite	7631-90-5	30 - 60

Composition comments Information for specific product ingredients as required by the WHMIS Regulations is listed. Refer to additional sections of this MSDS for our assessment of the potential hazards of this formulation.

4. First Aid Measures

First aid procedures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.

Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Notes to physician	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General advice	If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire Fighting Measures

Extinguishing media

Suitable extinguishing media	Water fog. Carbon dioxide (CO2). Foam. Dry chemical powder.
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.

Protection of firefighters

Protective equipment for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	In case of fire and/or explosion do not breathe fumes. Use standard firefighting procedures and consider the hazards of other involved materials. Move containers from fire area if you can do so without risk. Cool containers / tanks with water spray.

Explosion data

Sensitivity to static discharge	Not available.
Sensitivity to mechanical impact	Not available.

6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Avoid breathing mist or vapor. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the MSDS.
Environmental precautions	Water contaminated with this product may be sent to a sanitary sewer treatment facility, or a permitted waste treatment facility, in accordance with any local agreements.
Methods for containment	Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible.
Methods for cleaning up	Wear appropriate protective equipment and clothing during clean-up. Wet area may be slippery.

7. Handling and Storage

Handling	Vent carefully before opening. Sulfur dioxide can be formed during the normal use and handling of this product. Avoid breathing mist or vapor. Avoid contact with eyes. Avoid prolonged exposure. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices.
Storage	Store containers closed when not in use. Protect from freezing. If frozen, thaw completely and mix thoroughly prior to use. Shelf life 270 days. Store locked up. Store away from incompatible materials (see Section 10 of the MSDS). Store in original tightly closed container.

8. Exposure Controls / Personal Protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
Sodium Bisulfite (CAS 7631-90-5)	TWA	5 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Engineering controls Adequate ventilation to maintain air contaminants below exposure limits.

Personal protective equipment

Eye/face protection Splash proof chemical goggles.

Skin protection Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls do not maintain airborne concentrations below recommended exposure limits (where applicable) or to an acceptable level (in countries where exposure limits have not been established), an approved respirator must be worn.

Hand protection The choice of an appropriate glove does not only depend on its material but also on other quality features and is different from one producer to the other. Glove selection must take into account any solvents and other hazards present.

9. Physical & Chemical Properties

Appearance

Physical state Liquid

Color Yellow to green

Odor Mild

Odor threshold Not available.

pH (concentrated product) 3.8

pH in aqueous solution 4 (5% SOL.)

Vapor pressure 18 mm Hg

Vapor pressure temp. 70 °F (21 °C)

Vapor density < 1 (Air = 1)

Boiling point Not available.

Melting point/Freezing point 27 °F (-3 °C)

Solubility (water) 100 %

Specific gravity (70°F, 21°C) 1.36

Flash point > 200 °F (> 93 °C) P-M(CC)

Flammability limits in air, upper, % by volume Not available.

Flammability limits in air, lower, % by volume Not available.

Auto-ignition temperature Not available.

Evaporation rate < 1 (Ether = 1)

Viscosity 20 cps

Viscosity temperature 70 °F (21 °C)

Percent volatile 0 (Estimated)

Pour point 32 °F (0 °C)

10. Chemical Stability & Reactivity Information

Reactivity The product is stable and non-reactive under normal conditions of use, storage and transport.

Chemical stability Material is stable under normal conditions.

Conditions to avoid	Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Avoid contact with strong oxidizers. and Amines.
Hazardous decomposition products	Oxides of sulphur evolved in fire.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Product	Species	Test Results
SPECTRUS DT1404 (CAS Mixture)		
Acute		
Dermal		
LD50	Rabbit	> 5000 mg/kg, (Calculated according to GHS additivity formula)
Inhalation		
LC50	Rat	> 5.5 mg/l, 4 Hours, (Calculated according to GHS additivity formula)
Oral		
LD50	Rat	3550 mg/kg, (Calculated according to GHS additivity formula)

Components	Species	Test Results
Sodium Bisulfite (CAS 7631-90-5)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg
Inhalation		
LC50	Rat	> 5.5 mg/l, 4 Hour
Oral		
LD50	Rat	1420 mg/kg

Carcinogenicity	Not classified.

ACGIH Carcinogens

Sodium Bisulfite (CAS 7631-90-5)	A4 Not classifiable as a human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Sodium Bisulfite (CAS 7631-90-5)	3 Not classifiable as to carcinogenicity to humans.

Mutagenicity	Not classified.
Reproductive effects	Not classified.
Teratogenicity	Not available.

12. Ecological Information

Ecotoxicity

Product		Species	Test Results
SPECTRUS DT1404 (CAS Mixture)			
	LC50	Fathead Minnow	175 mg/L, Static Renewal Bioassay, 96 hour
	NOEL	Fathead Minnow	125 mg/L, Static Renewal Bioassay, 96 hour
Aquatic			
Crustacea	LC50	Daphnia magna	175 mg/L, Static Renewal Bioassay, 48 hour
	NOEL	Daphnia magna	125 mg/L, Static Renewal Bioassay, 48 hour
Fish	LC50	Rainbow Trout	330 mg/L, Static Renewal Bioassay, 96 hour, (pH adjusted)

Product		Species	Test Results
	NOEL	Rainbow Trout	125 mg/L, Static Renewal Bioassay, 96 hour, (pH adjusted)

Persistence and degradability

- COD (mgO2/g) 165

13. Disposal Considerations

Disposal instructions Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Dispose of contents/container in accordance with local/regional/national/international regulations.

Waste from residues/unused products Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions). Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner.

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport Information

TDG

Not regulated as dangerous goods.

The goods described above have been classified using a combination of testing, technical data, calculations and manufacturer knowledge in accordance with Part 2, Classification.

DOT

UN number UN3082

UN proper shipping name ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (SODIUM BISULFITE SOLUTION), RQ

Transport hazard class(es)

Class 9

Packing group III

ERG number 171

Some containers may be exempt from Dangerous Goods/Hazmat Transport Regulations, please check BOL for exact container classification.

IMDG

UN number UN3082

UN proper shipping name ENVIRONMENTALLY HAZARDOUS SUBSTANCES, LIQUID, N.O.S. (SODIUM BISULPHITE SOLUTION), RQ

Transport hazard class(es)

Class 9

Subsidiary risk -

Packing group III

Environmental hazards

Marine pollutant No.

EmS F-A,S-F

Special precautions for user Not available.

IATA

Not regulated as dangerous goods.

DOT

IMDG

15. Regulatory Information

WHMIS status Controlled

WHMIS classification D2A - Other Toxic Effects-VERY TOXIC
E - Corrosive

WHMIS labeling

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other Information

List of abbreviations

CAS: Chemical Abstract Service Registration Number
TWA: Time Weighted Average
STEL: Short Term Exposure Limit
LD50: Lethal Dose, 50%
LC50: Lethal Concentration, 50%
NOEL: No Observed Effect Level
COD: Chemical Oxygen Demand
BOD: Biochemical Oxygen Demand
TOC: Total Organic Carbon
IATA: International Air Transport Association
IMDG: International Maritime Dangerous Goods Code
ACGIH: American Conference of Governmental Industrial Hygienists
TSRN indicates a Trade Secret Registry Number is used in place of the CAS number.

HMIS® ratings
Health: 3
Flammability: 0
Physical hazard: 1
Personal protection: B

NFPA ratings
Health: 3
Flammability: 0
Instability: 0
Special hazards: NONE

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

This data sheet contains changes from the previous version in section(s):
This document has undergone significant changes and should be reviewed in its entirety.

* Trademark of General Electric Company. May be registered in one or more countries.

Appendix B

Slag

B1 – Methodology for the Production of Slag with the same Characteristics (French only)
B2 – Decision Flowchart for Repurposing (extract from the guide) (French only)
B3 – Slag Analytical Results Overview (French only)
B4 – Detailed Results and Certificates of Analyses (French only)

Appendix B1 – Methodology for the Production of Slag with the same Characteristics

SNC-Lavalin GEM Québec inc.
550, Sherbrooke Ouest
Montréal (Québec) Canada H3A 1B9
514.393.1000 514.392.4758

27 mai 2016

Madame Mélissa Gagnon, biol., M.Sc. Eau
Coordonnatrice - Projets industriels
Direction de l'évaluation environnementale des projets hydriques et industriels
Ministère du Développement durable, de l'Environnement et
de la Lutte contre les changements climatiques
675, boul. René-Lévesque Est, 6e étage
Québec (Québec) G1R 5V7

Objet : Usine de fabrication de fonte en gueuse au Saguenay – NAIC
N/Réf. : 634451

Madame Gagnon,

La présente fait suite à différents échanges ainsi qu'à notre rencontre du 24 mai dernier concernant la caractérisation des scories qui seront produites par l'usine de fonte en gueuse de NAIC au Saguenay.

Mise en contexte

Selon l'annexe 4 du règlement sur les matières résiduelles, les scories sont des matières dangereuses E10. Les scories qui seront produites par NAIC ne présentent pas les caractéristiques d'une matière résiduelle dangereuse. Les scories sont constituées de la gangue, soit l'ensemble des minéraux sans valeur contenus dans les boulettes, et du fondant. Les boulettes de fer ne sont pas classifiées comme des matières dangereuses. Par ailleurs, les scories des aciéries et des fonderies sont typiquement valorisées et réutilisées comme agrégats. En 2002, le ministère de l'Environnement a rédigé un guide de valorisation des matières résiduelles inorganiques non dangereuses de source industrielle comme matériau de construction. À la page 4 de ce guide, en guise d'introduction, il est mentionné que le guide a été rédigé dans le but de favoriser les démarches pour la valorisation des sables de fonderie, des scories d'aciérie, des résidus miniers, etc. Le guide présumait alors que les scories étaient des matières non dangereuses. Toutefois, le règlement sur les matières dangereuses adopté postérieurement au Guide a statué que les scories seraient des matières dangereuses.

La production annuelle des scories sera de l'ordre de 70 000 tonnes. L'étude de faisabilité économique du projet assume que les scories pourront être valorisées comme agrégat et qu'elles n'auront pas à être gérées, tant au niveau de l'entreposage, de la manutention que de la disposition comme une matière résiduelle dangereuse. La conception du projet ainsi que l'étude d'impact prennent donc comme hypothèse de base que les scories sont des matières non dangereuses et qu'elles pourront être valorisées.

Protocole d'analyse

NAIC propose de réaliser des essais de production pour obtenir des scories qui pourront ensuite être analysées selon le protocole prévu au Guide mentionné plus haut. NAIC possède une fonderie (four à arc électrique) de petite taille à ses installations de Forks Specialty Metals (FSM). Ses installations ont été utilisées pour différents tests dans le cadre du développement du projet. NAIC propose de les utiliser pour produire des scories qui pourront ensuite être analysées.

NAIC ne possède pas d'installation pilote qui peut produire le fer de réduction directe (FRD, ou en anglais : *Direct Reduced Iron DRI*). Par contre, elle détient une quantité suffisante de fer de réduction directe provenant d'une usine d'Arcelor basée à Hambourg, Allemagne. Cette usine produit du fer de réduction directe par un procédé similaire (procédé Midrex) à celui qui sera utilisé par NAIC. Le FRD de Hambourg sera utilisé pour les essais de production qui permettront d'obtenir de la fonte et des scories qui pourront ensuite être analysées. Puisque les compositions des FRD de Hambourg et de NAIC ne seront pas exactement les mêmes, NAIC a défini la composition du FRD produit par modélisation pour les comparer. Cette comparaison a ensuite permis de définir les proportions de FRD/Fondant à utiliser lors des essais.

NAIC s'approvisionnera principalement de boulettes de fer provenant de la Côte-Nord, soit d'Arcelor Mittal à Port-Cartier. La source d'approvisionnement en boulettes de fer pourra varier en fonction des conditions du marché sans impact sur les procédés de production, à l'exception de l'ajustement du dosage du fondant au four à arc électrique.

Arcelor Mittal à Port-Cartier a fourni la composition de ses boulettes de fer. Il est donc possible par modélisation mathématique de définir les caractéristiques du fer préréduit. Tenova, le concepteur de la technologie de réduction, a développé, au fil des années, un modèle mathématique, validé par de multiples essais et données de production.

Les caractéristiques du fer préréduit ne sont pas fournies par Tenova pour tous les paramètres tels qu'analysés par Arcelor Mittal. Pour fournir une caractérisation complète, NAIC a développé son propre modèle mathématique qui se compare très bien aux résultats fournis par celui de Tenova. Lorsque les paramètres se retrouvent sous les limites de détection pour les matières premières, NAIC fixe la valeur minimale à zéro et la valeur maximale comme étant la limite de détection. Ensuite, par modélisation, elle calcule les concentrations attendues au niveau du fer préréduit.

Finalement, la composition du fer préréduit dérivée par modélisation à partir des boulettes d'Arcelor Mittal à Port-Cartier (FSM AM BMC) est comparée à la composition du fer préréduit produit par Arcelor Mittal de Hamburg qui est obtenue par analyses en laboratoire.

Toujours par modélisation mathématique, NAIC a calculé la composition des scories en se basant sur la composition du FRD fournie par Tenova (Tenova AM BMC slag), celles fournies par son propre modèle (FSM AM BMC slag min et max) ainsi que sur la composition obtenue par analyses du FRD d'Arcelor Hamburg.

Puisque le procédé de réduction de NAIC (reformage in situ) sera légèrement différent de celui d'Arcelor Hamburg (procédé Midrex) et que la source d'approvisionnement est aussi différente, la composition du FRD quoique similaire présente quelques différences.

Dans ses modélisations définissant la composition des scories, NAIC a utilisé des proportions différentes de FRD et de fondants afin de tenir compte de ces légères différences, notamment au niveau de la concentration en silice. Ainsi, la modélisation de la composition des scories à partir du FRD d'Arcelor (FSM-AM BMC) a été réalisée avec un ratio de 94,6% de FRD, de 2,7% de chaux vive et de 2,7% de chaux dolomitique alors que la modélisation de la composition des scories à partir du FRD d'Arcelor de Hamburg a été réalisée avec un pourcentage de 93,1% de FRD, de 0,9% de chaux dolomitique, de 1,5 % de silice et de 1,5% de chaux vive.

La gangue provient des boulettes de minerai de fer et les données indiquent qu'elle est plus importante dans les boulettes d'Arcelor Mittal à Port-Cartier, notamment pour les concentrations de CaO, MgO et SiO_2, ce qui explique le ratio scorie/charge plus élevé.

Les résultats des différentes modélisations sont présentés en annexe, des photos illustrent les installations de FMC.

Les modélisations précédemment présentées ont permis de définir le ratio de fondant à utiliser lors des essais avec le FRD de Hambourg afin de se rapprocher le plus possible des scories qui seront produites.

NAIC propose de réaliser des essais de production avec le FRD de Hambourg afin de récolter des scories qui seront ensuite analysées selon le protocole défini au guide de valorisation des matières résiduelles inorganiques non dangereuses de source industrielle comme matériau de construction. Les scories seront analysées par un laboratoire accrédité par le MDDELCC et selon les méthodes indiquées par le MDDELCC :

http://www.ceaeq.gouv.qc.ca/methodes/list_matresinorg.htm#alteration

Les tests seront réalisés dès la semaine prochaine.

Sur la base de la composition calculée des scories, on constate que les concentrations seraient toutes inférieures aux critères A de la politique de réhabilitation des sols à l'exception :

- Chrome : 2 300 ppm vs 45 ppm
- Cobalt : 200 ppm vs 15 ppm
- Manganèse : 4 500 ppm vs 1 000 ppm
- Molybdène : 10 ppm vs 6 ppm

Cela indique que des tests de mobilité seront plus que probablement nécessaires.

Les résultats issus du protocole d'analyse seront donc utilisés pour confirmer le potentiel de valorisation des scories. Une fois l'usine en production, le protocole d'analyse sera repris avec les scories produites à l'usine de Saguenay afin de valider les résultats obtenus lors des essais réalisés aux installations de FSM et basé sur du fer préréduit de Hamburg. Un protocole d'analyses et de suivi sera convenu afin d'assurer une gestion adéquate des scories.

Le marché des scories

Depuis plusieurs années les scories des fonderies et aciéries sont valorisées, que ce soit au Québec ou plus globalement en Amérique du Nord et de l'Europe. La majorité des scories utilisée comme matériel de construction provient notamment du secteur de la fonte et des aciéries. Les scories sont considérées comme une commodité dont l'offre et la demande sont suivies annuellement par le *United States Geological Survey* (Piatak, N.M, M.B. Parsons and R.R. Seal II. 2015. Characteristics and Environmental Aspects of Slag : A Review. Applied Geochemistry 57 : 236-266. Available at http://www.sciencedirect.com/science/article/pii/S0883292714000821. Consulted: May 2016).

Le marché de la scorie est global. En 2011, plus de 500 millions de tonnes de scories d'origine ferreuse étaient produites et commercialisées. Les scories peuvent être utilisées comme agrégat au niveau des fondations de routes ou dans les mélanges de béton ou encore comme matériau de remblai. Le protocole d'analyse du Guide de valorisation cité plus haut permet d'ailleurs de catégoriser les scories selon leur usage permis.

La particularité des scories produites par NAIC, comparativement à celles produites par des procédés similaires, notamment celui d'Arcelor Mittal à Contrecoeur (réduction directe de boulettes de fer provenant majoritairement de Port-Carier suivie de fusion et fonte dans un four à arc électrique), est qu'elles ne seront pas «contaminées» par la ferraille. NAIC utilisera uniquement des boulettes de fer, qui une fois réduites, seront introduites au four à arc électrique avec un fondant fait de chaux vive et chaux dolomitique. Il n'y aura pas d'ajout de ferraille. Ainsi, il est relativement aisé de prédire les caractéristiques des scories par modélisation, cette dernière n'étant pas influencée par la variabilité de la ferraille. De plus, la qualité des scories produites à Contrecoeur est bien connue du MDDELCC puisque leur gestion a fait l'objet d'une entente de valorisation. À notre connaissance, ces scories ne sont pas des matières dangereuses, elles ne lixivient pas et sont valorisées.

Entreposage

Les scories seront accumulées dans un pot de coulée qui pourra contenir plusieurs fournées. Une fois plein, le pot sera mis de côté à l'intérieur du bâtiment de coulée pour son refroidissement. Une fois solidifiées, les scories seront amenées à leur aire d'entreposage à l'extérieur et seront entreposées en tas directement sur le sol dans un secteur ou de l'argile est présente.

Lors de la réunion du 24 mai 2016, il a été mentionné que les scories devraient être entreposées sur une surface imperméable, peu importe leur niveau de dangerosité ou leur potentiel de valorisation. NAIC voudrait comprendre quelles sont les bases de cette exigence. Il apparaît curieux qu'une matière qui pourrait être utilisée comme agrégat dans l'industrie de la

construction doive faire l'objet de mesures particulières au niveau de son entreposage. Il nous apparaît plus approprié de définir le type d'entreposage selon le niveau de lixiviation, tout comme c'est le cas pour les résidus miniers.

Finalement, NAIC voudrait connaître quels sont les autres tests qui devraient être réalisés pour déclassifier les scories de leur statut de matières dangereuses. La majorité des tests sera déjà faite dans le cadre du protocole du Guide et nous voudrions valider s'il est pertinent de réaliser les autres tests dans le cadre de l'étude d'impact.

Veuillez accepter, Madame Gagnon, nos salutations distinguées.

SNC-Lavalin GEM inc.

Lina Lachapelle, ing.
Directeur de projets

Environnement et géosciences
Infrastructures

c.c. Kevin Kemper et Chris McKinney (NAIC)

Table 1. Arcelor Mittal BMC Pellets and calculated DRI compositions, compared to assay for Arcelor Mittal Hamburg DRI available at FSM.

Component	AM BMC Pellets[1]	Tenova AM BMC DRI[2]	FSM AM BMC DRI Min[3]	FSM AM BMC DRI Max[3]	AM Hamburg DRI[4]
As	<0.0003		0.00	0.0004	0.0005
Al_2O_3	0.45	0.60	0.59	0.59	0.47
C	<0.050	5.00	5.00	5.00	1.91
CaO	1.40	1.86	1.86	1.86	1.09
Co	<0.002		0.00	0.0026	0.0025
Cr	0.02		0.02	0.021	0.018
Cu	<0.001		0.00	0.0013	0.0031
$Fe_{metallic}$	0.00	80.14	80.19	80.18	85.48
FeO	1.50	6.58	6.58	6.58	8.09
Fe_2O_3	91.93		0.00	0.00	0.00
Hg	<0.0005		0.00	0.0007	0.00002
Pb	<0.002		0.00	0.0026	0.0006
MgO	0.62	0.82	0.81	0.81	0.39
Mn	0.03	0.04	0.04	0.04	0.08
Mo	<0.0012		0.00	0.0016	0.0001
Ni	<0.0015		0.00	0.0020	0.0023
K_2O	0.03	0.03	0.03	0.03	0.02
P	0.01	0.01	0.01	0.01	0.03
SiO_2	3.50	4.65	4.59	4.59	2.17
Na_2O	0.03	0.05	0.05	0.05	0.05
S	0.010	0.017	0.017	0.017	<0.010
Sn	<0.001		0.00	0.0013	0.0005
TiO_2	0.15	0.20	0.20	0.20	0.08
V	0.01		0.01	0.01	0.01
Zn	0.01		0.01	0.01	0.0008
Total	99.69	100.00	100.00	100.00	99.90
Fe_{Total}	65.50	85.26	85.31	85.30	91.77
Met		94%	94%	94%	93%
Total gangue	6.19%	8.22%	8.14%	8.14%	4.30%

Donnees fournies par AM Port-Cartier

Modelisation du fournisseur technologie

Modelisation NAIC Min = 0 LD MAX = LD

Analyses en laboratoire

AM Hamburg DRI

[1] Arcelor Mittal BMC pellets, after *"Arcelor Mittal Pellets Mines Canada (BMC); Date: 2016/01/27; Prepared by: Normand Paradis | Chief, Quality Assurance; Approved by: Gilles Couture | Manager, Energy and Quality."*

[2] NAIC DRI composition, after Tenova EAF Operating Memo *"North Atlantic Iron Corp. Nodular Pig Iron Plant Project, page 5."* Job MSP099.009, 31 March 2016.

[3] NAIC DRI composition, after Forks Specialty Metals DRI model calculations. Concentrations below detection limit assumed to be zero for "Min" calculations; concentrations below detection limit assumed to be at detection limit for "Max" calculations.

[4] Arcelor Mittal Hamburg DRI composition, after 3rd-party assays acquired by Forks Specialty Metals, March 2015.

Table 2. Tenova NAIC design slag and FSM calculated slag comparisons (wt pct).

Component	Tenova AM BMC Slag[1]	FSM AM BMC Slag Min[2]	FSM AM BMC Slag Max[2]	FSM AM Hamburg Slag[3,4]
As		0.0000	0.0001	0.0001
Al_2O_3	4.71	4.70	4.70	4.58
C		0.07	0.07	0.03
CaO	42.98	43.65	43.63	43.25
Co		0.00	0.02	0.02
Cr		0.22	0.22	0.23
Cu		0.0000	0.0002	0.0006
$Fe_{metallic}$		0.00	0.00	0.00
FeO	1.82	1.83	1.83	2.75
Fe_2O_3		0.00	0.00	0.00
Hg		0.000000	0.000097	0.000004
Pb		0.00000	0.00039	0.00011
MgO	14.15	13.64	13.64	13.82
Mn	0.16	0.15	0.15	0.45
Mo		0.000	0.011	0.001
Ni		0.000	0.001	0.003
K_2O		0.18	0.18	0.14
P_2O_5	0.02	0.02	0.02	0.06
SiO_2	33.75	33.82	33.80	33.53
Na_2O		0.25	0.25	0.34
S		0.020	0.020	0.025
Sn		0.0000	0.0007	0.0003
TiO_2	1.42	1.43	1.43	0.71
V		0.01	0.01	0.03
Zn		0.0005	0.0005	0.0001
Other	1.00			
Total	100.01	100.00	100.00	100.00
Fe_{Total}	1.42	1.42	1.42	2.14
Slag generation as % of charge	13%	13%	13%	10%
$Ib_2 = CaO/SiO_2$	1.29	1.29	1.29	1.29
$Ib_4 = (CaO+MgO)/(Al_2O_3+SiO_2)$	1.49	1.50	1.49	1.50

Modelisation par concepteur

Modelisation par NAIC; valeurs Min et Max des analyses fournies par AM: 94,6% de FRD, de 2,7% de chaux vive et de 2,7% de chaux dolomitique

Modelisation par NAIC; 93,1% de FRD, de 0,9% de chaux dolomitique, de 1,5 % de silice et de 1,5% de chaux vive.

Ajustement du ratio charge/ fondant pour tenir compte de la difference contenu silice

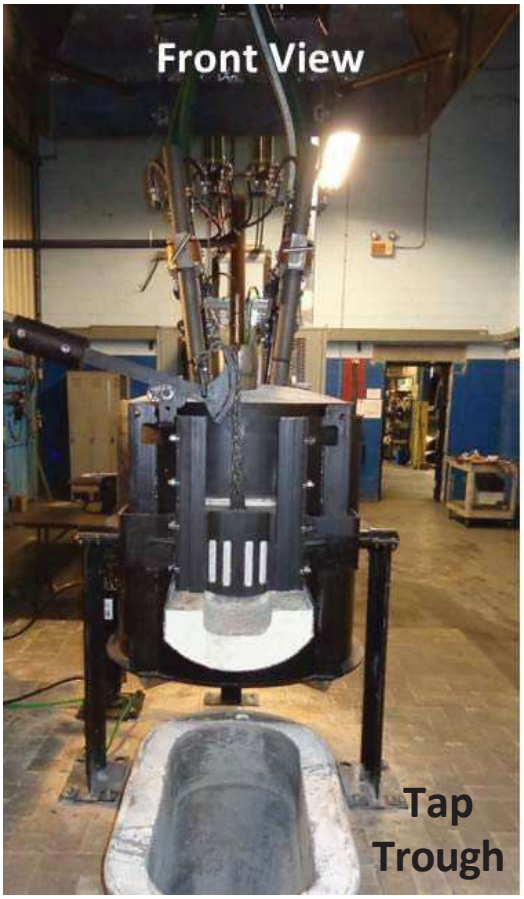
[1] NAIC design slag composition, after Tenova EAF Operating Memo *"North Atlantic Iron Corp. Nodular Pig Iron Plant Project, page 5."* Job MSP099.009, 31 March 2016.

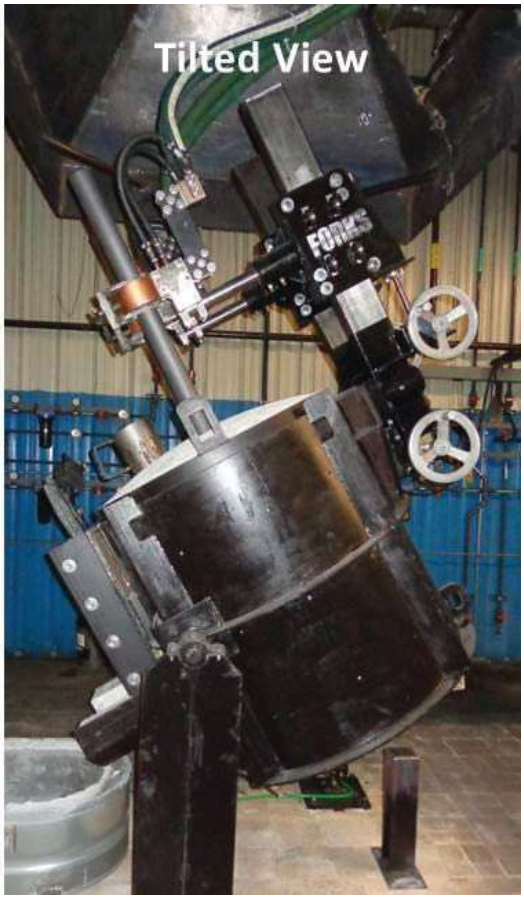
[2] FSM slag model calculations for AM BMC DRI, based on feed percentages to NAIC EAF: 94.6% DRI; 2.7% dolomitic lime; 2.7% lime.

[3] FSM slag model calculations for AM Hamburg DRI, based on feed percentages to NAIC EAF: 93.1% DRI; 3% dolomitic lime; 0.9% lime; 1.5% silica sand; 1.5% hydrated lime.

[4] Batch weights for 125 kg heat in FSM 300 kW EAF: 116 kg AM Hamburg DRI; 4 kg dolomitic lime; 1 kg lime; 2 kg silica sand; and 2 kg hydrated lime.

Forks Specialty Metals 300 kW Electric Arc Furnace





Skimming/sampling slag

Slag sample being poured onto Cu chill plate

PELLETS MINES CANADA (BMC)

Origin: Canada
Producer: ArcelorMittal Mining Canada G.P.

PARAMETERS	SPECIFICATIONS AT LOADING			TEST CONDITIONS and remarks
Dry chemical analysis (%)				
	TYPICAL	*MIN*	*MAX*	For purposes of determining conformance with the specifications shown on this sheet, an observed value or a calculated value shall be rounded "to the nearest unit" in the last right-hand digit used in expressing the specification limit, in accordance with the **rounding method** of **ASTM Practice E29-13, for** *Using Significant Digits in Test Data to Determine Conformance with Specifications.*
Fe	65.5	65.0		
SiO_2	3.5	3.25	3.75	
Al_2O_3	0.45		0.65	
CaO	1.40			
CaO/SiO_2	0.4	0.3	0.5	
MgO	0.62	0.47	0.77	
TiO_2	0.15		0.3	
P	0.010		0.03	
S	0.01		0.02	
Mn	0.030		0.06	
K_2O	0.025		0.04	
Na_2O	0.035		0.06	
Moisture	1.5		2.5	ISO 3087 : 2011
Sizing analysis (%)				
	TYPICAL	*MIN*	*MAX*	
+16 mm	1		5	ISO 4701 : 2008
-16 +9 mm	91	85		
-9 +6.3 mm	6.5			-6.3 mm at Unloading
-6.3 mm	1.5		3	typical : 2.5 max : 5
Physical analysis				
	TYPICAL	*MIN*	*MAX*	
Tumble +6.3 mm (%)	95.5	93.5		ISO 3271 : 2007
Tumble -0.5 mm (%)	4		5	
Compression (kg)	275	235		ISO 4700 : 2007
Pyrometallurgical analysis				
	TYPICAL	*MIN*	*MAX*	
Reducibility - R40 (% O2/min)	0.5			ISO 4695 : 2007
Swelling (%)	18			ISO 4698 : 2007
Static LTD +6.3 mm (%)	92			ISO 4696 : 2007
Static LTD -0.5 mm (%)	4			

Dry Chemical analysis (%) - Others Elements			
PARAMETERS	*TYPICAL*	PARAMETERS	*TYPICAL*
FeO	1.5	Mo	< 0.0012
As	< 0.0003	Ni	< 0.0015
C	< 0.05	Pb	< 0.002
Co	< 0.002	Sn	< 0.001
Cr	0.016	V	0.005
Cu	< 0.001	Zn	0.005
Hg	< 0.0005		

Others Physical Properties			
PARAMETERS	*TYPICAL*	PARAMETERS	*TYPICAL*
Bulk Density (nt/m³) (ISO 3852 : 2007)	2.05	Loss on Ignition (%)	0.15
Porosity	31.0		
Angle of repose (degrees)	27	Density (true) (g/cc)	4.96

Date : 2016/01/27

Prepared by : **Normand Paradis** | Chief, Quality Assurance

Approved by : **Gilles Couture** | Manager, Energy and Quality

ISO 9001 : 2008 REGISTERED QUALITY

AM Mining Luxembourg

Andrew S. McCreath & Son, Inc.
ANALYTICAL AND CONSULTING CHEMISTS
BALTIMORE, MD ♦ CHICAGO, IL ♦ CLEVELAND, OH ♦ GARY, IN ♦ GHENT, KY ♦ KALININGRAD, RUSSIA
KLAIPEDA, LITHUANIA ♦ NEW ORLEANS, LA ♦ PHILADELPHIA, PA ♦ PITTSBURGH, PA
1649 Bobali Drive
Harrisburg, PA 17104
Telephone: (717) 364-1440
Fax: (717) 364-1640

Analysis Report

March 4, 2015

Grand River Ironsands
Forks Specialty Metals
3700 Glover Road
Easton, Pennsylvania 18040

Gentlemen:

The sample received from you on February 24, 2015, identified as: Direct Reduced Iron (DRI), Sample No. 15-006, contained dried at 105°C:

Total Iron	91.77%
Metallic Iron	85.48%

Lab Nos. H15022501

Yours very truly,

ANDREW S. McCREATH & SON, INC.

George Wighton

This report cannot be reproduced except in its entirety.

ALS Canada Ltd.
2103 Dollarton Hwy
North Vancouver BC V7H OA7
Phone: 604 984 0221 Fax: 604 984 0218 www.alsgloba l.com

To: **GRAND RIVER IRONSANDS INC.**
805-1809 BARRINGTON ST.
HALIFAX NS B3J 3K8

Finalized Date: 24-MAR-2015
Account: GRVIRN

CERTIFICATE RE15027924

This report is for 5 Rock samples submitted to our lab in Reno, NV, USA on 25-FEB-2015.

The following have access to data associated with this certificate:

BILL OCONNOR

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Wei!1ht
LOG-22	Sample lo!1in - Red w/o BarCode
PUL-31	Pulverize split to 85% <75 um

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
ME-MS42	Up to 34 elements by ICP-MS	ICP-MS
OA-GRAOS	Loss on I!1nition at 1000C	WST-SEQ
TOT-ICPOS	Total Calculation for ICPOS	ICP-AES
ME-4ACD81	Base Metals by 4-acid di!1.	ICP-AES
Fe-VOLOS	FeO (Ferrous Iron)	
ME-ICP06	Whole Rock Packa!1e - ICP-AES	ICP-AES
C-IR07	Total Carbon (Leco)	LECO
S-IROB	Total Sulphur (Leco)	LECO
ME-MS81	Lithium Borate Fusion ICP-MS	ICP-MS

The results or this assay were based solely upon the content or the sample submitted. Any decision to Invest should be made only af1er ttle polentlal lnv8Stment velue of the claim ·or deposit hn been determined based on the results of assays of multiple 53mpes of geologk:al materials collected by the prospective lnve-stor or by a quallfled person selected by him/her and based on an evaluation of all engineering data which Is available concernh19 any proposed project. Stalement re lred byNevada State Law NRS 618

To: **GRAND RIVER IRONSANDS INC.**
ATTN: BILL OCONNOR
805-1809 BARRINGTON ST.
HAUFAX NS B3J 3K8

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

• ••• • See Appendix Pa!1e for comments re!1ardin!1 this certificate •• •••

Comments: Metallic Fe if present could interfere with FeO determination .

Signature: _____

Colin Ramshaw, Vancouver Laboratory Manager

ALS Canada Ltd.
2103 Oollarton Hwy
North Vancouver BC V 7H OA7
Phone: 604 984 0221 Fax: 604 984 0218 www.alsglobal.com

To: **GRAND RIVER IRONSANDS INC.**
805-1809 BARRINGTON ST.
HALIFAX NS B3J 3K8

Finalized Date: 24-MAR-2015
Account: GRVIRN

CERTIFICATE OF ANALYSIS RE15027924

Sample Description	Method Analyte Units LOR	WEI-21 RecvdWt. kg 0.02	Fe-VOL05 FeO " 0.01	ME-ICP06 SiO2 " 0.01	ME-ICP06 A1203 " 0.01	ME-ICP06 Fe203 " 0.01	ME-ICP06 CaO " 0.01	ME-fCP06 MgO " 0.01	ME-ICP06 Na20 " 0.01	ME-ICP06 K20 " 0.01	ME-ICP06 Ct203 " 0.01	ME-ICP06 Ti02 " Q.01	ME-ICP06 MnO " 0.01	ME-ICP06 P20S " 0.01	ME-ICP06 SrO 0.01	Bao 0.01
15-006 D		0.25	>100	2.17	0.47	>100	1.09	0.38	0.05	0.02	0.02	0.08	**011**	0.07	<0.01	0.01

Comments: Metallic Fe 1f present could ,nterfere with FeO determination.

..... See Appendix Page for comments regarding this certificate •• ...

ALS Canada l-td.
2103 Dollarton Hwy
North Vancouver BC V7H OA7
Phone: 604 984 0221 Fax: 604 984 0218 www.alsglobal.com

To: **GRAND RIVER IRONSANDS INC.**
805-1809 BARRINGTON ST.
HALIFAX NS B3J 3KB

Finalized Date: 24-MAR-2015
Account: **GRVIRN**

CERTIFICATE OF ANALYSIS RE15027924

Sample Description	Method / Analyte / Units / LOR	C-IR07 C '' 0.01	S-IR08 S '' 0.01	ME-MS81 Ba ppm 0.5	ME-MS81 Ce ppm 0.5	ME-MS81 Cr ppm ,O	ME-MS81 Cs ppm 0.01	ME-MS81 Dy ppm 0.05	ME-Ms.81 Er ppm O.OJ	ME-MS81 Eu ppm 0.03	ME-MS81 Go ppm 0.1	ME-MSB1 Gd ppm 0.05	ME-MS81 Ge ppm 5	ME-MS81 Hf ppm 0.2	ME-MS81 Ho ppm 0.01	ME-MS81 La ppm 0.5
		1.91	<0.01	91.0	15.2	180	0.07	1.12	0.72	0.22	4.3	0.82	7	0.5	0.19	9.0
15-006																

Comments: Metallic Fe 1f present could interfere **with** FeO determ1nat1on.

·• •• • See Appendix Page for comments regarding this certificate • •• ·•

ALS Canada ltd.
2103 0ollarlon Hwy
North Vancouver BC V7H 0A7
Phone: 604 984 0221 Fax: 604 984 0218 www.alsglobal.com

To: **GRAND RIVER IRONSANDS INC.**
805-1809 BARRINGTON ST.
HALIFAX NS BJJ 3KB

Finalized Date: 24-MAR-2015
Account: GRVIRN

CERTIFICATE OF ANALVSIS RE15027924

Sample Description	Method / Analyte / Units / LOR	ME-MS81 Lu ppm 0.01	ME-MS81 Nb ppm 0.2	ME-MS81 Nd ppm 0.1	ME-MS81 Pr ppm 0.03	ME-MS81 Rb ppm 0.2	ME-MS81 Sm ppm O.Q3	ME-MS81 Sn ppm 1	ME-MS81 Sr ppm 0.1	ME-MS81 To ppm 0.1	ME-M$81 Tb ppm 0.01	ME-MS81 Th ppm 0.05	ME-MS81 Tm ppm 0.01	ME-MS81 U ppm 0.05	ME-MS81 V ppm S	ME-MS81 W ppm 1
15-006		0.13	3.9	4.9	1.51	0.7	0.63	5	21 .6	0.1	0.14	0.92	0.09	0.99	149	3

Comments: Metallrc Fe tf present could interfere wrth FeO determ rn at ron .

• •• ·• See Appendix Page for comments regarding this certificate .....

ALS Canada li d.
2103 Dollarton Hwy
Norlh Vancouver BC V7H 0A7
Phone: 604 984 0221 Fax: 604 984 0218 www.alsglob al.com

To: **GRAND RIVER IRONSANDS INC.**
805-1809 BARRINGTON ST.
HALIFAX NS 83J 3KB

Finalized Date: 24-MAR-2015
Account: GRVIRN

CERTIFICATE OF ANALYSIS RE15027924

Sample Description	Method Analyte Units LOR	ME-MS81 y ppm 0.5	ME-MS81 Yb ppm 0.03	ME-MS81 Zr ppm 2	ME-MS-42 As ppm 0.1	ME-MS42 Bi ppm 0.01	ME-MS42 Hg ppm 0.005	ME-MS42 In ppm 0.005	ME-MS42 Re ppm 0.001	ME-MS42 Sb ppm 0.05	MC-MS-42 Se ppm 0.2	ME-MS42 To ppm 0.01	MC-MS42 Tl ppm 002	OA-GRA05 LOI % 0.01	TOT-ICP06 Tola! '' 0.01	ME-4AC081 Ag ppm 0.5
15-006		7.2	o.sa	22	5,3	0.08	0.023	0.007	0.003	1.65	<0.2	0.01	<0.02	-16.15	>102 .00	0.7

Comments: Metallic Fe 1f present could interfere with FeO determ1natIon.

• • • •• See Appendix Page for comments regarding this certificate ••· ••

Al5 canado lld .
2103 Dollarton Hwy
North Vancouver BC V7H 0A7
Phone : 604 984 0221 Fax : 604 984 021B www.alsglobal.com

To: **GRAND RIVER IRONSANDS INC.**
805-1809 BARRINGTON ST.
HALIFAX NS 83J 3KB

Finalized Date: 24-MAR-2015
Account: GRVIRN

CERTIFICATE OF ANALYSIS RE15027924

Sample Description	Method Analyte Units LOR	ME-4ACD81 Cd ppm 0.5	ME-4ACD81 Co ppm 1	ME-4ACD81 Cu ppm 1	ME-4AC081 u ppm 10	ME-4AC081 Mo ppm 1	M£-4ACD81 N; ppm 1	M£-4ACD87 Pb pprn 2	M£-4AC081 Sc ppm 1	ME-4AC087 2n ppm 2
15-006		<0.5	25	31	10	1	23	6	2	6

Comments: Metallic Fe 1f present could interfere with FeO determmat1on.

••••• See Appendix Page ror comments regarding this certificate •....

AIS Canada Ltd.
2103 Dollan on Hwy
North Van couver BC V7H OA 7
Phone: 604 984 0221 Fax: 604 984 0218 www.alsg lo bal.co m

To: **GRAND RIVER IRONSANDS INC.**
805-1809 BARRINGTON ST.
HALIFAX NS B3J 3K8

Finalized Date: 24-MAR-2015
Account: GRVIRN

CERTIFICATE OF ANALYSIS RE15027924

CERTIFICATE COMMENTS

LABORATORY ADDRESSES

Processed at ALS Reno located at 4977 Energy Way, Reno . NV, USA.

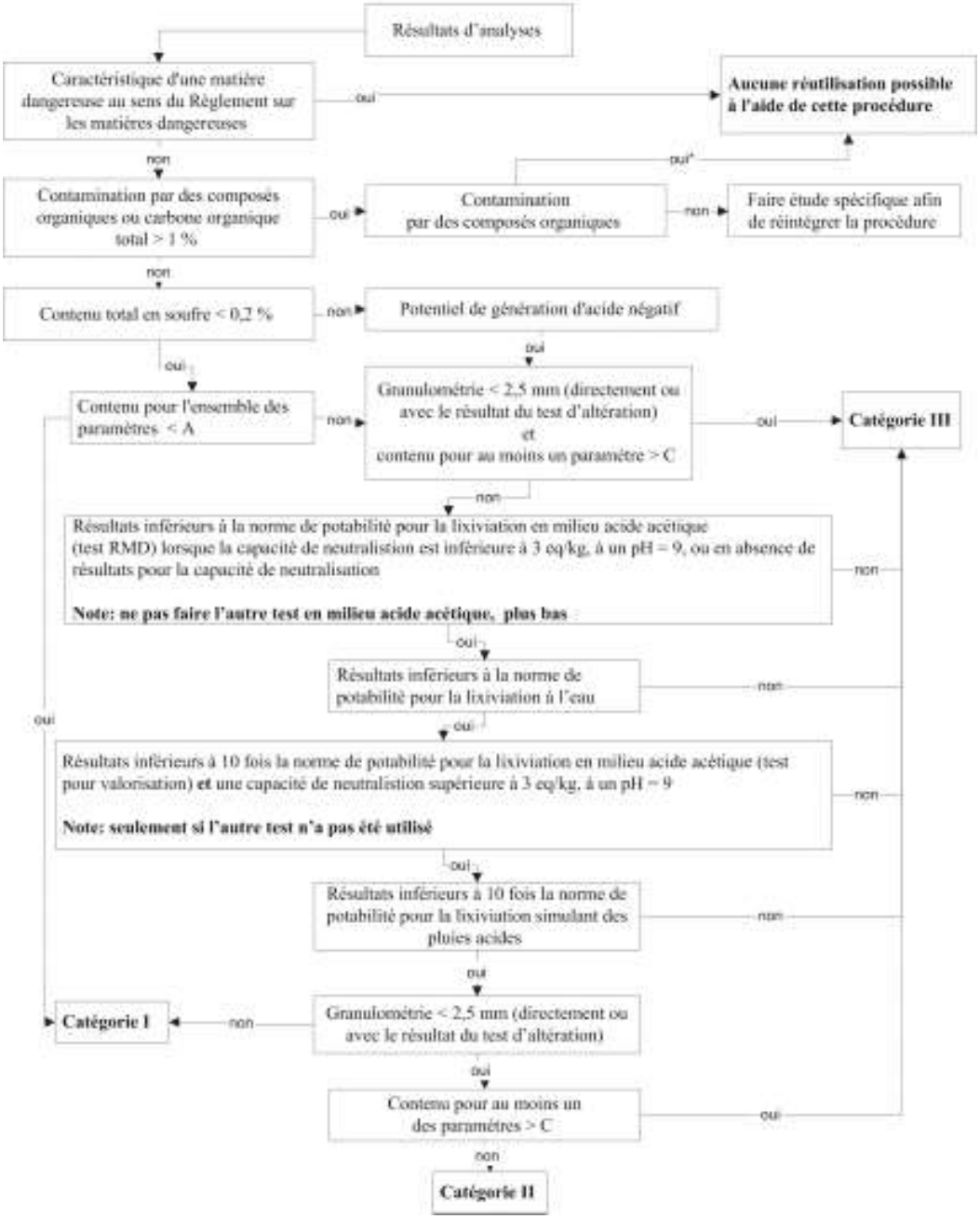
Applies to Method:				
	LOG-22	PUL-31	WEI-21	

Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada .

Applie s to Method:				
	C-IR07	Fe-VOLOS	ME-4ACD81	ME-ICP06
	ME-MS42	ME-MS81	OA-GRA0S	S-IR08
	TOT-ICP06			

Appendix B2 – Decision Flowchart for Repurposing (extract from the guide)

Figure 5 : Schéma récapitulatif



>			

Tire du guide de valorisation des matieres residuelles inorganiques non dangereuses de source industrielle comme materiau de construction. Ministere de l'environnement 19 juin 2002.

Appendix B3 – Slag Analytical Results Overview

Tableau B1 - Résultats d'analyse des Scories produites à Forks Specialty Metals (NAIC)

Paramètres	Unités	Critères génériques pour les sols[1]		Normes de potabilité[2]	Normes du RMD[3]	Valeur du Guide de valorisation	Résultats Scories NAIC			
		A	B				Autres tests selon RMD ou Guide de valorisation	Lixiviation RMD	Lixiviation pluies acides[4]	Lixiviation à l'eau[4]
								TCLP-1311	TCLP - 1312	3 CTEU-9
Conventionnels										
Carbone organique total (titrage)	**%g/g**					**> 1**	*0,08*			
Capacité de neutralisation							*ND; à venir*			
Chrome hexavalent (Cr 6+)	**mg/kg**						*<0,4*			
Soufre	**%g/g**	**0,04**	**0,1**		**-**	**< 0,2**	*<0,01*			
Matière assimilée à une matière dangereuse										
Biphényles polychlorés totaux	**mg/kg**						*<0,01*			
Halogènes organiques totaux	**mg/kg**						*ND; à venir*			
Huiles et graisses (C10C50)	**mg/kg**	**300**	**700**				*<100*			
Matière corrosive										
pH	**pH**				**>2; <12,5**		*10,2*			
Matière lixiviable										
Métaux - Lixiviation										
Arsenic	**mg/l**			**0,01**	**5**			*<0,004*		
Baryum	**mg/l**			**1**	**100**			*0,24*		
Bore	**mg/l**			**5**	**500**			*0,1*		
Cadmium	**mg/l**			**0,005**	**0,5**			*<0,002*	*<0,001*	*<0,001*
Chrome	**mg/l**			**0,05**	**5**			*0,008*	*<0,007*	*0,008*
Cuivre	**mg/l**			**1**	**-**			*0,17*	*<0,003*	*0,009*
Fer	**mg/l**			**-**	**-**				*<0,1*	*<0,1*
Mercure	**mg/l**			**0,001**	**0,1**			*<0,01*	*<0,0005*	*<0,0005*
Nickel	**mg/l**			**-**	**-**			*0,011*	*<0,006*	*<0,006*
Plomb	**mg/l**			**0,01**	**5**			*<0,01*	*<0,001*	*<0,001*
Sélénium	**mg/l**			**0,01**	**1**			*<0,005*	*0,001*	*<0,001*
Uranium	**mg/l**			**0,02**	**2**			*<0,02*		
Zinc	**mg/l**			**-**	**-**			*<0,2*	*<0,005*	*<0,005*
Nitrates+nitrites	**mg/l**			**10**	**1000**			*<0,2*		
Nitrites	**mg/l**			**1**	**100**			*<0,2*		
Fluorures totaux	**mg/l**			**1,5**	**150**			*<1*		
Matière toxique										
Biphényles polychlorés totaux	**mg/kg**	**0,05**	**1**		**50**		*<0,01*			
Composés phénoliques (Phénols-4AAP)	**mg/l**							*<0,04*		
Cyanure d'hydrogène					**250**		*<1*			
Sulfure d'hydrogène					**500**		*3*			
Métaux Extractibles Totaux										

Tableau B1 - Résultats d'analyse des Scories produites à Forks Specialty Metals (NAIC)

Paramètres	Unités	Critères génériques pour les sols[1]		Normes de potabilité[2]	Normes du RMD[3]	Valeur du Guide de valorisation	Résultats Scories NAIC			
		A	B				Autres tests selon RMD ou Guide de valorisation	Lixiviation RMD	Lixiviation pluies acides[4]	Lixiviation à l'eau[4]
								TCLP-1311	TCLP - 1312	3 CTEU-9
Argent	mg/kg	2	20				-			
Arsenic	mg/kg	6	30				-			
Baryum	mg/kg	200	500				-			
Cadmium	mg/kg	1,5	5				*<0,5*			
Chrome	mg/kg	85	250				*14*			
Cobalt	mg/kg	15	50				-			
Cuivre	mg/kg	40	100				**94**			
Fer	mg/kg	-	-				27000			
Étain	mg/kg	5	50				-			
Manganèse	mg/kg	770	1000				-			
Mercure	mg/kg	0,2	2				*<0,02*			
Molybdène	mg/kg	2	10				-			
Nickel	mg/kg	50	100				*2*			
Plomb	mg/kg	50	500				*<5*			
Zinc	mg/kg	110	500				*<10*			

(1) Critères génériques pour les sols de la Politique de protection des sols et de réhabilitation des terrains contaminés du MDDELCC (Politique) utilisés pour comparaison selon le Guide de valorisation

(2) Normes de potabilité selon le Règlement sur la qualité de l'eau potable utilisées à fin de comparaison selon le Guide de valorisation

(3) Normes du Règlement sur les matières dangereuses pour définir la dangerosité de la matière

(4) Essais de lixiviation réalisés selon la procédure décrite au Guide de valorisation, résultats à comparer avec la norme de potabilité

Légende

SCORIE-NAIC	Identification de l'échantillon
-	Échantillon non analysé
<0,1	Résultat analytique inférieur à la limite de détection du laboratoire
10	Concentration supérieure au Critère A de la politique
50	Concentration supérieure au Critère B de la politique
136	Concentration supérieure à la norme de potabilité
136	Concentration supérieure à la norme du RMD

Appendix B4 – Detailed Results and Certificates of Analyses

Maxxam
Une société du Groupe Bureau Veritas

Le succès par la science®

Votre # du projet: COMPLETE
Votre # Bordereau: N-A

Attention: Renée Rossignol

Les Minéraux Harsco
Sorel-Tracy
1690 Marie-Victorin
Edifice A -Suite 100
Sorel,Tracy, QC
CANADA J3R 1M7

Date du rapport:
Rapport:

CERTIFICAT D'ANALYSES

 # DE DOSSIER MAXXAM: B644082
Reçu: 2016/07/07, 13:35

Matrice: SOLIDE
Nombre d'échantillons reçus: 4

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Référence Primaire
Broyage	1	2016/07/13	2016/07/13	STL SOP-00019	Broyeur SK100
Hydrocarbures pétroliers (C10-C50)*	1	2016/07/13	2016/07/13	STL SOP-00172	MA.400-HYD. 1.1 R2 m
Réactivité: cyanures d'hydrogène (1)*	1	2016/07/15	2016/07/15	QUE SOP-00143	MA 300-CN 1.2 R3 m
Chrome hexavalent (Cr 6+)***	1	2016/07/14	2016/07/15	STL SOP-00026	MA200-CrHex 1.1 R1 m
Fluorures lixiviés*	1	N/A	2016/07/15	STL SOP-00038	SM 22 4500-F m
Lixiviation à l'eau (CTEU - 9)*	1	2016/07/14	2016/07/21	STL SOP-00024	MA100-Lixcom1.1 R1 m
Lixiviation - pluies acides (EPA 1312)*	1	2016/07/13	2016/07/14	STL SOP-00024	MA100-Lixcom1.1 R1 m
Métaux lixiviés*	1	2016/07/15	2016/07/15	STL SOP-00006	MA200–Mét 1.2 R5 m
Métaux extractibles totaux par ICP*	1	2016/07/13	2016/07/15	STL SOP-00006	MA200–Mét 1.2 R5 m
Métaux lixiviés par ICP-MS*	1	2016/07/14	2016/07/15	STL SOP-00006	MA200–Mét 1.2 R5 m
Métaux lixiviés par ICP-MS*	1	2016/07/21	2016/07/21	STL SOP-00006	MA200–Mét 1.2 R5 m
Nitrate et/ou Nitrite lixiviés*	1	N/A	2016/07/15	STL SOP-00014	MA300-Ions 1.3 R3 m
BPC Totaux*	1	2016/07/13	2016/07/13	STL SOP-00133	MA400-BPC 1.0 R5 m
pH*	1	2016/07/13	2016/07/13	STL SOP-00016	MA100- pH 1.1 R3 m
Phénols totaux par 4-AAP lixiviés***	1	2016/07/15	2016/07/15	STL SOP-00033	MA404-I.Phé 2.2 R2 m
Soufre*	1	N/A	2016/07/14	STL SOP-00028	MA310-CS 1.0 R3 m
Réactivité: sulfures d'hydrogène (1)*	1	2016/07/15	2016/07/18	QUE SOP-00107	MA. 300 – S 1.2m R3
Lix.-espèces inorg.(TCLP, EPA 1311)*	1	2016/07/14	2016/07/15	STL SOP-00024	MA100-Lixcom1.1 R1 m
Carbone organique total par titrage (1)*	1	2016/07/15	2016/07/15	QUE SOP-00153	MA. 405 – C 1.1 r2 m

Lorsque la méthode de référence comprend un suffixe « m », cela signifie que la méthode d'analyse du laboratoire contient des modifications validées et appliquées afin d'améliorer la performance de la méthode de référence.

(1) Cette analyse a été effectuée par Maxxam - Québec

* Maxxam détient l'accréditation pour cette analyse selon le programme du MDDELCC.
*** Cette analyse ne fait pas partie du programme d'accréditation du MDDELCC.

MAXXAM ANALYTIQUE

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

HYDROCARBURES PAR GCFID (SOLIDE)

ID Maxxam					CP9963		
Date d'échantillonnage					2016/07/06		
# Bordereau					N-A		
	Unités	**A**	**B**	**C**	**SCORIE-NAIC**	**LDR**	**Lot CQ**
% HUMIDITÉ	%	-	-	-	0	N/A	N/A
HYDROCARBURES PÉTROLIERS							
Hydrocarbures pétroliers (C10-C50)	mg/kg	**300**	700	3500	<100	100	1634619
Récupération des Surrogates (%)							
1-Chlorooctadécane	%	**-**	-	-	77	N/A	1634619

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

MÉTAUX EXTRACTIBLES TOTAUX (SOLIDE)

ID Maxxam					CP9963		
Date d'échantillonnage					2016/07/06		
# Bordereau					N-A		
	Unités	**A**	**B**	**C**	**SCORIE-NAIC**	**LDR**	**Lot CQ**
% HUMIDITÉ	%	-	-	-	0	N/A	N/A
MÉTAUX							
Cadmium (Cd)	mg/kg	**1.5**	5	20	<0.5	0.5	1634596
Chrome (Cr)	mg/kg	**85**	250	800	14	2	1634596
Cuivre (Cu)	mg/kg	**40**	100	500	**94**	2	1634596
Fer (Fe)	mg/kg	**-**	-	-	27000	10	1634596
Mercure (Hg)	mg/kg	**0.2**	2	10	<0.02	0.02	1634596
Nickel (Ni)	mg/kg	**50**	100	500	2	1	1634596
Plomb (Pb)	mg/kg	**50**	500	1000	<5	5	1634596
Sélénium (Se)	mg/kg	**1**	3	10	<1	1	1634596
Zinc (Zn)	mg/kg	**110**	500	1500	<10	10	1634596

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

MÉTAUX LIXIVIÉS (SOLIDE)

ID Maxxam					CP9964		CP9965		
Date d'échantillonnage					2016/07/06		2016/07/06		
# Bordereau					N-A		N-A		
	Unités	A	B	C	SCORIE-NAIC TCLP EPA 1312	Lot CQ	SCORIE-NAIC-3 CTEU -9	LDR	Lot CQ
% HUMIDITÉ	%	-	-	-	0	N/A	0	N/A	N/A
MÉTAUX									
Cadmium (Cd)	mg/L	**1.5**	5	20	<0.001	1635419	<0.001	0.001	1638409
Chrome (Cr)	mg/L	**85**	250	800	<0.007	1635419	0.008	0.007	1638409
Cuivre (Cu)	mg/L	**40**	100	500	<0.003	1635419	0.009	0.003	1638409
Fer (Fe)	mg/L	**-**	-	-	<0.1	1635419	<0.1	0.1	1638409
Mercure (Hg)	mg/L	**0.2**	2	10	<0.0005	1635419	<0.0005	0.0005	1638409
Nickel (Ni)	mg/L	**50**	100	500	<0.006	1635419	<0.006	0.006	1638409
Plomb (Pb)	mg/L	**50**	500	1000	<0.001	1635419	<0.001	0.001	1638409
Sélénium (Se)	mg/L	**1**	3	10	0.001	1635419	<0.001	0.001	1638409
Zinc (Zn)	mg/L	**110**	500	1500	<0.005	1635419	<0.005	0.005	1638409

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

ID Maxxam					CQ0778		
Date d'échantillonnage					2016/07/06		
# Bordereau					N-A		
	Unités	A	B	C	SCORIE-NAIC -TCLP 1311	LDR	Lot CQ
% HUMIDITÉ	%	-	-	-	0	N/A	N/A
MÉTAUX							
Arsenic (As)	mg/L	**6**	30	50	<0.004	0.004	1635747
Baryum (Ba)	mg/L	**200**	500	2000	0.24	0.005	1635747
Bore (B)	mg/L	**-**	-	-	0.1	0.1	1635747
Cadmium (Cd)	mg/L	**1.5**	5	20	<0.002	0.002	1635747
Chrome (Cr)	mg/L	**85**	250	800	0.008	0.007	1635747
Cuivre (Cu)	mg/L	**40**	100	500	0.17	0.02	1635747
Mercure (Hg)	mg/L	**0.2**	2	10	<0.01	0.01	1635747
Nickel (Ni)	mg/L	**50**	100	500	0.011	0.006	1635747
Plomb (Pb)	mg/L	**50**	500	1000	<0.01	0.01	1635747
Sélénium (Se)	mg/L	**1**	3	10	<0.005	0.005	1635747
Uranium (U)	mg/L	**-**	-	-	<0.02	0.02	1635747
Zinc (Zn)	mg/L	**110**	500	1500	<0.2	0.2	1635747

LDR = Limite de détection rapportée
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N/A = Non Applicable

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

PARAMÈTRES CONVENTIONNELS (SOLIDE)

ID Maxxam					CP9963		
Date d'échantillonnage					2016/07/06		
# Bordereau					N-A		
	Unités	A	B	C	SCORIE-NAIC	LDR	Lot CQ
% HUMIDITÉ	%	-	-	-	0	N/A	N/A
CONVENTIONNELS							
Carbone organique total (titrage)	% g/g	-	-	-	0.08	0.05	1635894
Chrome Hexavalent (Cr 6+)	mg/kg	-	-	-	<0.4	0.4	1635357
Cyanures d'hydrogène	mg/kg	-	-	-	<1	1	1635850
pH	pH	-	-	-	10.2	N/A	1634644
Soufre (S)	% g/g	**0.04**	0.1	0.2	<0.01	0.01	1634614
Sulfures d'hydrogène	mg/kg	-	-	-	3	1	1635951

LDR = Limite de détection rapportée
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Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

PARAMÈTRES CONVENTIONNELS-LIXIVIAT LABO (SOLIDE)

ID Maxxam					CQ0778		
Date d'échantillonnage					2016/07/06		
# Bordereau					N-A		
	Unités	**A**	**B**	**C**	**SCORIE-NAIC -TCLP 1311**	**LDR**	**Lot CQ**
% HUMIDITÉ	%	-	-	-	0	N/A	N/A
CONVENTIONNELS							
Fluorure (F)	mg/L	**200**	400	2000	<1	1	1635754
Phénols-4AAP	mg/L	**-**	-	-	<0.04	0.04	1635913
Nitrites (N-NO2-)	mg/L	**-**	-	-	<0.2	0.2	1635744
Nitrate(N) et Nitrite(N)	mg/L	**-**	-	-	<0.2	0.2	1635744

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

MaxXam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

BPC CONGÉNÈRES (SOLIDE)

ID Maxxam					CP9963		
Date d'échantillonnage					2016/07/06		
# Bordereau					N-A		
	Unités	A	B	C	SCORIE-NAIC	LDR	Lot CQ
% HUMIDITÉ	%	-	-	-	0	N/A	N/A
BPC							
BPC Totaux	mg/kg	**0.05**	1	10	<0.01	0.01	1634548
Récupération des Surrogates (%)							
2,3,3',4,6-Pentachlorobiphényle	%	-	-	-	100	N/A	1634548
2',3,5-Trichlorobiphényle	%	-	-	-	91	N/A	1634548
22'33'44'566'-Nonachlorobiphényle	%	-	-	-	103	N/A	1634548

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

TCLP-EPA 1311 (SOLIDE)

ID Maxxam		CQ0778	CQ0778	
Date d'échantillonnage		2016/07/06	2016/07/06	
# Bordereau		N-A	N-A	
	Unités	**SCORIE-NAIC -TCLP 1311**	**SCORIE-NAIC -TCLP 1311 Dup. de Lab.**	**Lot CQ**
% HUMIDITÉ	%	0	0	N/A
Lixiviat				
Poids de l'échantillon (g)	n/a	35.0	20.0	1635033
pH de l'eau déionisée	n/a	6.02	6.02	1635033
pH du pré-test	n/a	<1.68	<1.68	1635033
pH final du lixiviat	n/a	5.15	5.19	1635033
Volume fluide d'extraction 1 (ml)	n/a	700	400	1635033

Lot CQ = Lot contrôle qualité
Duplicata de laboratoire
N/A = Non Applicable

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

SPLP-EPA 1312 (SOLIDE)

ID Maxxam		CP9964	
Date d'échantillonnage		2016/07/06	
# Bordereau		N-A	
	Unités	**SCORIE-NAIC TCLP EPA 1312**	**Lot CQ**
% HUMIDITÉ	%	0	N/A
Lixiviat			
Poids de l'échantillon (g)	n/a	25.0	1634616
Volume du fluide d'extraction (mL)	n/a	500	1634616
pH après 18 heures de mélange	n/a	10.3	1634616
pH du fluide d'extraction	n/a	4.16	1634616
Lot CQ = Lot contrôle qualité N/A = Non Applicable			

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

LIXIVIATION À L'EAU-CTEU-9 (SOLIDE)

ID Maxxam		CP9965	
Date d'échantillonnage		2016/07/06	
# Bordereau		N-A	
	Unités	**SCORIE-NAIC-3 CTEU -9**	**Lot CQ**
% HUMIDITÉ	%	0	N/A
Lixiviat			
Poids de l'échantillon (g)	n/a	40.0	1635035
pH de l'eau déionisée	n/a	6.02	1635035
Addition du fluide d'extraction	n/a	2016/07/14	1635035
Arrêt de la lixiviation	n/a	2016/07/21	1635035
Volume du fluide d'extraction (mL)	n/a	160	1635035
pH après 7 jours de mélange	n/a	11.0	1635035

Lot CQ = Lot contrôle qualité
N/A = Non Applicable

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

REMARQUES GÉNÉRALES

Tous les résultats sont calculés sur une base sèche excepté lorsque non-applicable.

État des échantillons à l'arrivée: BON

A,B,C: Ces critères proviennent de l'Annexe 2 de la « Politique de protection des sols et de réhabilitation des terrains contaminés ». Pour les analyses de métaux(et métalloides) dans les sols, le critère A désigne la « Teneur de fond Secteur Basses-Terres du Saint-Laurent ».
A,B-eau souterraine: A=Critère pour fin de consommation; B=Critère pour la résurgence dans les eaux de surface ou infiltration dans les égouts.
Ces références ne sont rapportées qu'à titre indicatif et ne doivent être interprétées dans aucun autre contexte.

- = Ce composé ne fait pas partie de la réglementation.

HYDROCARBURES PAR GCFID (SOLIDE)

Veuillez noter que les résultats n'ont pas été corrigés pour la récupération des échantillons de contrôle de qualité (blanc fortifié et surrogates).
Veuillez noter que les résultats n'ont pas été corrigés pour le blanc de méthode.

MÉTAUX EXTRACTIBLES TOTAUX (SOLIDE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.

MÉTAUX LIXIVIÉS (SOLIDE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de lixiviat.

PARAMÈTRES CONVENTIONNELS (SOLIDE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.

PARAMÈTRES CONVENTIONNELS-LIXIVIAT LABO (SOLIDE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.
Les limites de détections indiquées sont multipliées par les facteurs de dilution utilisés pour l'analyse des échantillons.
Veuillez noter que les résultats ci-dessus n'ont pas été corrigés pour le blanc de lixiviat.

BPC CONGÉNÈRES (SOLIDE)

Veuillez noter que les résultats n'ont été corrigés ni pour la récupération des échantillons de contrôle qualité (blanc fortifié), ni pour le blanc. Les résultats des échantillons ont été corrigés pour le pourcentage de récupération des surrogates.

TCLP-EPA 1311 (SOLIDE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.

SPLP-EPA 1312 (SOLIDE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.

LIXIVIATION À L'EAU-CTEU-9 (SOLIDE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.

Les résultats ne se rapportent qu'aux échantillons soumis pour analyse

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

RAPPORT ASSURANCE QUALITÉ

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
1634548	CB5	Blanc fortifié	2,3,3',4,6-Pentachlorobiphényle	2016/07/13		93	%
			2',3,5-Trichlorobiphényle	2016/07/13		92	%
			22'33'44'566'-Nonachlorobiphényle	2016/07/13		98	%
			BPC Totaux	2016/07/13		99	%
1634548	CB5	Blanc de méthode	2,3,3',4,6-Pentachlorobiphényle	2016/07/13		95	%
			2',3,5-Trichlorobiphényle	2016/07/13		89	%
			22'33'44'566'-Nonachlorobiphényle	2016/07/13		98	%
			BPC Totaux	2016/07/13	<0.01		mg/kg
1634596	KK	MRC	Cadmium (Cd)	2016/07/15		112	%
			Chrome (Cr)	2016/07/15		114	%
			Cuivre (Cu)	2016/07/15		113	%
			Mercure (Hg)	2016/07/15		101	%
			Nickel (Ni)	2016/07/15		114	%
			Plomb (Pb)	2016/07/15		101	%
			Sélénium (Se)	2016/07/15		112	%
			Zinc (Zn)	2016/07/15		114	%
1634596	KK	Blanc fortifié	Cadmium (Cd)	2016/07/15		96	%
			Chrome (Cr)	2016/07/15		99	%
			Cuivre (Cu)	2016/07/15		102	%
			Fer (Fe)	2016/07/15		101	%
			Mercure (Hg)	2016/07/15		102	%
			Nickel (Ni)	2016/07/15		99	%
			Plomb (Pb)	2016/07/15		94	%
			Sélénium (Se)	2016/07/15		93	%
			Zinc (Zn)	2016/07/15		97	%
1634596	KK	Blanc de méthode	Cadmium (Cd)	2016/07/15	<0.5		mg/kg
			Chrome (Cr)	2016/07/15	<2		mg/kg
			Cuivre (Cu)	2016/07/15	<2		mg/kg
			Fer (Fe)	2016/07/15	<10		mg/kg
			Mercure (Hg)	2016/07/15	<0.02		mg/kg
			Nickel (Ni)	2016/07/15	<1		mg/kg
			Plomb (Pb)	2016/07/15	<5		mg/kg
			Sélénium (Se)	2016/07/15	<1		mg/kg
			Zinc (Zn)	2016/07/15	<10		mg/kg
1634614	DKH	MRC	Soufre (S)	2016/07/14		87	%
1634614	DKH	Blanc de méthode	Soufre (S)	2016/07/14	<0.01		% g/g
1634616	ECH	Blanc de méthode	Volume du fluide d'extraction (mL)	2016/07/14	500		n/a
			pH après 18 heures de mélange	2016/07/14	4.21		n/a
			pH du fluide d'extraction	2016/07/14	4.16		n/a
1634619	SL6	Blanc fortifié	1-Chlorooctadécane	2016/07/13		79	%
			Hydrocarbures pétroliers (C10-C50)	2016/07/13		75	%
1634619	SL6	Blanc de méthode	1-Chlorooctadécane	2016/07/13		93	%
			Hydrocarbures pétroliers (C10-C50)	2016/07/13	<100		mg/kg
1634644	ECH	MRC	pH	2016/07/13		99	%
1634644	ECH	Blanc fortifié	pH	2016/07/13		102	%
1635033	ECH	Blanc de méthode	pH de l'eau déionisée	2016/07/15	6.02		n/a
			pH final du lixiviat	2016/07/15	4.95/2.90		n/a
			Volume fluide d'extraction 1 (ml)	2016/07/15	700		n/a
1635033	ECH	Blanc de méthode DUP	pH de l'eau déionisée	2016/07/15	6.02		n/a
			pH final du lixiviat	2016/07/15	4.94/2.90		n/a
			Volume fluide d'extraction 1 (ml)	2016/07/15	400		n/a
1635035	ECH	Blanc de méthode	pH de l'eau déionisée	2016/07/21	6.02		n/a
			Addition du fluide d'extraction	2016/07/21	2016/07/14		n/a
			Arrêt de la lixiviation	2016/07/21	2016/07/21		n/a

Maxxam Analytique - Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			Volume du fluide d'extraction (mL)	2016/07/21	160		n/a
			pH après 7 jours de mélange	2016/07/21	7.16		n/a
1635357	DKH	MRC	Chrome Hexavalent (Cr 6+)	2016/07/15		67	%
1635357	DKH	Blanc de méthode	Chrome Hexavalent (Cr 6+)	2016/07/15	<0.4		mg/kg
1635419	JS2	BL. LIXIVIAT	Cadmium (Cd)	2016/07/15	<0.001		mg/L
			Chrome (Cr)	2016/07/15	<0.007		mg/L
			Cuivre (Cu)	2016/07/15	<0.003		mg/L
			Fer (Fe)	2016/07/15	<0.1		mg/L
			Mercure (Hg)	2016/07/15	<0.0005		mg/L
			Nickel (Ni)	2016/07/15	<0.006		mg/L
			Plomb (Pb)	2016/07/15	<0.001		mg/L
			Sélénium (Se)	2016/07/15	<0.001		mg/L
			Zinc (Zn)	2016/07/15	<0.005		mg/L
1635419	JS2	Blanc fortifié	Cadmium (Cd)	2016/07/15		103	%
			Chrome (Cr)	2016/07/15		100	%
			Cuivre (Cu)	2016/07/15		101	%
			Fer (Fe)	2016/07/15		102	%
			Mercure (Hg)	2016/07/15		107	%
			Nickel (Ni)	2016/07/15		101	%
			Plomb (Pb)	2016/07/15		103	%
			Sélénium (Se)	2016/07/15		102	%
			Zinc (Zn)	2016/07/15		100	%
1635744	JL1	BL. LIXIVIAT	Nitrites (N-NO2-)	2016/07/15	<0.2		mg/L
			Nitrate(N) et Nitrite(N)	2016/07/15	<0.2		mg/L
1635744	JL1	Blanc fortifié	Nitrites (N-NO2-)	2016/07/15		111	%
			Nitrate(N) et Nitrite(N)	2016/07/15		103	%
1635747	JS2	BL. LIXIVIAT	Arsenic (As)	2016/07/15	<0.004		mg/L
			Baryum (Ba)	2016/07/15	<0.005		mg/L
			Bore (B)	2016/07/15	<0.1		mg/L
			Cadmium (Cd)	2016/07/15	<0.002		mg/L
			Chrome (Cr)	2016/07/15	<0.007		mg/L
			Cuivre (Cu)	2016/07/15	<0.02		mg/L
			Mercure (Hg)	2016/07/15	<0.01		mg/L
			Nickel (Ni)	2016/07/15	<0.006		mg/L
			Plomb (Pb)	2016/07/15	<0.01		mg/L
			Sélénium (Se)	2016/07/15	<0.005		mg/L
			Uranium (U)	2016/07/15	<0.02		mg/L
			Zinc (Zn)	2016/07/15	<0.2		mg/L
1635747	JS2	Blanc fortifié	Arsenic (As)	2016/07/15		102	%
			Baryum (Ba)	2016/07/15		96	%
			Bore (B)	2016/07/15		99	%
			Cadmium (Cd)	2016/07/15		103	%
			Chrome (Cr)	2016/07/15		94	%
			Cuivre (Cu)	2016/07/15		95	%
			Mercure (Hg)	2016/07/15		98	%
			Nickel (Ni)	2016/07/15		97	%
			Plomb (Pb)	2016/07/15		103	%
			Sélénium (Se)	2016/07/15		100	%
			Uranium (U)	2016/07/15		100	%
			Zinc (Zn)	2016/07/15		96	%
1635754	MR4	BL. LIXIVIAT	Fluorure (F)	2016/07/15	<1		mg/L
1635754	MR4	Blanc fortifié	Fluorure (F)	2016/07/15		101	%
1635850	CB8	MRC	Cyanures d'hydrogène	2016/07/15		101	%
1635850	CB8	Blanc de méthode	Cyanures d'hydrogène	2016/07/15	<1		mg/kg

Maxxam Analytique | Résultats préliminaires

Dossier Maxxam: B644082
Date du rapport:

Les Minéraux Harsco
Votre # du projet: COMPLETE

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
1635894	NS	MRC	Carbone organique total (titrage)	2016/07/15		98	%
1635913	MH1	BL. LIXIVIAT	Phénols-4AAP	2016/07/15	<0.04		mg/L
1635913	MH1	MRC	Phénols-4AAP	2016/07/15		104	%
1635913	MH1	Blanc fortifié	Phénols-4AAP	2016/07/15		98	%
1635951	AG5	MRC	Sulfures d'hydrogène	2016/07/18		100	%
1635951	AG5	Blanc de méthode	Sulfures d'hydrogène	2016/07/18	<1		mg/kg
1638409	JS2	BL. LIXIVIAT	Cadmium (Cd)	2016/07/21	<0.001		mg/L
			Chrome (Cr)	2016/07/21	<0.007		mg/L
			Cuivre (Cu)	2016/07/21	<0.003		mg/L
			Fer (Fe)	2016/07/21	<0.1		mg/L
			Mercure (Hg)	2016/07/21	<0.0005		mg/L
			Nickel (Ni)	2016/07/21	<0.006		mg/L
			Plomb (Pb)	2016/07/21	<0.001		mg/L
			Sélénium (Se)	2016/07/21	<0.001		mg/L
			Zinc (Zn)	2016/07/21	<0.005		mg/L
1638409	JS2	Blanc fortifié	Cadmium (Cd)	2016/07/21		105	%
			Chrome (Cr)	2016/07/21		100	%
			Cuivre (Cu)	2016/07/21		98	%
			Fer (Fe)	2016/07/21		102	%
			Mercure (Hg)	2016/07/21		101	%
			Nickel (Ni)	2016/07/21		99	%
			Plomb (Pb)	2016/07/21		104	%
			Sélénium (Se)	2016/07/21		110	%
			Zinc (Zn)	2016/07/21		100	%

Blanc de lixiviat: Blanc contenant les réactifs utilisés dans le processus de lixiviation. Sert à évaluer toutes contaminations de procédure.

MRC: Un échantillon de concentration connue préparé dans des conditions rigoureuses par un organisme externe. Utilisé pour vérifier la justesse de la méthode.

Blanc fortifié: Un blanc, d'une matrice exempte de contaminants, auquel a été ajouté une quantité connue d'analyte provenant généralement d'une deuxième source. Utilisé pour évaluer la précision de la méthode.

Blanc de méthode: Une partie aliquote de matrice pure soumise au même processus analytique que les échantillons, du prétraitement au dosage. Sert à évaluer toutes contaminations du laboratoire.

Surrogate: Composé se comportant de façon similaire aux composés analysés et ajouté à l'échantillon avant l'analyse. Sert à évaluer la qualité de l'extraction.

Réc = Récupération

Maxxam Analytique - Résultats préliminaires

Appendix C

Potable Water Quality (French Only)

Appendix C – Potable Water Characteristics

Puits		Résultats
COULEUR	uCv	<5
TURBIDITÉ	uTn	0,4
ALCALINTÉ($CaCO_3$)	mg/L	132
DURETÉ Total ($CaCO_3$)	mg/L	178
DURETÉ calcique ($CaCO_3$)	mg/L	133
CALCIUM	mg/L	53
MAGNÉSIUM	mg/L	11
SODIUM	mg/L	7,3
CHLORURE Cl	mg/L	10,2
FER Fe	mg/L	0,07
MANGANÈSE Mn	mg/L	0,015
PHOSPHORE TOTAL	mg/L	0,001
PH		7,67
SULFATE SO4	mg/L	27
SULFURE H2s	mg/L	<0,005
AZOTE AMMONIACAL N	mg/L	<0,04
CARBONE ORGANIQUE COT	mg/L	0,7
CONDUCTIVITÉ	mS/cm	0,37

Note : Analyses fournies par la Ville de Saguenay, Service du Génie, mars 2016.

Appendix D

Atmospheric Emissions

D1 – Atmospheric Emission Calculations

D2 – Atmospheric Dispersion Study (English version beginning only at section 2.7)

Appendix D1 – Atmospheric Emission Calculations

Table of Contents

D1 ATMOSPHERIC EMISSION CALCULATIONS 1

D1.1 A1 – MAIN STACK OF THE GAS PREHEATER AND OF THE THERMAL OXIDATION UNIT 1
D1.1.1 Reduction Gas Preheater 2
D1.1.2 CO_2 Removal System (Thermal Oxidation) 4
D1.2 A2-PACKAGE BOILER 6
D1.3 A3 – FLARE AND PILOTS 7
D1.4 A4 – STACK OF THE SMELTING AND CASTING BUILDING'S BAGHOUSE 9
D1.4.1 Smelting and Casting Building 10
D1.4.2 Preheating and Drying of Ladles 11
D1.5 A5, A6, A7 MATERIAL HANDLING BAGHOUSES 13
D1.6 A8 – BRIQUETTING UNIT STACK 13
D1.6.1 Drying of Briquettes 14
D1.6.2 Drying of Treatment Water Sludge 16
D1.6.3 Briquetting Building Baghouses 17
D1.7 A9 – ACID SCRUBBER OF THE WASTEWATER TREATMENT UNIT 18
D1.8 A10 – EMERGENCY GENERATOR 18
D1.9 A-11 - EMISSIONS ASSOCIATED WITH TRUCKING ACTIVITIES WITHIN THE PLANT'S PERIMETER 20
D1.10 CUMULATIVE IMPACT SOURCES 21
D1.10.1 Emissions Associated with Off-site Trucking Activities 21
D1.10.2 Fugitive Emissions from Loading and Unloading of Pellets at the Jetty 23

REFERENCES 27

List of Tables

Table D1.1	Estimate of Atmospheric Emissions from the Main Stack of the Gas Preheater and Thermal Oxidation Unit	1
Table D1.2	Composition of Flared Gases in the Gas Preheater	2
Table D1.3	Estimate of Atmospheric Emissions from the Reduction Gas Preheater	3
Table D1.4	Composition of the Gases Flared in the Sulfur Oxidizer	4
Table D1.5	Estimate of Atmospheric Emissions from the CO_2 Removal System	5
Table D1.6	A2 – Estimate of Atmospheric Emissions from the Package Boiler	6
Table D1.7	Estimate of Atmospheric Emissions from the Flare	8
Table D1.8	Estimate of Atmospheric Emissions from the Stack of the Smelting and Casting Building	9
Table D1.9	Estimate of Atmospheric Emissions from the Electric Arc Furnace	11
Table D1.10	Estimate of Atmospheric Emissions from the Ladle's Preheating Burner	12
Table D1.11	A5, A6 and A7-Estimate of Atmospheric Emissions from the Transfer, Storage and Screening	13
Table D1.12	A8-Estimate of Atmospheric Emissions from the Stack of the Briquetting Unit	14
Table D1.13	Estimate of Atmospheric Emissions from the Briquette Dryer	15
Table D1.14	Estimate of Atmospheric Emissions from the Sludge Dryer	16
Table D1.15	Estimate of Atmospheric Emissions from the Baghouses inside the Briquetting Building	17
Table D1.16	Estimate of Atmospheric Emissions from the Acid Scrubber	18
Table D1.17	Estimate of Atmospheric Emissions from the Emergency Generator	19
Table D1.18	Estimate of Atmospheric Emissions due to Trucking Activities on the Plant Site	20
Table D1.19	Estimate of Atmospheric Emissions caused by Trucking Off-Site Trucking Activities	22
Table D1.20	Estimate of Emissions from Pellet Unloading	24
Table D1.21	Estimate of Pellet onto Truck Loading Emissions	25
Table D1.22	Estimate of Emissions from Wind Erosion of the Pellet Pile	26

Each source of emission to the atmosphere as well as the hypotheses used for the calculations are presented in the sections below.

D1 ATMOSPHERIC EMISSION CALCULATIONS

D1.1 A1 – Main Stack of the Gas Preheater and of the Thermal Oxidation Unit

Combustion gas from the reduction gas preheater as well as those from the thermal oxidizing unit are released into the atmosphere through a single 125 m high stack. This stack has two distinct sources that are detailed in sections 1.1.1 and 1.1.2. Table D1.1 shows the main features of the flue gases released into the atmosphere by source A1.

Table D1.1 Estimate of Atmospheric Emissions from the Main Stack of the Gas Preheater and Thermal Oxidation Unit

Flue Gas (10% of Excess Air)		
Standardized volumetric flowrate (Nm^3/h)		94,203
Dry reference volumetric flowrate (Rm^3/h)		84,916
Temperature (°C)		195
Actual volumetric flowrate (Am^3/h)		161,453
Typical Compostion (% volume)		
CO_2		17.1
H_2O		17.4
O_2		1.74
N_2		63.0
Ar		0.75
Stack diameter (m)		2.3
Gas velocity at the stack (m/s)		10.8
Stack height (m)		125
Contaminants	**Emission Rate**	
	(kg/h)	**(T/year)**
NOx	6.42	56.3
CO	9.11	79.8
SO_2	5.16	45.2
PMt = $PM_{2.5}$	0.82	7.22
TOC	1.19	10.45
VOC	0.60	5.22
NH_3	0.00	0.00
CO_2	31,689	277,592
CH_4	0.28	2.45
N_2O	0.25	2.18
GHG CO_2eq	-	278,320

D1.1.1 Reduction Gas Preheater

The temperature of the reduction gas, which is a mixture of natural and process gas, is increased by direct heating in a gas preheater before it is fed to the reactor for the reduction of iron oxides from the pellets. Heat is produced by the combustion of a mixture of natural gas and process gas.

Table D1.2 shows the typical chemical composition of the flue gases of the gas preheater and the characteristics of the gases present at the stack for the maximum load. This composition is based on the use of a standard combustion method.

Table D1.2 Composition of Flared Gases in the Gas Preheater

	Process Gas	Natural Gas
	v/v	v/v
H_2	51.60	-
CO	10.33	-
CO_2	7.87	0.64
CH_4	16.40	95.70
N_2	12.86	1.84
H_2O	0.94	-
C_2H_6	-	1.63
C_3H_8	-	0.14
C_4H_{10}	-	0.04
C_5H_{12}	-	0.01
C_6H_{14}	-	0.01
H_2S	1.3E-03	4.0E-04
Total	100	100

The emissions of atmospheric contaminants are calculated using US emission factors (US-EPA AP42), with the exception of nitrogen oxide (NOx) emissions. The maximum nitrogen oxide emissions levels from the heating system were estimated using a value of 25 grams of NOx per gigajoule (g/GJ) of energy provided by the fuel, which is equivalent to the Government of Canada's *Multi-Sector Air Pollutants Regulation* released on June 17, 2016 for a furnace or an industrial boiler with thermal efficiency of 90%. For greenhouse gases, the emission parameters of the *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* for the combustion of natural and refinery gas (flexigas) were considered.

Table D1.3 Estimate of Atmospheric Emissions from the Reduction Gas Preheater

Parameters		Load
Power at supply point (MW HHV)		70.6
Gas heat value (MJ/kg)		28.1
Gas consumption (kg/h)		6,364.1
Gas consumption (Sm^3/h)		9,528.1
Gas consumption (GJ/h, HHV)		254.2
Flue Gas (10% of Excess Air)		
Standardized volumetric flowrate (Nm^3/h)		81,998
Temperature (°C)		195
Actual volumetric flowrate (Am^3/h)		140,536
Typical composition (% volume)		
CO_2		8.71
H_2O		18.23
O_2		1.70
N_2		70.52
Ar		0.84
Stack diameter (m)		2.3
Gas velocity at the stack (m/s)		10.8
Stack height (m)		125
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**
NOx	25 [1]	6.35
CO	35.4 [2]	9.0
SO_2	0.7 [3]	0.17
PMt = $PM_{2.5}$	3.2 [2]	0.81
TOC	4.6 [2]	1.18
VOCs	2.3 [2]	0.59
CO_2	49,010 [4]	14,027
CH_4	0.966 [4]	0.28
N_2O	0.861 [4]	0.25

(1) NOx emission factor corresponding to the standard for boilers and industrial furnaces proposed in the Canadian Government's Multi-Sector Air Pollutants Regulation (June 16, 2016).
(2) AP42 emission factors for natural gas combustion. (In $lb/MMpi^3$: CO: 84, PM: 1.9, TOC:11, VOCs:5.5).
(3) Based on an average sulfur content of 5.7 mg/Nm^3 in natural gas.
(4) Emission factors set in the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere.

D1.1.2 CO_2 Removal System (Thermal Oxidation)

The gaseous effluent from the CO_2 removal unit consists mainly of CO_2 and water vapor, a mixture of organic compounds similar to natural gas and sulfur compounds present in natural gas, in pellets and in the reduction gas to which some H_2S is added. This gaseous effluent is incinerated in order to oxidize odorous sulfur compounds before being discharged into the atmosphere via the stack of the gas preheater.

Table D1.4 shows the composition calculated by the project's designers for the gas to be incinerated. Around 71.5 Nm^3/h of fresh natural gas will be used as a supplementary fuel source to incinerate 10,230 Nm^3/h of flue gas from the desorption column.

Table D1.4 Composition of the Gases Flared in the Sulfur Oxidizer

	Off Gas	Natural Gas
	v/v	v/v
H_2	0.029	-
CO	0.005	-
CO_2	87.155	0.64
CH_4	0.036	95.70
N_2	0.002	1.84
H_2O	12.756	-
C_2H_6	0	1.63
C_3H_8	0	0.14
C_4H_{10}	0	0.04
C_5H_{12}	0	0.01
C_6H_{14}	0	0.01
H_2S	1.7E-02	4.0E-04
Total	100	100

Post-incineration gas releases will be similar to those resulting from the combustion of natural gas in a boiler, with a CO_2 and water vapor surplus. Table D1.5 provides an estimate of air emissions from the thermal oxidation unit based on combustion calculations, a mass balance and emission factors associated with natural gas combustion (AP42). All working assumptions are presented in the table's footnotes. Thermal oxidation gases will be routed to the stack of the preheating furnace.

Table D1.5 Estimate of Atmospheric Emissions from the CO_2 Removal System

Parameters		Load
Power at supply point (MW HHV)		0.84
Gas heat value (MJ/kg)		0.29
Gas consumption (kg/h)		18,624
Gas consumption (Sm^3/h)		10,867
Gas consumption (GJ/h, HHV)		3.0
Flue Gas (10% of Excess Air)		
Standardized volumetric flowrate (Nm^3/h)		12,205
Temperature (°C)		195
Actual volumetric flowrate (Am^3/h)		20,918
Typical composition (% volume)		
CO_2		73.67
H_2O		12.02
O_2		2.01
N_2		12.15
Ar		0.15
Stack diameter (m)		1.95
Gas velocity at the stack (m/s)		1.95
Stack height (m)		33.5
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**
NOx	23 [1]	0.07
CO	35.4 [2]	0.11
SO_2	1648 [3]	4.981
PMt = $PM_{2.5}$	3.2 [2]	0.01
TOC	4.6 [2]	0.01
VOCs	2.3 [2]	0.01
CO_2	49,010 [4]	17,662
CH_4	0.966 [4]	0.003
N_2O	0.861 [4]	0.003

(1) NOx emission factor corresponding to the standard for boilers and industrial furnaces proposed in the Canadian Government's Multi-Sector Air Pollutants Regulation (June 17, 2016)
(2) AP42 emission factors for natural gas combustion. (In $lb/MMpi^3$: CO: 84, PM:7.6, TOC:11, VOCs:5.5)
(3) Based on the average sulfur content of 5.7 mg/Nm^3 in natural gas
(4) Emission factors set in the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere.

D1.2 A2-Package Boiler

The package boiler is used to provide the energy required during process shutdowns and start-ups. It is fueled by natural gas and operates at low speed all the time. During a start-up/shutdown event, the boiler's energy consumption rises by 3.2 GJ/h up to more than 16.0 GJ/h. These events occur for about 200 h per year.

To estimate emissions of air contaminants, AP-42 emission factors were used along with the federal standard of 18 g/GJ for NOx. For SO_2 emissions, a fuel sulfur mass balance approach was preferred. The equations of the *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* (RMRCECA) were used to calculate combustion-generated greenhouse gas emissions.

Table D1.6 shows emission rates as well as the main characteristics of the package boiler's emission source.

Table D1.6 A2 – Estimate of Atmospheric Emissions from the Package Boiler

Parameters		Low Load	Maximum Load
Power at supply point (MW HHV)		0.89	4.45
Higher heating value (HHV) of the gas (MJ/kg)		38.3	38.3
Gas consumption (kg/h)		58.1	290.7
Gas consumption (Sm^3/h)		88.2	441.0
Gas consumption (GJ/h, HHV)		3.2	16.0
Flue Gas (10% of Excess Air)			
Standardized volumetric flowrate (Nm^3/h)		959	4,795
Dry reference volumetric flowrate (Rm^3/h)		862	4,309
Temperature (°C)		230	230
Actual volumetric flowrate (Am^3/h)		1,767	8,834
Typical composition (% volume)			
CO_2		8.74	8.74
H_2O		17.68	17.68
O_2		1.73	1.73
N_2		71.01	71.01
Ar		0.85	0.85
Gas velocity at the stack (m/s)		2.3	11.4
Stack diameter (m)		0.50	
Stack height (m)		10	
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**	**Emission Rate (kg/h)**
NOx	18 [1]	0.06	0.29
CO	35.4 [2]	0.11	0.57

SO_2	0.3 [3]	0.001	0.005
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**	**Emission Rate (kg/h)**
PMt = $PM_{2.5}$	3.2 [2]	0.00	0.05
TOC	4.6 [2]	0.01	0.07
VOCs	2.3 [2]	0.01	0.04
CO_2	49,010 [4]	157	785
CH_4	0.966 [4]	0.003	0.015
N_2O	0.861 [4]	0.003	0.014

(1) NOx emission factor corresponding to the standard for boilers and industrial furnaces proposed in the Canadian Government's Multi-Sector Air Pollutants Regulation (June 17, 2016).
(2) Emission factors for natural gas combustion. (In lb/MMpi³ : CO: 84, PM:7.6, TOC:11, VOCs:5.5)
(3) Based on the average sulfur content of 5.7 mg/Nm³ in natural gas
(4) Emission factors laid down in the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere.

D1.3 A3 – Flare and Pilots

The flare of the pig iron manufacturing plant will be used mainly during shutdowns and starts and in emergency situations. Certain gasses are, however, burned continuously at the flare:

- Natural gas pilots
- Gasses from the wastewater treatment vent
- Gasses from the cooling water treatment vent

The flare's pilots operate continuously, i.e. 8,760 hours per year. The pilots are powered by commercial natural gas at a rate of 14.3 Nm^3/h, i.e. 125,268 Nm^3 per year. Unlike process and vented gas, the pilot emissions are calculated using the AP-42 factors of combustion of natural gas as well as the RMRCECA equations. The gas from the deaerator vents of the quenching and cooling water are burned continuously at a rate of 116 Nm^3/h and 6 Nm^3/h.

For the atmospheric emissions balance, a total of four events (start-up/shutdown) was considered by the project's designers. These events correspond to 16 hours of operation at a process gas flow rate of 8,000 Nm^3/h. This assumption is conservative, if we consider that the reduction unit operates continuously and that in normal operation only one annual shutdown is planned.

US-EPA AP42 emission factors for flares were used for NOx, CO and particulate matter. GHG emissions were estimated by considering the emission factors laid down in the *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* for greenhouse gases. For VOCs and other contaminants present in the exhaust gas, a hydrocarbon destruction efficiency of 98% was considered. As for sulfur emissions (H_2S and SO_X), they were estimated by mass balance, assuming a 100% conversion of H_2S and SO_2.

Table D1.7 Estimate of Atmospheric Emissions from the Flare

Parameters		Continuous Emissions	Events
Annual use (h/year)		8760	16
Gas consumption (kg/h)		144	4925
Gas consumption (Nm^3/h)		144	8000
Calorific value (MJ/Rm^3)		9.05	11.7
Gas consumption (GJ/h, HHV)		1.34	102
Gas velocity (m/s)		20	20
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**	
NO_X	29.2 [1,2]	0.04	2.98
CO	133 [1], 35.4 [2]	0.12	13.6
SO_2	0.0014 [3]	0.00	0.00
PM	81.7 [1], 3.2 [2]	0.07	8.33
TOC	246 [1], 4.64 [2]	0.20	25.1
VOCs	245 [1], 2.32 [2]	0.19	25.0
CO_2	57000 [4]	146.7	5355
CH_4	2.80 [4]	0.59	26.3
N_2O	0.57 [4]	0.00	0.05
Annual Emissions	**Emission Factors (g/GJ)**	**Total Continuous (t/year)**	**Events Total (t/year)**
NO_X	29.2 [1,2]	0.34	0.05
CO	133 [1], 35.4 [2]	1.09	0.22
SO_2	0.0014 [3]	0.00	0.00
PM	81.7 [1], 3.2[2]	0.58	0.13
TOC	246 [1], 4.64 [2]	1.72	0.40
VOCs	245 [1], 2.32 [2]	1.70	0.40
CO_2	57,000 [4]	1285	85.7
CH_4	2.80 [4]	5.16	0.42
N_2O	0.57 [4]	0.01	0.00

(1) AP42 emission factors for industrial flares
(2) AP42 emission factors for natural gas combustion
(3) Based on the average sulfur content of 5.7 mg/Nm^3 in natural gas
(4) Emission factors laid down in the Regulation respectingmandatory reporting of certain emissions of contaminants into the atmosphere.

D1.4 A4 – Stack of the Smelting and Casting Building's Baghouse

The stack of the smelting and casting building's baghouse is one of the main sources of atmospheric emissions at the plant site. This source releases combustion gases from the electric arc furnace, dusts from the smelting and casting building collected by the casting and smelting hoods, and flue gases from the ladle preheaters. The flow rate and final composition of the gas released into the atmosphere is presented in Table D1.8.

The following sections further explain the calculation methods used for each source individually.

Table D1.8 Estimate of Atmospheric Emissions from the Stack of the Smelting and Casting Building

Combustion Gas Parameters		Load
Standardized volumetric flowrate (Nm^3/h)		482,067
Dry reference volumetric flowrate (Rm^3/h)		522,172
Temperature (°C)		71
Actual volumetric flowrate (Am^3/h)		607,867
Typical composition (% volume)		
CO_2		0.54
H_2O		0.77
O_2		20.3
N_2		77.4
Ar		0.93
Stack diameter (m)		4
Gas velocity at the stack (m/s)		13
Stack height (m)		33
Contaminants		
NOx	6.14	53.8
CO	1.66	14.5
SO_2	0.01	0.05
PMt = $PM_{2.5}$	4.82	42.8
TOC	0.70	6.14
VOCs	0.65	5.73
NH_3	0	0
CO_2	5,082	44,525
CH_4	0.02	0.17
N_2O	0.02	0.15
GHG CO_{2eq}	-	44,576

D1.4.1 Smelting and Casting Building

The fumes generated during the smelting are extracted by a fourth opening in the roof of the furnace (three are present for the electrodes) via a flexible suction pipe cooled with water leading to a sedimentation chamber (“drop-out box”) . The configuration of the sedimentation chamber makes it possible to separate coarse particles from the gas and the addition of air to the hot gas (800 °C) completes the combustion of the CO. The assumption used for the estimate of the emissions is that 98% of the carbon monoxide is oxidized into CO_2before being directed to the baghouse.

The complete cycle of the EAF lasts 132 minutes. The smelting occurs during the first 112 minutes. Then, the electric supply is interrupted for 20 minutes and the furnace door is opened to allow the metal to be poured into the ladle. A suction hood placed on the roof collects the gas in the smelting section of the building. The suction flow rate is modulated in accordance with the operation cycle. The gas flow sucked by the hood increases significantly when the furnace is opened. An average flow rate, with the time of each of the operation cycles was calculated. Finally, the fumes of the casting machine are sucked by a roof hood located in the casting area. During the 132 minutes cycle, the pig iron color operates for 73 minutes. To simplify calculations, the gas flow of the casting hood was always considered as simultaneous to the gas flows from the smelting area.

CO_2 emissions were estimated by performing a carbon balance of the process, as requested in the RMRCECA. The AP-42 emission factors indicated in Chapter 12.5.1 (*Minimills*) were used to estimate NOx, CO and VOCs. Since these factors consider various modes of operation, including the addition of scrap, it is assumed that these factors will tend to overestimate emissions.

The approach used to estimate dust emissions consisted in using the warranty of the equipment’s supplier, i.e. a transmission rate of 10 mg/Nm³ at the exit of the baghouse. This approach can be described as conservative since the expected performance is below 5 mg/Nm^3.

Table D1.9 Estimate of Atmospheric Emissions from the Electric Arc Furnace

Parameters		EAF
Production (T of metal per cycle)		132
Anode consumption (kg/h)		120
DRI consumption (kg/h)		69,850
Flue Gas		
Standardized volumetric flowrate (Nm^3/h)		6,033
Temperature (°C)		71
Actuel volumetric flowrate (Am^3/h)		7,607
Typical composition (% volume)		
CO_2		34.50
H_2O		0.46
O_2		1.59
N_2		64.28
Ar		0.77
Stack diameter (m)		4.1
Gas velocity at the stack (m/s)		10.8
Stack height (m)		33.1
Contaminants	**Emission Factors (kg/t)**	**Emission Rate (kg/h)**
NOx	0.10 [1]	5.81
CO*	0.016 [1,2]	0.95
SO_2	0.00	0.000
PMt = $PM_{2.5}$	0.081 [3]	4.82
TOC	0.01 [1]	0.61
VOCs	0.01 [1]	0.61
CO_2	69.1 [4]	4,091
CH_4	0	0.000
N_2O	0	0.000

(1) AP42 Emission Factors, Steel Minimills, chapter 12.5.1. (In lb/ton of metal : CO: 1.8, NOx : 0.22, VOCs: 0.023)
(2) The CO is considered oxidized with a 98% CO_2 efficiency.
(3) Manufacturer's warranty at the exit of the dust collector : 10 mg/Nm^3 of particulate matter.
(4) CO_2 emissions are based on a carbon balance by considering the following carbon percentages: DRI: 5%; Graphite electrodes: 100%; Smelting: 3.9%; Slag: 0.07%; CO: 42.9%

D1.4.2 Preheating and Drying of Ladles

Before the molten metal can be transferred into the ladles, they must be preheated. This step helps avoid thermal shocks and explosions that could be triggered by the presence of water inside of the ladle. The three (3) burners used intermittently for drying purposes are powered by natural gas. It is estimated that 2 to 3 burners on average are in operation. Each of these burners have a natural gas

consumption rate of 264 Nm³/h. Emissions from these burners were estimated using the factors laid down in AP-42, Section 1.4 for natural gas combustion. Greenhouse gas quantities were calculated in accordance with the RMRCECA (QC.1.3.1 and QC.1.4.1). The following table shows the composition of the flue gas and the emissions rates for the main atmospheric contaminants.

Table D1.10 Estimate of Atmospheric Emissions from the Ladle's Preheating Burner

Parameters		Load
Power at supply point (MW HHV)		5.62
High heating value (HHV) of the gas (MJ/kg)		38.3
Gas consumption (kg/h)		367.2
Gas consumption (Sm³/h)		557.0
Gas consumption (GJ/h, HHV)		20.2
Flue gas (10% of excess air)		
Standardized volumetric flowrate (Nm³/h)		6,056
Temperature (°C)		400
Actual volumetric flowrate (Am³/h)		14,930
Typical composition (% volume)		
CO_2		8.74
H_2O		17.68
O_2		1.73
N_2		71.01
Ar+He		0.85
Stack diameter (m)		NA
Gas velocity at the stack (m/s)		NA
Stack height (m)		NA
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**
NOx	16 [1]	0.32
CO	35.4 [2]	0.71
SO_2	0.3 [3]	0.006
PMt = $PM_{2.5}$	3.2 [2]	0.06
TOC	4.6 [2]	0.09
VOCs	2.3 [2]	0.05
CO_2	49,010 [4]	992
CH_4	0.966 [4]	0.020
N_2O	0.861 [4]	0.017

(1) NOx emission factor corresponding to the standard for boilers and industrial furnaces proposed in the Canadian Government's Multi-Sector Air Pollutants Regulation (June 7, 2014).
(2) AP42 emission factors for natural gas combustion. (In lb/MMpi³ : CO: 84, PM:7.6, TOC:11, VOCs:5.5)
(3) Based on the average sulfur content of 5.7 mg/Nm³ in natural gas
(4) Emission factors laid down in the Regulation respectingmandatory reporting of certain emissions of contaminants into the atmosphere.

These combustion gases will be captured by the ventilation hoods of the smelting and casting building and routed to the associated baghouse.

D1.5 A5, A6, A7 Material Handling Baghouses

The transfer and handling of pellets and solids may generate dust. The ventilation of buildings where these activities are conducted will be directed towards a local baghouse before the air is released outside. The preferred dust emissions estimation approach consisted in using the equipment supplier's warranty, i.e. a transmission rate of 10 mg/Nm^3 at the exit of the baghouse.

Table D1.11 presents the details of dust emissions for the A5, A6 and A7 sources.

Table D1.11 A5, A6 and A7-Estimate of Atmospheric Emissions from the Transfer, Storage and Screening

Baghouse Gas	A5 – Transfer Building		A6 – Storage Building		A7 – Screening and Coating Building	
Standardized volumetric flowrate (Nm³/h)	13,200		22,000		13,200	
Dry reference volumetric flowrate (Rm³/h)	14,003		23,338		14,003	
Temperature (°C)	32		32		32	
Actual volumetric flowrate (Am³/h)	14,747		24,579		14,747	
Typical composition (% volume)						
CO_2	0		0		0	
H_2O	2.82		2.82		2.82	
O_2	20.4		20.36		20.4	
N_2	75.9		75.92		75.9	
Ar	0.91		0.91		0.91	
Stack diameter (m)	0.60		0.8		0.60	
Gas velocity at the stack (m/s)	13.0		12.2		13.0	
Stack height (m)	43		33.0		33	
Contaminants	**Emission Rate**		**Emission Rate**		**Emission Rate**	
	(kg/h)	**(t/y)**	**(kg/h)**	**(t/y)**	**(kg/h)**	**(t/y)**
PMt = $PM_{2.5}$	0.13 [1]	1.16	0.22 [1]	1.93	0.13 [1]	1.16

(1) Manufacturer's warranty at the exit of the dust collector : 10 mg/Nm³ of particulate matter.

D1.6 A8 – Briquetting Unit Stack

The stack of the briquetting unit includes five distinct sources of atmospheric emissions:

- The baghouse of the briquetting machine's feeding silos (sifting of fines, sludge from the water treatment unit and dust bag filters);
- The baghouse of the briquettes' mixer/compactor;
- The baghouse of the briquette storage silos;
- The dryer of the sludge from the water treatment unit;

› The dryer of the briquettes.

Each one of the sources was assessed individually and combined into a single source whose characteristics are presented in Table D1.12.

Table D1.12 A8-Estimate of Atmospheric Emissions from the Stack of the Briquetting Unit

Flue Gas (10% of Excess Air)		Load
Standardized volumetric flowrate (Nm^3/h)		12,529
Dry reference volumetric flowrate (Rm^3/h)		13,096
Temperature (°C)		32
Actual volumetric flowrate (Am^3/h)		13,997
Typical composition (% volume)		0
CO_2		0.84
H_2O		4.24
O_2		18.6
N_2		75.4
Ar		0.90
Stack diameter (m)		0.80
Gas velocity at the stack (m/s)		7.7
Stack height (m)		23.0
NO_x	0.06	0.56
CO	0.14	1.23
SO_2	0.00	0.01
PMt = $PM_{2.5}$	0.13	1.10
TOC	0.02	0.16
VOCs	0.01	0.08
CO_2	0	0
CH_4	196.25	1719
N_2O	0.02	0.15
GHG CO_2eq	0.00	0.03

D1.6.1 Drying of Briquettes

Before they are fed to the reactor, the briquettes have to be heated in order to control the level of humidity inside the reactor. The dryer uses natural gas as fuel at a flowrate of 38.5 Nm^3/h. A 10% excess air was used for the calculations.

CO, PM, TOC and VOC emissions were estimated using the AP-42 emission factors for natural gas combustion. For NOx, the federal standard of 16 g/GJ was used to estimate emissions. Greenhouse gases were estimated using RMRCECA emission factors.

Table D1.13 Estimate of Atmospheric Emissions from the Briquette Dryer

Parameters	Load
Power at supply point (MW HHV)	0.41
High heating value (HHV) of the gas (MJ/kg)	38.3
Gas consumption (kg/h)	26.8
Gas consumption (Sm^3/h)	40.6
Gas consumption (GJ/h, HHV)	1.5
Flue Gas (10% of Excess Air)	
Standardized volumetric flowrate (Nm^3/h)	442
Temperature (°C)	400
Actual volumetric flowrate (Am^3/h)	1089
Typical composition (% volume)	
CO_2	8.74
H_2O	17.68
O_2	1.73
N_2	71.01
Ar	0.85
Stack diameter (m)	NA
Gas velocity at the stack (m/s)	NA
Stack height (m)	NA

Contaminants	Emission Factors (g/GJ)	Emission Factors (kg/h)
NOx	16 [1]	0.02
CO	35.4 [2]	0.052
SO_2	0.3 [3]	0.000
PMt = $PM_{2.5}$	3.2 [2]	0.00
TOC	4.6 [2]	0.01
VOCs	2.3 [2]	0.00
CO_2	49,010 [4]	72
CH_4	0.966 [4]	0.014
N_2O	0.861 [4]	0.001

(1) NOx emission factor corresponding to the standard for boilers and industrial furnaces proposed in the Canadian Government's Multi-Sector Air Pollutants Regulation (June 16, 2016).
(2) AP42 emission factors for natural gas combustion. (In $lb/MMpi^3$: CO: 84, PM:7.6, TOC:11, VOCs:5.5)
(3) Based on the average sulfur content of 5.7 mg/Nm^3 in natural gas
(4) Emission factors laid down in the Regulation respecting mandatory reporting of certain emissions of contaminants intothe atmosphere.

D1.6.2 Drying of Treatment Water Sludge

The sludge from water treatment operations is reused in the form of briquettes in a reduction furnace. The briquettes should be formed in a specific ratio in order to control production parameters at the reduction reactor. For this reason, the sludge is dried up before being turned into briquettes. This drying operation is carried out using a natural gas-fueled dryer. To estimate emissions, it is considered that sludge drying is a continuous operation which will vary depending on the moisture content of the sludge. The emissions of atmospheric contaminants were estimated using the AP-42 emission factors for natural gas combustion. For NOx, the Canadian standard of 16 g/GJ was used. SO_2 emissions were calculated by mass balance. Finally, greenhouse gases were calculated using RMRCECA emission factors. The following table shows the composition of the flue gas as well as the emission rates for the main atmospheric contaminants.

Table D1.14 Estimate of Atmospheric Emissions from the Sludge Dryer

Parameters		Load
Power at supply point (MW HHV)		0.70
Higher heating value (HHV) of the gas (MJ/kg)		38.3
Gas consumption (kg/h)		45.9
Gas consumption (Sm^3/h)		69.6
Gas consumption (GJ/h, HHV)		2.5
Flue Gas (10% of Excess Air)		
Standardized volumetric flowrate (Nm^3/h)		757
Temperature (°C)		400
Actual volumetric flowrate (Am^3/h)		1,866
Typical composition (% volume)		
CO_2		8.74
H_2O		17.68
O_2		1.73
N_2		71.01
Ar		0.85
Stack diameter (m)		NA
Gas velocity at the stack (m/s)		NA
Stack height (m)		NA
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**
NOx	16 [1]	0.04
CO	35.4 [2]	0.09
SO_2	0.3 [3]	0.001
PMt = $PM_{2.5}$	3.2 [2]	0.01
TOC	4.6 [2]	0.01

Contaminants	Emission Factors (g/GJ)	Emission Rate (kg/h)
VOCs	2.3 [2]	0.01
CO_2	49,010 [4]	124
CH_4	0.966 [4]	0.002
N_2O	0.861 [4]	0.002

(1) NOx emission factor corresponding to the standard for boilers and industrial furnaces proposed in the Canadian Government's Multi-Sector Air Pollutants Regulation (June 16, 2016).
(2) AP42 emission factors for natural gas combustion. (In lb/MMpi³ : CO: 84, PM:7.6, TOC:11, VOCs:5.5)
(3) Based on the average sulfur content of 5.7 mg/Nm³ in natural gas.
(4) Emission factors laid down in the Regulation respectingmandatory reporting of certain emissions of contaminants into the atmosphere.

D1.6.3 Briquetting Building Baghouses

Three baghouses will be installed inside the briquetting building in order to reduce the amount of dust generated. Depending on the supplier's guarantees, these baghouses release a maximum concentration of 10 mg/Nm³ of particles to the atmosphere.

The vents of the baghouses will be directed towards the stack of the building. Table D1.15 shows emissions associated with the three baghouses inside the briquetting building.

Table D1.15 Estimate of Atmospheric Emissions from the Baghouses inside the Briquetting Building

Baghouse Gas	Briquetting Machine Baghouse	Feeding Silos Baghouse	Briquette Storage Silos Baghouse	Total
Standardized volumetric flowrate (Nm³/h)	990	5,170	5,170	11,330
Temperature (°C)	32	32	32	32
Actual volumetric flowrate (Am³/h)	1,106	5,776	5,776	12,658
Typical composition (% volume)				
CO_2	0.00	0.00	0.00	0.00
H_2O	2.82	2.82	2.82	2.82
O_2	20.4	20.4	20.4	20.4
N_2	75.9	75.9	75.9	75.9
Ar	0.91	0.91	0.91	0.91
Stack diameter (m)	-	-	-	
Gas velocity at the stack (m/s)	-	-	-	
Stack height (m)	-	-	-	
Contaminants	**Emission Rate**			
	(kg/h)	(kg/h)	(kg/h)	(t/year)
$PM_T = PM_{2.5}$	0.010 [1]	0.052 [1]	0.052 [1]	0.993

(1) Manufacturer's warranty at the exit of the dust collector: 10 mg/Nm³ of particulate matter.

D1.7 A9 – Acid Scrubber of the Wastewater Treatment Unit

Ammonia will be the main contaminant released into the atmosphere by the acid scrubber. The warranty of the equipment manufacturer is 5 Nm^3/h and this is the value used to calculate the emission rate at the exit of the stack. Table D1.16 shows ammonia emissions associated with this source.

Table D1.16 Estimate of Atmospheric Emissions from the Acid Scrubber

Parameters		Scrubber Performance
Ammonia concentration (mg/Nm^3)		5.0
Stack Gas		
Standardized volumetric flowrate (Nm^3/h)		33.0
Dry reference volumetric flowrate (Rm^3/h)		33.4
Temperature (°C)		50
Actual volumetric flowrate (Am^3/h)		39
Typical composition (% volume)		
CO_2		0.00
H_2O		7.31
O_2		19.41
N_2		72.41
Ar		0.87
Stack diameter (m)		0.80
Gas velocity at the stack (m/s)		0.02
Stack height (m)		11
Contaminants	**Emission Factors (g/Nm^3)**	**Emission Rate (kg/h)**
NH_3	0.005	0.17

D1.8 A10 – Emergency Generator

The emergency diesel generator, which produces 2 to 2.5 MW of electricity, will be used only during plant power outages. The generator will be started to ensure that the emergency systems are functioning properly. This generator is powered with low sulfur diesel fuel. Air emissions will come from the diesel engine exhaust gases whose main air contaminants are NOx and particulate matters. Table D1.17 shows an estimate of the typical atmospheric emissions of an emergency generator of this capacity as indicated in the manufacturer's specifications, including contaminant emission factors. Based on the evaluation of annual emissions, the generator will operate 87.6 hours every year, which corresponds to 1% of the time.

Table D1.17 Estimate of Atmospheric Emissions from the Emergency Generator

Parameters			Values
Type of fuel			Diesel
Fuel consumption (l/h)			656.8
Higher heating value (HHV) of the fuel (MJ/kg)			38.3
Fuel consumption (GJ/h, HHV)			25.2
Gas Combustion			
Dry reference volumetric flowrate (Rm^3/h)			12,336
Temperature (°C)			491
Actual volumetric flowrate (Am^3/h)			34,159
Typical composition (% volume)			
CO_2			7.6
H_2O			7.5
O_2			9.1
N_2 + Ar			75.9
Stack diameter (m)			0.6
Gas velocity at the stack (m/s)			33.6
Stack height (m)			5 (typical)
Contaminants	**Emission Factors (g/GJ)**	**Ref./Note**	**Emission Rate (kg/h)**
NOx	708.7	1	17.8
CO	56.0	1	1.41
SO_2	0.7	2	0.017
PM	4.9	1	0.12
TOC	13.3	1	0.34
VOCs	13.3	3	0.34
CO_2	69,530	4	1749
CH_4	3	4	0.087
N_2O	10	4	0.26

(1) Emission factors based on the manufacturer's data for a 2.5 MW engine.
(2) Fuel sulfur mass balance (15 ppm/S).
(3) It is assumed that TOC is all VOCs.
(4) Emission factors set in the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere.

D1.9 A-11 - Emissions Associated with Trucking Activities within the Plant's Perimeter

The sludge generated in the wastewater treatment unit, the dust from bag filters and the sifting-generated fines are all materials that contain a considerable amount of iron. These materials will be transported from their source to the briquetting unit building. The slag generated during smelting and casting will also be trucked to the storage area. Depending on the feeding rate of the briquetting unit, the slag production rates and the distances between the various buildings and storage area, a total distance of about 1120 km will be covered within the plant every year. The (EPA Average In-Use Emissions from Heavy-Duty Trucks) emission factors are the ones used to calculate NOx, CO, SO_2, PM, VOC and TOC emissions. Regarding the calculation of GHG emissions, the RMRCECA emission factors were used. The average heavy vehicle diesel consumption was extracted from Resources Canada's September 2010 *Canadian Vehicle Survey*. Since roads inside the site are unpaved, dust emissions were estimated using the EPA factors for road fugitive emissions. The percentage of silt from the roads was estimated at 6%[1] for the purpose of the calculations.

Table D1.18 Estimate of Atmospheric Emissions due to Trucking Activities on the Plant Site

Parameters		Maximum Load		
		Combustion	Road Fugitive Emissions	Total
Type of fuel		Diesel	Diesel	Diesel
Fuel consumption (L/100km)		35.2	35.2	35.2
Average mass of vehicule (t)		37.5	37.5	37.5
Maximum transportation rate (t/h)		14.7	14.7	14.7
Total distance traveled (km-vehicule/h)		0.128	0.128	0.26
Fuel consumed (l/h)		0.045	0.045	0.09
Contaminants	**Emission Factors (g/kmV)**	**Emission Rate (kg/h)**		**Total (kg/h)**
NOx	5.7 [1]	0.00	0	0.00
CO	1.49 [1]	0.00	0	0.00
SO_2	0.009 [3]	0.00	0	0.00
PMt	0.14 [1], 2.72 [2]	0.00	0.35	0.35
PM_{10}	0.14 [1], 0.72 [2]	0.00	0.09	0.09
$PM_{2.5}$	0.13 [1], 0.07 [2]	0.00	0.01	0.01
TOC	0.29 [1]	0.00	0	0.00
VOCs	0.28 [1]	0.00	0	0.00
CO_2	937 [4]	0.12	0	0.12
CH_4	0.05 [4]	0.00	0	0.00
N_2O	0.39 [4]	0.00	0	0.00

[1] AP-42 Table 11.9-3

Contaminants	Emission Factors (g/kmV)	Annual Emission Rate (T/y)		Total (T/y)
NOx	5.7 [1]	0.006	0	0.006
CO	1.49 [1]	0.002	0	0.002
SO_2	0.009 [3]	0.00	0	0.000
PMt	0.14 [1], 2.72 [2]	0.00	3.044	3.044
PM_{10}	0.14 [1], 0.72 [2]	0.00	0.812	0.812
$PM_{2.5}$	0.13 [1], 0.07 [2]	0.00	0.080	0.080
TOC	0.29 [1]	0.00	0	0.000
VOCs	0.28 [1]	0.00	0	0.000
CO_2	937 [4]	1.05	0	1.050
CH_4	0.05 [4]	0.00	0	0.000
N_2O	0.39 [4]	0.00	0	0.000

(1) Emission Factors AP-42 - Average In-Use Emissions from Heavy-Duty, table 2 for *VIIIa type*
(2) Emission Factors AP-42 – 13.2.2
(3) Fuel sulfur mass balance as per Canadian standards (15 mg/kg)
(4) Emission factors laid down in the *Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere* QC.27

D1.10 Cumulative Impact Sources

The receiving and expediting of raw material and finished product as well as their handling between the jetty and the facility site are the responsibility of the APS. These activities are likely to emit dust as well as combustion emissions. They will be considered in the cumulative impact of atmospheric emissions.

D1.10.1 Emissions Associated with Off-site Trucking Activities

Every year about 671,500 t of raw materials will be trucked towards the plant and 425,020 t of pig iron will be shipped. The raw material and the finished product transit through the port located 2.4 km away from the plant. In the event of the conveyor being unavailable, the APS, which is responsible for loading/unloading and transportation operations from the dock to the plant, will transport these materials by truck to *Chemin* du Quai Marcel-Dionne. Considering ship loading and unloading logistics, the production and storage capacity and an average load of 25 t per truck, it was estimated that the pellets and smelting materials would be trucked at a pace of 400 t/h and 100 t/h respectively.

Since the road is paved, it is reasonable to assume fugitive dust emissions caused by moving trucks will be negligible. Only air emissions resulting from the combustion of diesel engines are taken into consideration. A truck will consume an estimated 35.2 l/100km[2] and EPA[3] emission factors are used to determine contaminant emissions. Greenhouse gases were estimated using protocol QC.27 of the RMRCECA.

[2] http://oee.nrcan.gc.ca/publications/statistiques/evc08/pdf/evc08.pdf
[3] EPA Average In-Use Emissions from Heavy-Duty Trucks

Table D1.19 Estimate of Atmospheric Emissions caused by Trucking Off-Site Trucking Activities

Parameters	Maximum Load		
	Raw Material	Finished Product	Total
Type of fuel	Diesel	Diesel	Diesel
Fuel consumption (L/100km)	35.2	35.2	35.2
Average mass of vehicle (t)	37.5	37.5	37.5
Distance to be covered one-way trip (km)	2.4	2.4	2.4
Maximum transportation rate (t/h)	400	100	500
Total distance traveled (km-vehicle/h)	76.8	19.2	96.0
Fuel consumed (l/h)	27.0	6.8	33.8

Contaminants	Emission Factors (g/kmV)	Emission Rate (kg/h)		Total (kg/h)
NOx	5.7 [1]	0.44	0.110	0.55
CO	1.49 [1]	0.11	0.029	0.14
SO_2	0.009 [2]	0.001	0.0002	0.00
PMt	0.14 [1]	0.01	0.003	0.01
PM_{10}	0.14 [1]	0.01	0.003	0.01
$PM_{2.5}$	0.13 [1]	0.01	0.003	0.01
TOC	0.29 [1]	0.02	0.005	0.03
VOCs	0.28 [1]	0.02	0.005	0.03
CO_2	937 [3]	72.0	18.0	90.0
CH_4	0.053 [3]	0.004	0.001	0.005
N_2O	0.387 [3]	0.03	0.01	0.04

Contaminants	Emission Factors (g/kmV)	Annual Emission Rate (T/Year)		Total (T/Year)
NOx	5.7 [1]	0.74	0.47	1.20
CO	1.49 [1]	0.19	0.12	0.31
SO_2	0.009 [2]	0.00	0.00	0.00
PMt	0.14 [1]	0.02	0.01	0.03
PM_{10}	0.14 [1]	0.02	0.01	0.03
$PM_{2.5}$	0.13 [1]	0.02	0.01	0.03
TOC	0.29 [1]	0.04	0.02	0.06
VOCs	0.28 [1]	0.04	0.02	0.06
CO_2	937 [3]	120.85	76.5	197
CH_4	0.053 [3]	0.01	0.00	0.01
N_2O	0.387 [3]	0.05	0.03	0.08

(1) Emission Factors AP-42 - Average In-Use Emissions from Heavy-Duty, table 2 for *VIIIa type*.
(2) Fuel sulfur mass balance as per Canadian standards (15 mg/kg)
(3) Emission factors laid down in the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere. QC.27

D1.10.2 Fugitive Emissions from Loading and Unloading of Pellets at the Jetty

Annually, at most 830,000 tons of pellets will be delivered by boat to Port Saguenay and will be unloaded at a rate of 5,500 t/h. The pellets will be stored in a temporary pile on the jetty to be then transported to the facility by trucks.

A ship will approach the jetty around every 12 days and the unloading duration is 5 hours per day. Then, the pile will be loaded into trucks at a rate of 400 t/h, or 69 hours of loading activity for each unloading of the ship cargo.

During unloading of bulk materials, the APS will take the necessary measures to attenuate the dust emissions due to loading and unloading activities. In addition to a wind-break screen barrier that can be installed near the pile, spraying water will allow dust emissions to be cut down. Attenuation factors of 75% and 50% were considered respectively for unloading and loading of pellets at the jetty. The attenuation factors come from Appendix 5 of the MDDELCC document "*Guide d'instructions-Préparation et réalisation d'une modélisation de la dispersion des émissions atmosphériques des projets miniers (2015)* ", (Instruction guide for the preparation and execution of mining project atmospheric emission dispersion modeling - 2015).

The estimates of the atmospheric emissions of particulate matter from the piling of pellets during ship unloading are presented in Table D1.20. The emissions from loading of pellet transport trucks going towards the facility are presented in Table D1.21 while the estimate of emissions from wind erosion of the pellet pile is presented in Table D1.22.

Table D1.20 Estimate of Emissions from Pellet Unloading

Reference: AP42, section 13.2.4, Aggregate Handling and Storage Piles	
Emission Factor, FE (kg/t) = k x 0.0016 x $(U/2.2)^{1.3}$ / $(M/2)^{1.4}$	
U: Average wind velocity (m/s)	
M: % humidity of the material	
	k
PMt	0.74
PM_{10}	0.35
$PM_{2.5}$	0.053
% humidity of the material	1.5
Average wind velocity (m/s)	4.12
% attenuation	75
FE (kg/t), with attenuation	
PMt	0.00100
PM_{10}	0.00047
$PM_{2.5}$	0.00007
Unloading rate (t/h)	5500
Emission rate (kg/h)	
PMt	**5.5**
PM_{10}	**2.6**
$PM_{2.5}$	**0.4**
Maximum number of ships per year	30
Duration of pellet unloading (hours)	5
Unloading time per year (hours)	150
Annual emissions (t/year)	
PMt	**0.82**
PM_{10}	**0.39**
$PM_{2.5}$	**0.059**

Table D1.21 Estimate of Pellet onto Truck Loading Emissions

Reference: AP42, section 13.2.4, Aggregate Handling and Storage Piles

Emission Factor, FE (kg/t) = k x 0.0016 x $(U/2.2)^{1.3}$ / $(M/2)^{1.4}$

U: Average wind velocity (m/s)
M: % humidity of the material

	k
PMt	0.74
PM_{10}	0.35
$PM_{2.5}$	0.053
% humidity of the material	1.5
Average wind speed (m/s)	4.12
% Attenuation factor	50
FE (kg/t)	
PMt	0.002000
PM_{10}	0.000946
$PM_{2.5}$	0.000143
Truck loading rate (t/h)	400
\	
Emission rate (kg/h)	
PMt	**0.80**
PM_{10}	**0.38**
$PM_{2.5}$	**0.06**
Duration of a truck loading operation (hours)	68.75
Number of loading operations per year	30
Annual duration of truck loading (hours)	2063
Annual emissions (t/y)	
PMt	**1.65**
PM_{10}	**0.78**
$PM_{2.5}$	**0.12**

Table D1.22 Estimate of Emissions from Wind Erosion of the Pellet Pile

MDDELCC wind erosion emission model		
FE (g/m²/s) =	1.52 x 10^{-5} x J x s, if the wind velocity is >= 19.3 km/h 0, if the wind velocity is less than 19.3 km/h	
where:	s: average concentration in silt of the stock pile as a percentage (%) J (particle class factor)	
	J	
PMt	1	MDDELCC
PM_{10}	0.5	MDDELCC
$PM_{2.5}$	0.2	MDDELCC
% silt in the material (s)	3.5	Project given
FE (g/s/m²)		
PMt	5.32E-05	If the wind ≥ 19.3 km/h, 0 otherwise.
PM_{10}	2.66E-05	If the wind ≥ 19.3 km/h, 0 otherwise.
$PM_{2.5}$	1.06E-05	If the wind ≥ 19.3 km/h, 0 otherwise.
Surface of the pile (m²)	5202	
Emission Rate (kg/h)	TE	
PMt	**1.00**	
PM_{10}	**0.50**	
$PM_{2.5}$	**0.20**	
Strong wind frequency (> 19.3 km/h) **- Fv**	30%	Bagotville
Frequency of the presence of the pellet pile at the jetty - **Fp**	26%	30 deliveries per year x 75 hours/delivery / 8760 hours per yr
Probability of the presence of the pile and strong winds (**Pp**=Fv*Fp)	7.7%	
Annual Emissions (t/a = kg/h * Pp)		
PMt	**0.67**	
PM_{10}	**0.34**	
$PM_{2.5}$	**0.13**	

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Appendix D2 – Atmospheric Dispersion Study

Table des matières

D2. Étude de dispersion atmosphérique 1

D2.1 INTRODUCTION 1
D2.2 MODELE DE DISPERSION 1
D2.3 METEOROLOGIE 2
D2.3.1 Sources et périodes de données 2
D2.3.2 Traitement des données 3
D2.3.3 Rose des vents 4
D2.3.4 Paramètres de surface 6
D2.3.5 Options sélectionnées de AERMET 10
D2.4 RECEPTEURS 11
D2.5 CONVERSION DU NO EN NO_2 11
D2.6 ESTIMATION DES CONCENTRATIONS POUR UNE PÉRIODE INFÉRIEURE À UNE HEURE 11
D2.7 AIR QUALITY STANDARDS AND INITIAL CONCENTRATIONS 13
D2.8 SCENARIOS AND EMISSION PARAMETERS 14
D2.8.1 Emission Scenarios 14
D2.8.2 Source Parameters and Emission Rate 14
D2.8.3 Buildings Downwash Effect 18
D2.9 RESULTS OF THE ATMOSPHERIC DISPERSION STUDY 18

REFERENCES 24

Liste des tableaux

Tableau D2.1 Liste des stations météorologiques 3
Tableau D2.2 Paramètres de surface par saison et par type de couverture du sol 9
Tableau D2.3 Paramètres de surface utilisés dans le modèle météorologique 10
Table D2.4 Initial Concentrations and Ambient Air Quality Standards 13
Table D2.5 Emission Parameters of the Stacks 15
Table D2.6 Volume Sources Emission Parameters for Roads inside and outside the Plant Site 16
Table D2.7 Area Sources Emission Parameters Representing the Wind Erosion over the Stoke Piles (without attenuation measures) 15
Table D2.8 Volumic Sources emission Parameters for handling material (with mitigation measures) 15
Table D2.9 Summary of the Results of the Atmospheric Dispersion Study for Scenarios 1 and 2 19
Table D2.10 Summary of the Results of the Atmospheric Dispersion Study of the cumulative effects of plant operation and handling activities by the APS 19

Liste des figures

Figure D2.1 Rose des vents à 10 m du sol – Bagotville (2010-2014) 5
Figure D2.2 Carte de couverture du sol sur un domaine de 10 X 10 km centré sur le site de la station météorologique de Bagotville 7
Figure D2.3 Définition des secteurs dans un rayon de 1 km de la station météorologique de Bagotville utilisés pour l'estimation de la rugosité de la surface 8
Figure D2.4 Domaine de modélisation, topographie et récepteurs 12
Figure D2.5 Atmospheric Emission Sources and Buildings Locations 17
Figure D2.6 Maximum Daily Concentrations (µg/m³) of TPM Calculated in Ambient Air, Scenario 1 20
Figure D2.7 Maximum Daily Concentrations (µg/m³) of $PM_{2,5}$ Calculated in Ambient Air, Scenario 1 21
Figure D2.8 Maximum Daily Concentrations (µg/m³) of PMt Calculated in Ambient Air, Scenarios 1 and 3 (with mitigation measures) 22
Figure D2.9 Maximum Daily Concentrations (µg/m³) of $PM_{2,5}$ Calculated in Ambient Air, Scenarios 1 and 3 (with mitigation measures) 23

D2. Étude de dispersion atmosphérique

D2.1 Introduction

Cette annexe présente plus de détails sur la méthodologie utilisée pour l'évaluation des concentrations maximales de contaminants dans l'air ambiant liées à l'usine de fonte en gueuse située à la ville de Saguenay dont les résultats sont présentés au Chapitre 7 du rapport principal de l'étude d'impact environnemental.

Afin d'évaluer les effets du projet sur la qualité de l'air et faire la démonstration que le projet n'entrainerait pas de dépassements des normes de qualité de l'air du Québec spécifiées à l'annexe K du *Règlement sur l'assainissement de l'atmosphère* (RAA), une étude de dispersion atmosphérique (modélisation de la dispersion atmosphérique) a été réalisée.

La méthodologie utilisée pour la modélisation de la dispersion atmosphérique rencontre les exigences du *Guide de la modélisation de la dispersion atmosphérique* du MDDELCC (Leduc, 2005) et de l'annexe H du RAA. Les sous-sections suivantes présentent les détails techniques de l'étude de dispersion atmosphérique.

D2.2 Modèle de dispersion

Le modèle AERMOD (« ***A****merican Meteorological Society and* ***E****nvironmental Protection Agency* ***R****egulatory Air Dispersion* ***Mod****el* », version 15181) a été utilisé pour cette étude. Ce modèle est régulièrement utilisé dans les études d'impact sur la qualité de l'air de projets industriels au Québec et ailleurs dans le monde. Il s'agit en fait du modèle règlementaire aux États-Unis et dans plusieurs provinces canadiennes, dont le Québec.

Ce modèle permet de tenir compte du sillage des bâtiments sur la dispersion des émissions de cheminées. Le modèle considère aussi l'élévation initiale du panache due à la quantité de mouvement vertical et à la flottabilité (« buoyancy ») des gaz chauds s'échappant des cheminées. Finalement, le modèle tient aussi compte de la variation horaire des paramètres météorologiques et des inversions de température au sol ou en altitude.

L'approche utilisée dans la modélisation est dite conservatrice, car aucune transformation chimique et aucun puits (déposition par voies sèche et humide, absorption par la végétation) n'ont été considérés. Par le fait même, les concentrations ont tendance à être surestimées à mesure que l'on s'éloigne de la source.

Les données d'entrée du modèle comprennent :

- les caractéristiques des émissions (taux d'émission des divers contaminants, vitesse de sortie des gaz, température d'émission, etc.);
- les caractéristiques des sources d'émission (position, diamètre et hauteur des cheminées, dimensions des sources de surface et des sources de volume);
- les dimensions caractéristiques des bâtiments si les effets de sillage de bâtiments sur les panaches des cheminées sont considérés;
- les données météorologiques horaires (température, vitesse et direction du vent, indices de la stabilité atmosphérique et de la turbulence, hauteur de mélange);

- la position et l'élévation des récepteurs, c'est-à-dire les lieux où l'on désire évaluer la concentration atmosphérique du polluant;
- des paramètres contrôlant les options du modèle et les calculs statistiques à effectuer sur les concentrations calculées par le modèle.

Pour cette étude, les phénomènes de déposition sèche ou humide n'ont pas été considérés et l'option de dispersion en mode rural a été sélectionnée pour toutes les sources.

D2.3 Météorologie

Les principaux paramètres météorologiques contrôlant la dispersion atmosphérique des émissions d'une cheminée et considérés par le modèle AERMOD sont : la vitesse et la direction du vent, les indices de la stabilité atmosphérique (vitesse de friction, longueur de Monin-Obukov) et la hauteur de mélange. Ces paramètres, de même que la température ambiante, doivent être fournis sur une base horaire au modèle.

Le modèle micro-météorologique AERMET (version 15181) a été utilisé pour préparer la base de données météorologique nécessaire au modèle AERMOD.

Le modèle météorologique AERMET requiert des observations horaires en surface (vitesse et direction du vent, température et opacité du couvert nuageux) et des sondages aérologiques une fois par jour le matin. Les sondages aérologiques au lever du jour (mesure du profil vertical des paramètres météorologiques à l'aide de ballons-sondes) sont utilisés pour l'estimation des hauteurs de mélange durant le jour. AERMET requiert aussi la détermination des paramètres de surface au site météorologique afin d'estimer la turbulence dans la couche limite planétaire.

D2.3.1 Sources et périodes de données

Les observations horaires en surface pour l'aéroport de Bagotville ont été fournies par les services climatologiques d'Environnement Canada pour les années 2005 à 2014. La période de 2010 à 2014 a été sélectionnée pour l'étude de dispersion atmosphérique, les années précédentes (2005 à 2009) étant réservées comme remplacement advenant la présence de longues périodes de données manquantes dans le période de 2010 à 2014.

Les sondages aérologiques disponibles pour la station de Maniwaki, la seule station dans le sud-ouest du Québec et aussi la station jugée la plus représentative pour la région de Saguenay, ont été obtenus auprès des services climatologiques américains[1].

Le tableau D2.1 présente les stations météorologiques considérées dans cette étude. Les paramètres additionnels facultatifs pour AERMET ont aussi été considérés.

[1] NOAA/ESRL Radiosonde Database (http://www.esrl.noaa.gov/raobs/)

Tableau D2.1 Liste des stations météorologiques

Noms des stations (numéros)(1)	Latitudes Longitudes Altitudes	Types de station et fréquences des observations	Distances et directions relatives par rapport au site du projet	Paramètres utilisés
Aéroport de Bagotville (7060400)	48°20'N 71°00'O 151 m	Surface, horaire	12 km au sud-ouest du projet	› Vitesse du vent à 10 m › Direction du vent à 10 m › Température › Opacité du couvert nuageux › Étendue du couvert nuageux(2) › Humidité relative(2) › Pression(2) › Plafond(2)
Maniwaki (4734)(3)	46,38°N 75,97°O 170 m	Altitude, deux fois par jour	425 km au sud-ouest de Saguenay	Profils verticaux de température le matin

(1) Numéros attribués par Environnement Canada.
(2) Paramètres facultatifs.
(3) Numéro WBAN (Weather Bureau Army Navy)

D2.3.2 Traitement des données

D2.3.2.1 Observations horaires en surface

Les observations en surface fournies par Environnement Canada dans le format des archives climatologiques nationales (HLY01) doivent être reformatées dans un format compatible avec AERMET. La première étape de traitement consiste à extraire les observations et à les reformater de façon à obtenir des enregistrements horaires contenant tous les paramètres.

Les données manquantes sont remplacées par interpolation linéaire jusqu'à trois heures consécutives. Seulement cinq heures sur la période de 2010 à 2014 comporte des observations manquantes qui ont requis une interpolation. Finalement les données sont reformatées avec conversion d'unités dans le format CD144, un format de donnée américain compatible avec AERMET.

D2.3.2.2 Sondages aérologiques

Les sondages aérologiques disponibles en format FSL (Forecast Systems Laboratory) auprès de la National Oceanographic and Atmospheric Administration (NOAA) sont compatibles avec AERMET.

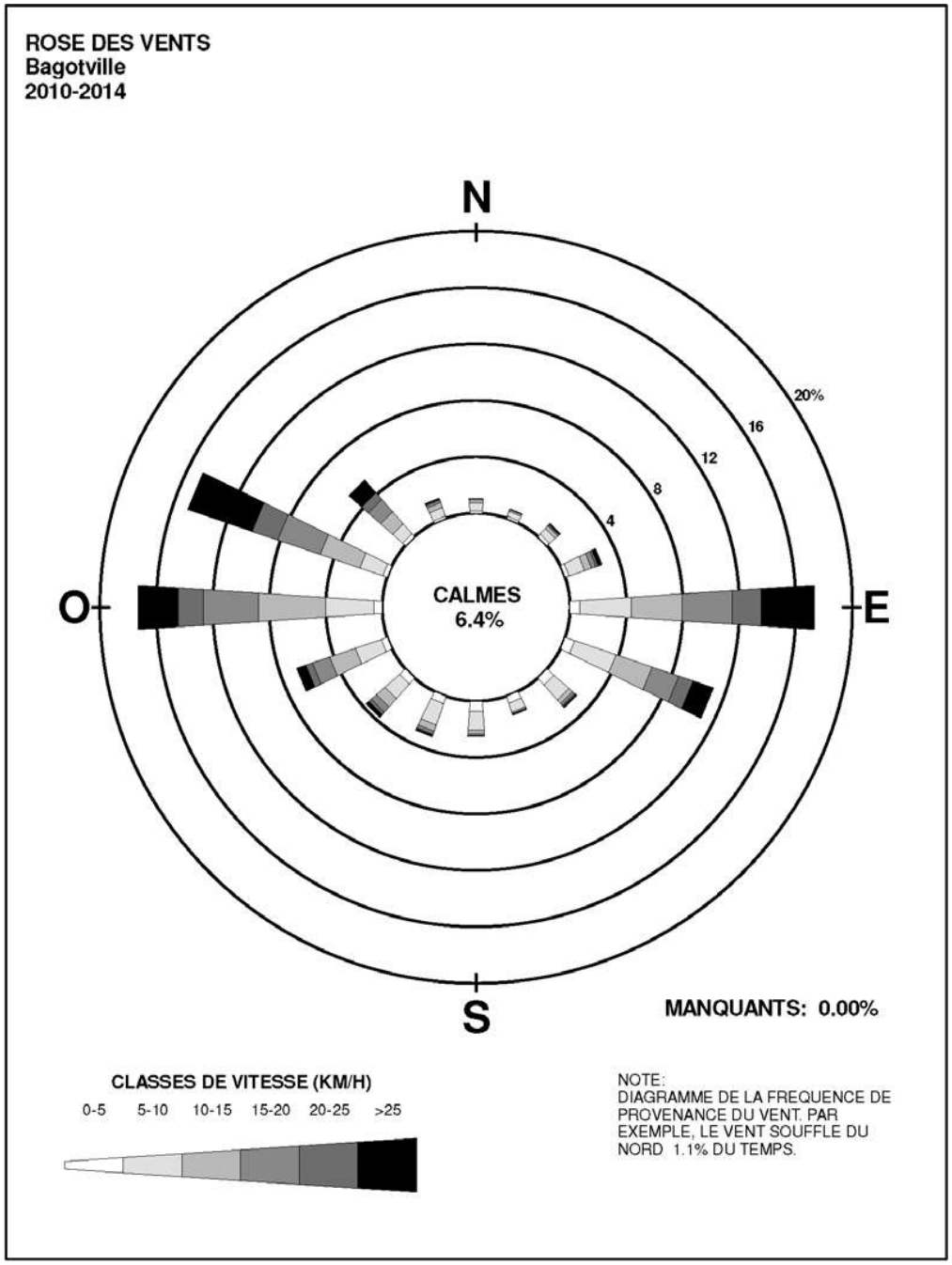
Un traitement de remplacement des sondages manquants ou invalides a toutefois été appliqué à ces données. Seuls les sondages du matin (12:00 UTC), avec une tolérance de deux heures car certains sondages sont réalisés en avance ou en retard, sont analysés. Les sondages manquants ou invalides sont remplacés par le sondage valide de 12:00 UTC de la journée précédente ou par celui de la journée suivante. Il est ainsi possible de remplacer jusqu'à deux sondages manquants ou invalides consécutifs. Un sondage invalide est un sondage dont le

niveau de surface est absent, qui ne possède que quelques niveaux de mesures ou dont les paramètres (température, pression et hauteur) sont manquants sur trop de niveaux sous 5 000 m. sur l'ensemble de la période de 2010 à 2014, six sondages invalides et trois sondages manquants ont été identifiés et remplacés par le sondage de la journée précédente.

D2.3.3 Rose des vents

La rose des vents illustrant la fréquence de la provenance du vent par classe de vitesse à Bagotville pour la période de 2010 à 2014 est présentée à la figure D2.1. Le vent dominant provient de l'est (17.3 %) et de l'ouest (17.4 %). Ces vents dominants en fréquence le sont aussi pour la vitesse, avec des vitesses moyennes de 16,9 km/h pour l'ouest et de 17,7 km/h pour l'est. La vitesse moyenne de toutes les observations est de 14,9 km/h et le vent est calme 6,4% du temps.

Figure D2.1 Rose des vents à 10 m du sol – Bagotville (2010-2014)



D2.3.4 Paramètres de surface

Lors de la préparation des données météorologiques avec AERMET, l'usager doit estimer certains paramètres de surface pour le site de mesure météorologique. Ces paramètres de surface sont utilisés par le modèle météorologique AERMET pour estimer les paramètres micro-météorologiques décrivant la couche limite atmosphérique (vitesse de friction, longueur de Monin-Obukov, hauteur de mélange, etc) à partir des observations météorologiques courantes : vitesse du vent, température, opacité du couvert nuageux. Ces paramètres de surface sont :

- La longueur de rugosité (z_0) est fonction de la hauteur des obstacles à l'écoulement du vent. Il s'agit de la hauteur théorique à laquelle la vitesse du vent horizontal tend vers zéro.
- L'albédo (α) représente la fraction du rayonnement solaire incident réfléchie par la surface à midi.
- Le rapport de Bowen (B_o) est le rapport entre le flux de chaleur sensible et le flux de chaleur latente durant le jour. Il représente en quelque sorte l'humidité de la surface.

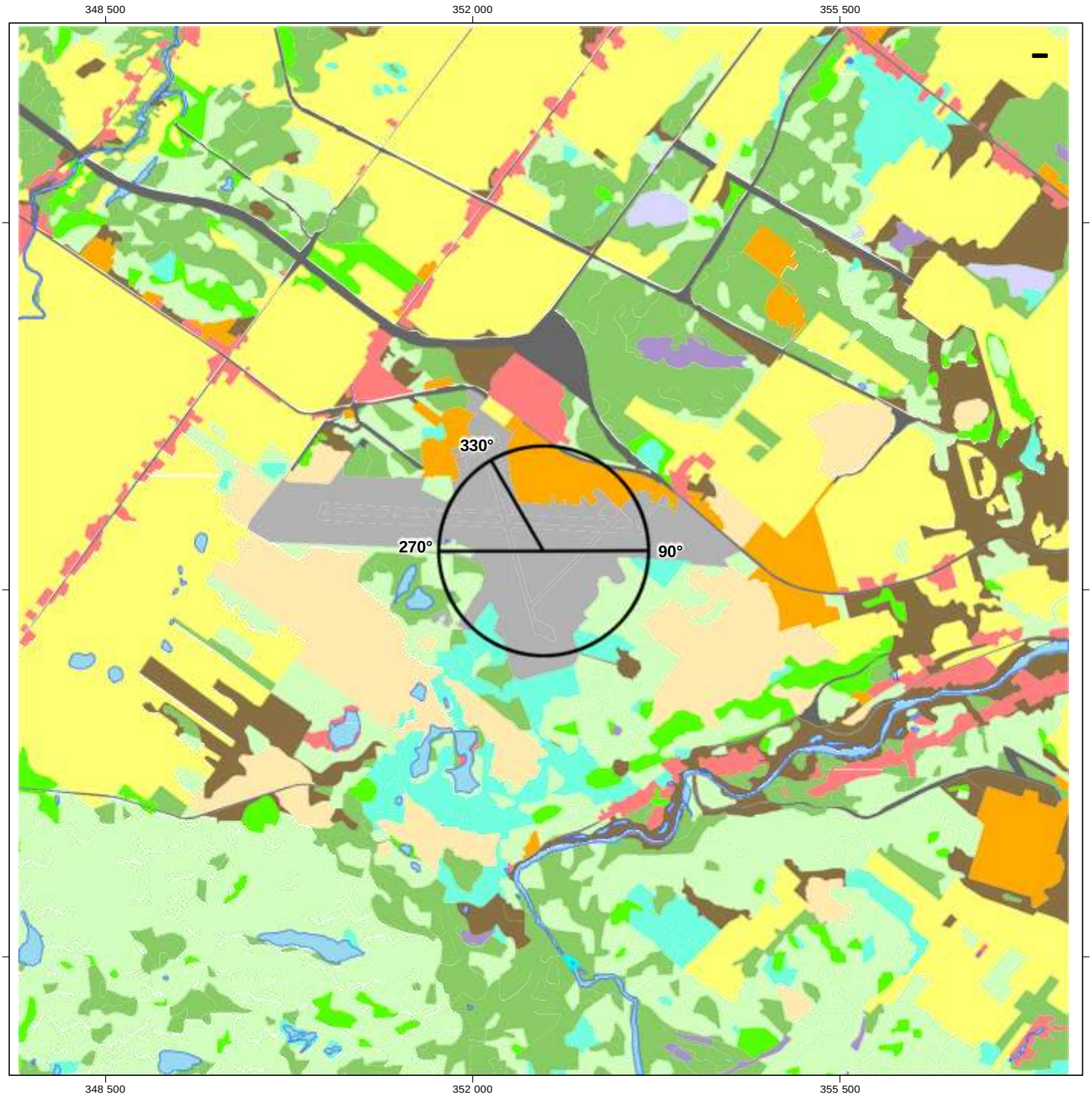
Selon la dernière version du guide d'application d'AERMOD par l'US EPA (US EPA, 2015), des valeurs régionales moyennes sur un domaine de 10 km par 10 km devraient être utilisées pour le rapport de Bowen et l'albédo. Pour la rugosité de la surface, des valeurs typiques selon la provenance du vent et de l'utilisation du sol dans un rayon de 1 km du site météorologique devraient être utilisées. Pour tous ces paramètres, les variations saisonnières (ou mensuelles) doivent aussi être considérées.

La couverture du sol sur un domaine de 10 km par 10 km a été déterminée à partir des carte éco-forestières du MRN et de l'interprétation d'images satellite à haute résolution.

La figure de couverture du sol ainsi préparée est présentée à la figure D2.2. La figure D2.3 montre une image satellite du site de la station météorologique de Bagotville et les trois secteurs utilisés pour définir la rugosité de la surface dans un rayon d'un kilomètre.

Dans un rayon d'un kilomètre de la station météorologique, la couverture du sol est principalement composée des terrains plats de l'aéroport (67 %). Pour le domaine de 10 x 10 km, les terres agricoles occupent 32,7 % de la superficie et les forêts mixtes et de conifères occupent respectivement 24,5 % et 16,8 % de la surface du domaine.

Le tableau D2.2 présente les caractéristiques de surface saisonnières utilisées dans cette étude pour chaque catégorie d'utilisation ou de couverture du sol identifiées. Des valeurs typiques par saison et par type de couverture du sol ont été utilisées (US EPA, 2013). La définition des saisons est principalement basée sur les normales climatiques de température moyenne journalière mensuelle et d'épaisseur de neige au sol en fin de mois à Bagotville et l'état de la végétation.



COUVERTURE DU SOL / LAND COVER

- Eau / Water
- Résidentiel peu dense / Low Intensity Residential
- Aéroport (piste et tarmac) / Airport
- Commercial, industriel, urbain / Commercial, Industrial, Urban
- Sol à nu / Bare Soil
- Carrière, mine, gravat / Pit, Waste Substance
- Forêt feuillue / Decideous Forest
- Forêt conifère / Evergreen Forest
- Forêt mixte / Mixed Forest
- Arbustif / Shrub
- Agriculture / Agricultural
- Pâturage / Fallow
- Milieu humide boisé / Wetland Wooded
- Milieu humide herbacé / Wetland

MODÉLISATION / MODELLING

- Limite et secteurs pour la détermination de la rugosité de la surface / Limits and sectors for surface roughness estimation

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Couverture du sol sur un domaine de 10 x 10 km centré sur le site de la station météorologique de l'aéroport de Bagotville / Land cover over a 10 x10 km area centered at Bagotville meteorological station

Projet : 634451
Fichier : snc634451_ei_AnD2-2_couv_sol_let_f00.mxd

0 0.55 1.1 km

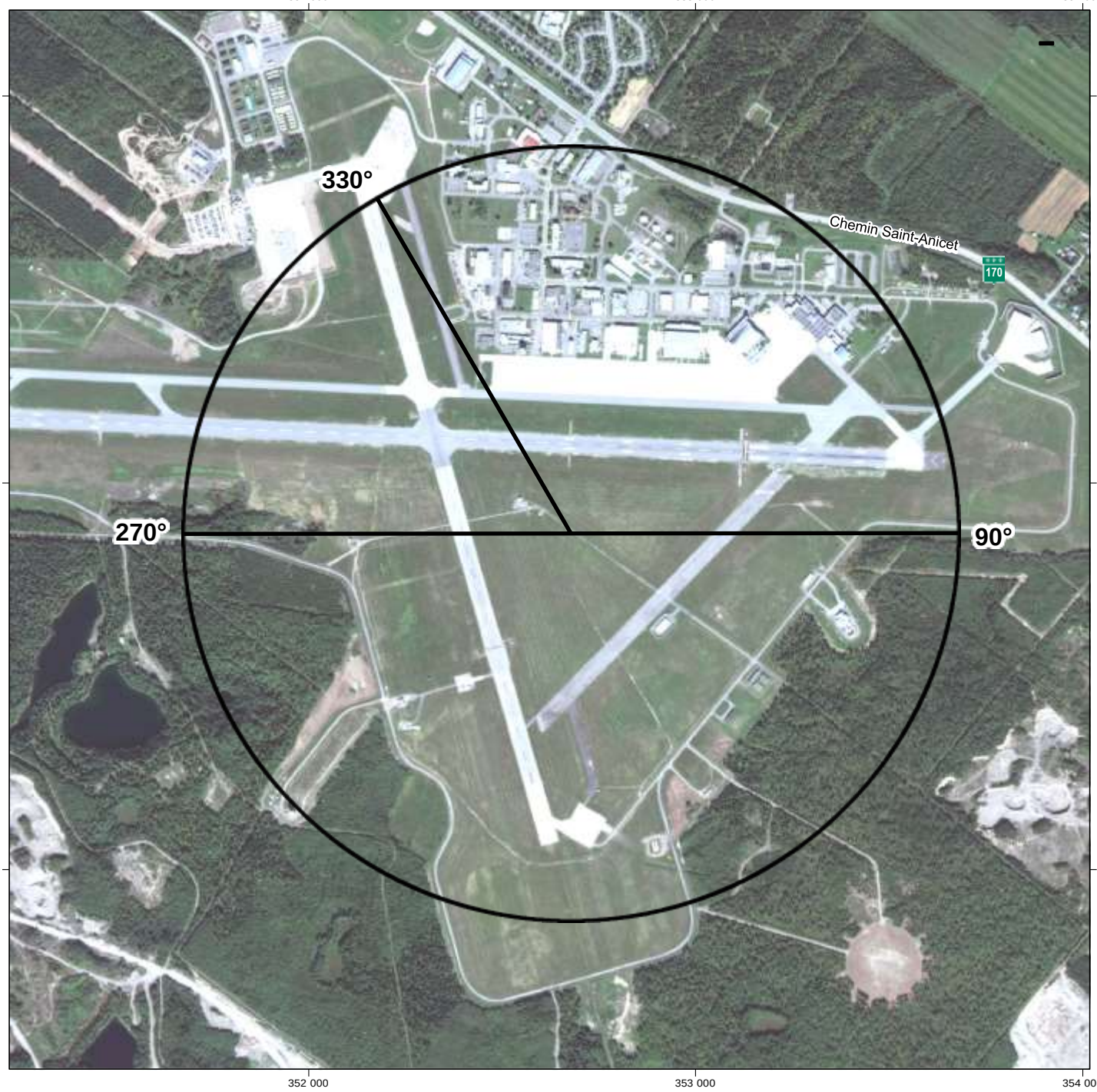
Projection UTM, fuseau 19, NAD83

1/55 000

Juillet 2016

Figure D2.2

T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnD2-2_couv_sol_let_f00.mxd



Note: Les secteurs sont définis dans un rayon de 1 km à partir de la position de l'anémomètre /
The sectors are defined in a circle of 1 km radius centered at the position of the anemometer

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Définition des secteurs à l'aéroport de Bagotville utilisés pour l'estimation de la rugosité de la surface / Definition of sectors at Bagotville airport used for surface roughness estimation

Sources :
Bing Maps Aerial
Projet : 634451
Fichier : snc634451_ei_AnD2-3_secteurs_let_f00.mxd

0 0.15 0.3 km

Projection UTM, fuseau 19, NAD83

1/15 000

Juillet 2016

Figure D2.3

T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnD2-3_secteurs_let_f00.mxd

Tableau D2.2 Paramètres de surface par saison et par type de couverture du sol

Utilisation ou	% de la couverture du domaine		Rugosité (m)				Albédo				Rapport de Bowen			
	Rayon de 1 km	10 x 10 km	E	A	H	P	E	A	H	P	E	A	H	P
Eau	0,0%	1,4%	0,001	0,001	0,002	0,001	0,10	0,10	0,40	0,10	0,1	0,1	0,3	0,1
Résidentiel, peu dense	0,0%	3,4%	0,4	0,3	0,3	0,4	0,16	0,18	0,45	0,16	0,8	1,0	0,5	0,8
Aéroport (surfaces planes)	66,6%	4,5%	0,05	0,05	0,05	0,05	0,18	0,18	0,35	0,18	1,5	1,5	0,5	1,5
Commercial/Industriel/urbain	14,9%	3,2%	0,7	0,7	0,7	0,7	0,18	0,18	0,35	0,18	1,5	1,5	0,5	1,5
Carrières, mines, gravats	0,0%	6,4%	0,3	0,3	0,3	0,3	0,20	0,20	0,60	0,20	1,5	1,5	0,5	1,5
Forêts, boisés mixtes	12,4%	24,5%	1,3	0,9	0,8	1,1	0,14	0,14	0,42	0,14	0,3	0,9	0,5	0,7
Arbustes	4,0%	4,5%	0,3	0,3	0,15	0,3	0,18	0,18	0,50	0,18	1,0	1,5	0,5	1,0
Pâturages	0,0%	32,7%	0,15	0,02	0,01	0,03	0,20	0,18	0,60	0,14	0,5	0,7	0,5	0,3
Sol nu, roche	0,6%	2,6%	0,05	0,05	0,05	0,05	0,20	0,20	0,60	0,20	1,5	1,5	0,5	1,5
Forêts de conifères	1,5%	16,8%	1,3	1,3	1,3	1,3	0,12	0,12	0,35	0,12	0,3	0,8	0,5	0,7

Notes :

L'été comprend la période de juin à septembre inclusivement.
L'automne (sans neige au sol et végétation minimale) comprend la période d'octobre et novembre.
L'hiver (neige au sol) comprend la période de décembre à mars inclusivement.
Le printemps (sans neige au sol et végétation minimale) comprend la période d'avril et mai.

Tel que recommandé par l'US EPA (2015), les paramètres de surface moyens dans la zone d'étude ont été établis de la façon suivante :

› Albedo (α) : moyenne arithmétique régionale, sans dépendance par la distance ou la provenance du vent, pour un domaine de 10 km par 10 km centré sur le site météorologique.
› Rapport de Bowen (Bo) : moyenne géométrique régionale, sans dépendance par la distance ou la provenance du vent, pour un domaine de 10 km par 10 km centré sur le site météorologique.
› Rugosité (z_0) : moyenne géométrique pondérée par l'inverse de la distance dans un rayon d'un kilomètre du site météorologique, pour chacun des cinq secteurs de provenance du vent sélectionnés.

Le tableau D2.3 présente les résultats des calculs des paramètres de surface saisonniers utilisés comme intrants au modèle micro-météorologique AERMET.

Tableau D2.3 Paramètres de surface utilisés dans le modèle météorologique

Saison	Albedo	Rapport de Bowen	Rugosité (m) par secteur		
			90 à 270°	270 à 330°	330 à 90°
Été	0,17	0,50	0,091	0,054	0,116
Automne	0,16	0,88	0,086	0,053	0,115
Hiver	0,48	0,50	0,082	0,053	0,115
Printemps	0,15	0,60	0,088	0,054	0,115

Notes :
L'été comprend la période de juin à septembre inclusivement.
L'automne (sans neige au sol et végétation minimale) comprend la période d'octobre et novembre.
L'hiver (neige au sol) comprend la période de décembre à mars inclusivement.
Le printemps (sans neige au sol et végétation minimale) comprend la période d'avril et mai.

D2.3.5 Options sélectionnées de AERMET

Lors de l'exécution de AERMET, les options de contrôle qualité interne ont été activées afin de détecter des anomalies qui auraient échappées à toutes les validations précédentes. Les résultats sont négatifs, en ce sens qu'aucune donnée de surface aberrante n'a été détectée.

Les paramètres de surface ont été modulés par mois selon la définition des saisons de la note du tableau D2.3, car la définition interne des saisons de AERMET n'est pas valide pour le Québec.

Finalement, l'option d'ajouter une composante aléatoire entre zéro et plus ou mois cinq degrés à la direction du vent a été sélectionnée afin de compenser pour l'effet de l'arrondissement au dix degré dans les données brutes.

D2.4 Récepteurs

Les récepteurs, ou points de calculs des concentrations de contaminants dans l'air ambiant, ont été disposés dans le domaine de modélisation de la façon suivante et apparaissent avec la topographie à la Figure D2.4 :

- aux 25 m le long de la propriété de NAIC;
- aux 100 m dans un domaine de 1 x 1 km centré sur l'usine;
- aux 250 m dans un domaine de 5 x 5 km centré sur l'usine;
- aux 500 m dans un domaine de 10 x 10 km, comprenant la ville de La Baie à 6 km de sud du site de l'usine;
- aux 549 bâtiments ayant une adresse civique situés dans le domaine de modélisation;
- aucuns récepteurs sensibles (écoles, garderie, résidences pour personnes âgées) n'ont été identifiés dans le domaine de 10 x 10 km de modélisation.

Bien que le domaine de modélisation soit relativement plat, la topographie locale a été prise en considération dans la modélisation en spécifiant l'élévation et l'information sur les pentes des 1 647 récepteurs à partir des données numériques d'élévation du Canada à l'échelle 1:50 000 d'une résolution horizontale approximative de 23 m. Le processeur de terrain AERMAP (version 11103) a été utilisé à cet effet.

D2.5 Conversion du NO en NO_2

Dans l'atmosphère, le NO est converti plus ou moins rapidement en NO_2 en fonction principalement de la concentration d'ozone de l'atmosphère et des conditions météorologiques. Du point de vue des normes de qualité de l'air ambiant, ce sont les concentrations de NO_2 dans l'air ambiant qui doivent être évaluées.

Dans cette étude, l'hypothèse de la conversion totale du NO en NO_2 a été utilisée. Cette hypothèse très conservatrice, qui surestime grandement les concentrations de NO_2 dans l'air ambiant, considère que le NO émis à l'atmosphère se transforme instantanément en NO_2 au point d'émission.

D2.6 Estimation des concentrations pour une période inférieure à une heure

Certaines des normes du RAA sont pour une durée inférieure à une heure (4 minutes par exemple pour le SO_2) alors que les résultats du modèle de dispersion sont représentatifs d'une durée d'une heure ou plus. La formule spécifiée à l'annexe H du RAA a été utilisée pour estimer les concentrations maximales sur 4 minutes à partir des concentrations maximales horaires obtenues du modèle de dispersion. Les résultats maximums horaires sont donc multipliés par un facteur de 1,91 pour l'estimation d'une concentration maximale sur 4 minutes.

355 000

360 000

365 000

5 365 000

5 360 000

SAINT-FULGENCE, M

SAGUENAY, V

Rivière Saguenay

Baie des Ha! Ha!

E Récepteur de grille / Receptor grid

·· Résidence / Residence

Domaine de modélisation / Modelling Domain

Topographie
Topography

Courbe de niveau (équidistance 10 m) / Contour Line (10 m interval)

Limites
Limits

Empreinte du projet / Project Footprint

Limite des municipalités / Municipality Boundary

Affectation
Land Allocation

Expansion industrielle / Industrial Expansion

Réserve industrielle / Industrial Reserve

Portuaire / Port Use

Forestière / Forest

Agricole / Agricultural

NAIC

Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Figure 2.4

Domaine de modélisation, topographie et récepteurs /
Modelling domain, topography and receptors

Sources :
Toporama Web Map Service, RNCan
SDA, 1/20 000, MERN Québec, sept. 2013
CanVec, 1/50 000, 2016
Ville de Saguenay, 2016

Projet : 634451

0 0.45 0.9 km

Projection UTM, fuseau 19, NAD83

00	2016/07/25	Final / Final	L. Bathalon	L. Lachapelle
Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified

Format 11x17

Envir01: T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnD2-4_topo_recepteur_tab_f00.mxd

D2.7 Air Quality Standards and initial concentrations

The RAA standards and the ambient air quality criteria of Quebec are presented in Table D2.4.

The atmospheric dispersion model estimates the contribution of the plant to the contaminants concentrations in the ambient air. The initial concentrations are used to reflect the presence of atmospheric contaminants already present in the air or produces from other sources. These initial concentrations are added to the results of the air dispersion model and the resulting concentrations are then compared to the quality standards of ambient air.

The TPM and $PM_{2.5}$ initial concentrations were determined from the air quality monitoring results from the MDDELCC station in La Baie (Saguenay) for the period from 2012 to 2014 (see Chapter 4) and are presented in table D2.4. For other contaminants, the default values specified in RAA were considered. These concentrations are usually relatively high which is typical of urban or highly industrialized areas.

Table D2.4 Initial Concentrations and Ambient Air Quality Standards

Contaminants	Periods	Initial concentrations (RAA values) ($\mu g/m^3$)	RAA standards ($\mu g/m^3$)
Ammonia	4 minutes	0	350
Sulphur dioxide (SO_2)	4 minutes	150	1 050 (99,5% of time, no exceedance over a threshold of 1 310 $\mu g/m^3$)
	24 hours	50	288
	Annual	20	52
Nitrogen dioxide (NO_2)	1 hour	150	414
	24 hours	100	207
	Annual	40	103
Carbon monoxide (CO)	1 hour	2 650	34 000
	8 hours	1 750	12 700
Total Particulate Matter (TPM)	24 hours	65 (1)	120
Fine Particulate Matter ($PM_{2.5}$)	24 hours	19 (1)	30

Notes : (1) The annual 98th percentile, averaged over 3 years (2012-2014), of the mean daily concentrations measured at MDDELCC stations in La Baie (TPM) and in Chicoutimi ($PM_{2.5}$)..

D2.8 Scenarios and Emission Parameters

D2.8.1 Emission Scenarios

Two facility operating scenarios as well as a scenario related to aggregate handling and stokepile fugitive emissions at the Grande-anse terminal were defined for the modelling:

Normal operation mode (scenario 1):

1. Includes all continuous sources of the plant plus the auxiliary boiler at low load, and on-site transportation sources.

Transient condition operation mode (scenario 2):

2. Includes all continuous sources plus the auxiliary boiler at maximum load, the flare stack, as well as the on-site transportation sources. It is expected that the process gas flaring occur about 16 hours per year; divided into four 4-hour stop-start events.

Cumulative effect of off-site sources (scenario 3):

3. Includes all sources from scenario 1 while adding fugitive emissions from the stoke piles, loading/unloading of the iron pellets at the Grande-Anse terminal and transportation of iron pellets and pig irons between the port and the plant.

For simulation purposes, intermittent emissions related to the transportation, to handling pellets at the port, and to the stoke piles are considered continuous.

D2.8.2 Source Parameters and Emission Rate

The emission parameters, i.e. the physical characteristics of the sources and emission rates of contaminants, are presented at table D2.5 for stack emissions and for flare; at the table D2.6 for truck transportation emissions inside and outside the perimeter of the plant, at the table for D2.7 for wind erosion from the stoke pile and at table D2.8 for loading and unloading emissions of the pellets delivered by ship to the Grand-Anse terminal. As described in Appendix D1, an attenuation factor of 75% was considered for the telescopic chute with watering during unloading; and an attenuation factor of 50% was used for watering during the loading the pellet to the trucks.

These parameters correspond to those described in Appendix D1. As a conservative assumption, the fine particulate matters ($PM_{2.5}$) from the flare stack were considered to represent 100% of total particulate matters, in the analysis. The location of the sources is shown in Figure D2.5 on a simplified diagram of the facilities.

Table D2.5 Emission Parameters of the Stacks

Parameters	Process gas heater (A1)	Auxiliary Boiler (A2)		Flare and pilot (A3)		Baghouse Melting and Casting (A4)	Baghouse Transfer Building (A5)	Baghouse Storage Building (A6)	Baghouse Screening and Coating Building (A7)	Briquetting Plant Stack (A8)	Ammonia scrubber (A9)
		Mean	Maximum	Total Emissions Continue	Total Emission Transient						
Coordinates (UTM18, WGS84)											
East (m)	362 121	362 064		362 034		361 982	362 210	362 148	362 046	362 068	362 084
North (m)	5 362 177	5 362 178		5 362 089		53 62 169	5 362 273	5 362 289	5 362 289	53 62 251	5 362 033
Base elevation (m)	140	140		140		141,2	140	140	140	140	140
Height (m)	125	9		51,1 (1)	58,4 (1)	33,1	43	33	33	23	11
Diameter (m)	2,3	0,5		0,2 (1)	1,7 (1)	4,1	0,6	0,8	0,6	0,8	0,8
Temperature (°C)	195	230		1000 (1)		71	32	32	32	32	50
Speed (m/s)	10,8	12,5		20 (1)		12,8	13	12,2	13	11,2	0,02
Emissions (g/s)											
NOx (into NO_2)	1,8	0,016	0,08	0,01	0,83	1,7	0	0	0	0,02	0
CO	2,5	0,031	0,16	0,03	3,77	0,5	0	0	0	0,04	0
SO_2	1,4	0,0003	0,0002	0,0001	9,8E-05	0,0	0	0	0	0,0003	0
PM (total and fine particles)	0,2	0,001	0,01	0,02	0,39 (2)	1,4	0,04	0,1	0,04	0,04	0
NH_3	0	0	0	0	0	0	0	0	0	0	0,05

(1) Pseudo-parameters for a continuous heat release rate of 0.37 MJ/s and 28.3 MJ/s per event.
(2) (3) Mean daily rate (4 hours flaring distributed over 24 hours since the ambient air standard is over 24 hours)

Table D2.6 Volume Sources Emission Parameters for Roads inside and outside the Plant Site

Segment	Length (m)	Number of sources	Elevation (m)	Number of road sides	Road length (m)	Emission height (m)	Sigma-Y (m)	Sigma-Z (m)
R_BC	76,2	4	140	1	8	2.38	9,64	2,21
R_DE	153,7	6	140	1	8	2.38	12,99	2,21
R_FE	84	4	140	1	8	2.38	10,86	2,21
R_GE	267,4	11	140	1	8	2.38	11,79	2,21
R_OFFSITE	2360,9	57	11 à 40	2	15	2.38	19,43	2,21

Segment	Contaminants' emission rates (g/s, total per segment)				
	NO_X	CO	SO_2	PMT	$PM_{2,5}$
R_BC	1,19E-04	3,10E-05	2,53E-07	5,59E-02	1,48E-03
R_DE	1,72E-05	4,48E-06	3,65E-08	8,33E-03	2,21E-04
R_FE	3,83E-05	9,97E-06	8,13E-08	1,85E-02	4,92E-04
R_GE	2,83E-05	7,38E-06	6,02E-08	1,37E-02	3,64E-04
R_OFFSITE	4,58E-02	1,19E-02	9,72E-05	1,16E-03	1,72E-03

Table D2.7 Area Sources Emission Parameters Representing the Wind Erosion over the Stoke Piles (without mitigation measures)

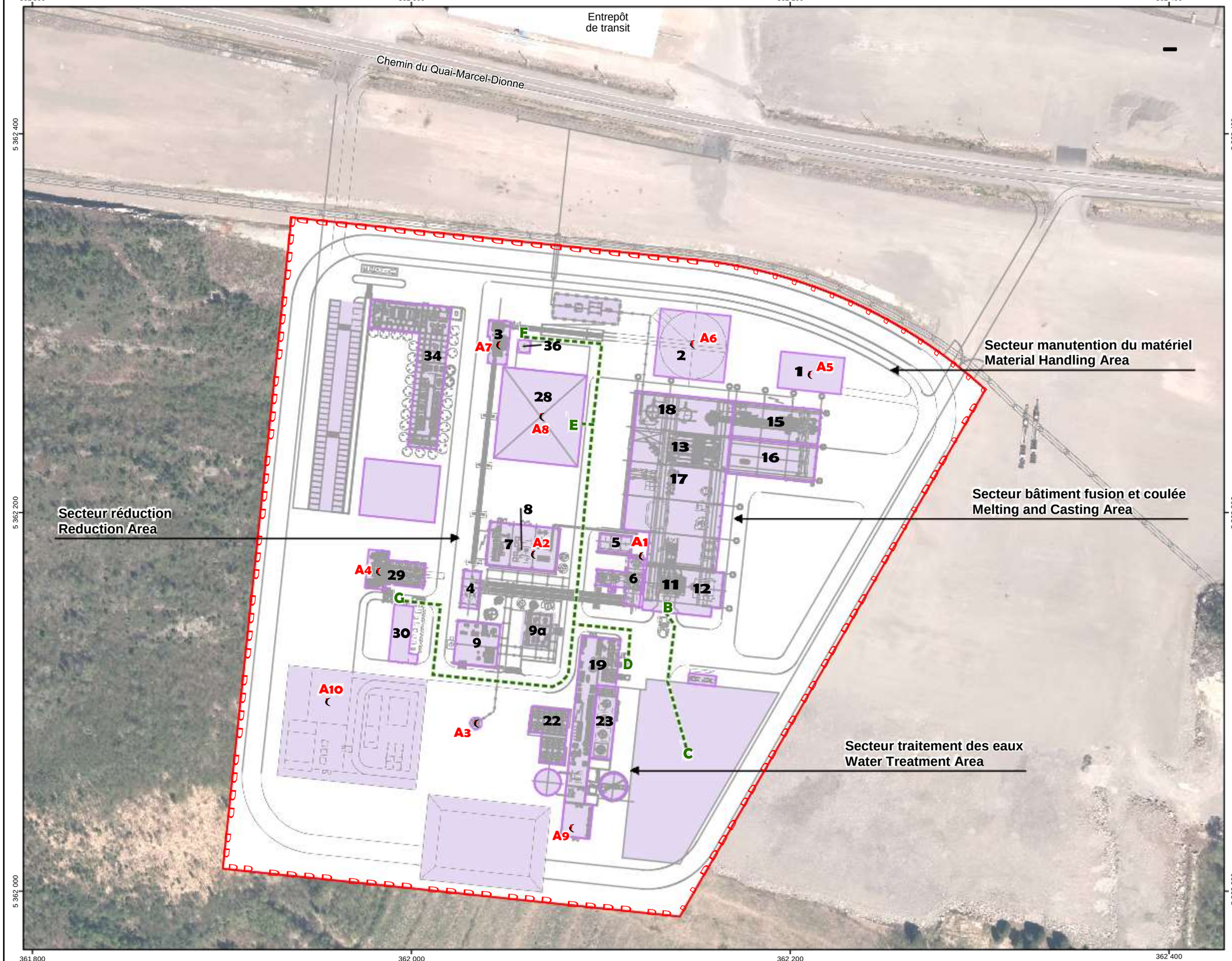
Source	Central coordinates (UTM18, WGS84)		Base elevation (m)	Emission height	Sigma-Z (m)
	East (m)	North (m)			
Stock pile	364 507	5 362 502	6,67	13,7	4,2

Emission rate of contaminants per surface unit (g/s/m²)				
NOx	CO	SO_2	TPM	$PM_{2,5}$
0	0	0	5,32E-05	1,06E-05

Table D2.8 Volumic Sources emission Parameters for handling material (with mitigation measures)

Source	Central coordinates (UTM18, WGS84)		Lateral Dimension (m)	Base elevation (m)	Emission height (m)	Sigma-Y (m)	Sigma-Z (m)
	Est (m)	Nord (m)					
Pellets unloading from ship to pile	364 507	5 362 502	35,1	6,67	14,2	8,16	4,19
Pellets - Truck loading	364 507	5 362 502	49,6	6,67	2	11,53	4,19

Source	Emission rate of contaminants (g/s)				
	PMt	$PM_{2,5}$	NOx	CO	SO_2
Pellets unloading from ship to pile	0,32	0,02	0	0	0
Pellets - Truck loading	0,22	0,02	0	0	0



Composantes du projet
Project Components

A1 Point d'émission / Emission Point

Id	Description
A1	Four de préchauffe/ Process Gas Heater
A2	Chaudière auxiliaire / Auxiliary Boiler
A3	Torchère / Flare
A4	Dépoussiéreur Fusion et coulée (FAE) / Baghouse Melting and Casting (EAF)
A5	Dépoussiéreur bâtiment de transfert / Baghouse Transfer Building
A6	Dépoussiéreur bâtiment d'entreposage / Baghouse Storage Building
A7	Dépoussiéreur bâtiment de tamisage et d'enrobage / Baghouse Screening and Coating Building
A8	Cheminée Unité d'agglomération /Briquetting Plant Stack
A9	Épurateur d'ammoniac
A10	Génératrice diésel d'urgence / Emergency Diesel Generator

Aire de projet / Project Area

Camionnage / Trucking

B - C	Camionnage des pots de scories / Slag Pots Trucking
D - E	Camionnage des boues / Sludge Trucking
F - E	Camionnage des fines / Fines Trucking
G - E	Camionnage des poussières / Dust Trucking

#	Description	Hauteur du bâtiment (m)
1	Bâtiment de transfert (Transfer building)	40
2	Bâtiment d'entreposage des boulettes (Pellet storage building)	30
3	Bâtiment tamisage et enrobage (Screening and coating building)	22
4	Silos journaliers - boulettes (Day bin pellets)	30
5	Four de préchauffe (Process gas heater)	38
6	Réacteur - Réduction (DRI Reactor)	123
7	Secteur de la réduction (Reduction area)	7
8	Chaudière auxiliaire (Auxiliary boiler)	7
9	Bâtiment et unité d'enlèvement du CO2 (Building and CO2 removal uni	7
11 et 12	Bâtiment fusion et coulée (Melting and casting)	49
13 et 17	Bâtiment fusion et coulée (Melting and casting)	38
15 et 16	Bâtiment fusion et coulée (Melting and casting)	26
18	Bâtiment fusion et coulée (Melting and casting)	28
19	Unité de traitement des eaux (Water treatment plant)	6
22	Aérorefroidisseurs (Air coolers)	6.5
23	Tours de refroidissement (Cooling towers)	7
28	Unité d'agglomération (Briquetting plant)	20
29	Dépoussiéreur FAE (EAF Baghouse)	17.5
30	Salle électrique - Dépoussiéreur (Electrical room EAF Baghouse)	6
34	Bureaux administratifs (Administrative area)	7
36	Silo des fines (Fines silo)	10.33
37	Bâtiment sur le quai* (Building at the port)	9

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NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay
/ Pig Iron Production Plant - Saguenay

Figure D2.5
Localisation des points d'émission à l'atmosphère
/ Emission Point to Atmosphere Location

Sources :
Dessin CAD3786-TARG-X-LY-000-003 REDESIGN ALTERNATIVA II.dwg, Tenova, 2016
Ville de Saguenay, imagerie 2015

Projet : 634451

Projection MTM, fuseau 7, NAD83

0 20 40 m
1/2 000

Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified
00	2016/07/25	Final / Final	L. Bathalon	L. Lachapelle

Format 11x17

Envir01: T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnD2-5_points_emission_f00.mxd

The flare with visible flame is modeled as point source (stack) using pseudo-emission parameters determined by the US-EPA (1995):

- The speed is 20 m/s;
- The temperature is set at 1000 ° C;
- The effective diameter (d_{eff}, m) and the effective height (h_{eff}, m) are calculated based on the heat rate released by the gas combustion (Q, cal /s) and the flare height (h_s, m) as follows:

$$dd_{eeeeee} = 00,000000000000\sqrt{QQ} \quad \textbf{(1)}$$

$$hh_{eeeeee} = hh_{ss} + 00,0000000000\,QQ^{00,004444} \quad \textbf{(2)}$$

D2.8.3 Buildings Downwash Effect

The building downwash effects on the atmospheric dispersion of the rising plumes from the stacks and flares were considered in the analysis. The dimensions and heights of buildings were analyzed by BPIP program “Building Profile Input Program” of the US EPA. In total, there are 16 buildings within the plant property and one building is located at the port of Saguenay (Figure D2.5).

D2.9 Results of the Atmospheric Dispersion Study

The maximum results for the five (5) modeling years (2010 to 2014) of dispersion study for contaminants (SO_2, NO_2, CO, NH_3, TPM and $PM_{2.5}$) are presented in Table D2.9 when Scenario 1 and scenario 2 respectively correspond to normal operation and the transient conditions of the plant. Table D2.10 presents the modeling results of contaminants of the cumulative effect of scenarios 1 and 3. No contaminant exceeds the air quality standards in the three scenarios studied.

Figures D2.6 and D2.7 present the maximum daily concentrations of $PM_{2.5}$ and TPM calculated in ambient air in the modeling domain for scenario 1, while figures D2.8 and D2.9 present the same types of results but also by considering the handling and storage of pellets at the Grand-Anse terminal as well as the transportation of iron pellets and pig irons between the plant and the terminal. Note that the figures only indicate the contribution of the sources, which means without considering the initial concentrations. These figures indicate that the maximum calculated concentrations in the ambient air rapidly decrease with distance from the source.

Figure D2.8 shows that the maximum concentrations of TPM in ambient air exceed the threshold of 120 µg/m³ near and around the terminal, mainly over the Saguenay River.

Table D2.7 Summary of the Results of the Atmospheric Dispersion Study for Scenarios 1 and 2

Scenarios/Maximum Simulated Concentrations									
Auxiliary Boiler Flare		Moderate No	Maximum Yes	Worst-Case Scenario		Initial con. (µg/m³)	Total Concentrations (Worst-Case Scenario)		Standards (µg/m³)
Contaminants	Durations	Scenario 1 (µg/m³)	Scenario 2 (µg/m³)	(µg/m³)	% standard		(µg/m³)	% standard	
SO_2	4 min	4.2	4.3	4.3	0.3 %	150	154.3	11.7 %	1310
	24 h	0.39	0.39	0.39	0.1 %	50	50.39	17.5 %	288
	an	0.06	0.06	0.06	0.1 %	20	20.06	38.6 %	52
NOx (into NO_2)	1h	16.9	28.8	28.8	7 %	150	178.8	43 %	414
	24 h	3.7	5.2	5.2	2.5 %	100	105.2	50.1 %	207
	an	0.5	1.2	1.2	1.2 %	30	31.2	30.2 %	103
CO	1 h	13.1	105	105	0.3 %	2 650	2 755	8.1 %	34 000
	8 h	4.1	70.4	70.4	0.6 %	1 750	1 820.4	14.3 %	12 700
PM_t	24 h	10	10.4	10.4	8.6 %	65	75.4	62 %	120
$PM_{2.5}$	24 h	3.2	3.2	3.2	10.6 %	19.3	22.5	75 %	30
NH_3	4 min	30.6	30.6	30.6	8.7 %	0	30.6	8.7 %	350

Note : Résultats maximums à l'extérieur des zones industrielles et portuaires, mais incluant les résidences.

Table D2.8 Summary of the Results of the Atmospheric Dispersion Study of the cumulative effects of plant operation and handling activities by the APS

Contaminants	Duration	Scenario 1+ port activities (with attenuation)		Initial concentration (µg/m³)	Total Concentrations (worst case)		Standards
		(µg/m³)	% norme		(µg/m³)	% standard	(µg/m³)
SO_2	4 min	4,8	0,4 %	150	154,8	11,8 %	1310
	24 h	0,4	0,1 %	50	50,4	17,5 %	288
	an	0,06	0,1 %	20	20,06	38,6 %	52
NOx (into NO_2)	1h	17,6	4,2 %	150	167,6	40,5 %	414
	24 h	3,8	1,8 %	100	103,8	50 %	207
	an	0,6	0,6 %	30	30,6	29,7 %	103
CO	1 h	13,2	0,04 %	2 650	2 663,2	7,8 %	34 000
	8 h	4,2	0,03 %	1 750	1 754,2	13,8 %	12 700
TPM	24 h	52	43,3 %	65	117	97,5 %	120
$PM_{2.5}$	24 h	4,5	15 %	19,3	23,8	79,3 %	30
NH_3	4 min	30,6	8,7 %	0	30,6	8,7 %	350

Note : Résultats maximums à l'extérieur des zones industrielles et portuaires, mais incluant les résidences.

360 000 362 000 364 000 366 000

5 364 000 5 362 000 5 360 000

Rivière Saguenay

Chemin de la Grande Anse

Terminal de Grande-Anse

90 70 50 30 20 15 10 5 2 1

Qualité de l'air
Air Quality

E Récepteurs résidence / Residence Receptors

Concentration de PMT dans l'air ambiant (µg/m³) / PMT concentration (µg/m³) in ambient air

Norme de qualité de l'air : 120 µg/m³
Ambient air quality criteria: 120 µg/m³

Limite
Limit

Empreinte du projet / Project Foot print

Affectation
Land Allocation

Expansion industrielle / Industrial Expansion

Réserve industrielle / Industrial Reserve

Portuaire / Port Use

Modèle de dispersion / Disperson model: AERMOD
Météorologie / Meteorology: Bagotville 2010-2014

Notes:
Les concentrations indiquées ne tiennent pas compte la concentration initiale de 65 ug/m^3. / The concentrations contour lines do not include the initial concentration of 65 ug/m^3.

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Figure D2.6
Concentrations (µg/m³) maximales journalières de PMT calculées dans l'air ambiant, scénario 1 / Daily maximum concentration (µg/m³) of PMT calculated in ambient air, scenario 1

Sources :
Toporama Web Map Service, RNCan
SDA, 1/20 000, MERN Québec, sept. 2013

Projet : 634451

Projection UTM, fuseau 19, NAD83

0 0,25 0,5 km

1/25 000

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Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified

Format 11x17

Envir01: T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnD2-6_PMT_journalier_s1_tab_f00.mxd

360 000 362 000 364 000 366 000

5 364 000

5 362 000

5 360 000

Rivière Saguenay

Terminal de Grande-Anse

Qualité de l'air
Air Quality

E Récepteurs résidence / Residence Receptors

Concentration de PMT dans l'air ambiant (µg/m³) / PMT concentration (µg/m³) in ambient air

Norme de qualité de l'air : 30 µg/m³
Ambient air quality criteria: 30 µg/m³

Limite
Limit

Empreinte du projet / Project Footprint

Affectation
Land Allocation

Expansion industrielle / Industrial Expansion

Réserve industrielle / Industrial Reserve

Portuaire / Port Use

Modèle de dispersion / Disperson model: AERMOD
Météorologie / Meteorology: Bagotville 2010-2014

Notes :
Les concentrations indiquées ne tiennent pas compte la concentration initiale de 19,3 ug/m^3. / The concentrations contour lines do not include the initial concentration of 19.3 ug/m^3.

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NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Figure D2.7
Concentrations (µg/m³) maximales journalières de $PM_{2.5}$ calculées dans l'air ambiant, scénario 1 / Daily maximum concentration (µg/m³) of PM2.5 calculated in ambient air, scenario 1

Sources :
Toporama Web Map Service, RNCan
SDA, 1/20 000, MERN Québec, sept. 2013

Projet : 634451

Projection UTM, fuseau 19, NAD83

0 0.25 0.5 km

1/25 000

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Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified

Format 11x17

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360 000 362 000 364 000 366 000

5 364 000 5 362 000 5 360 000

Rivière Saguenay

Terminal de Grande-Anse

Qualité de l'air
Air Quality

E Récepteurs résidence / Residence Receptors

Concentration de PMT dans l'air ambiant (µg/m³) / PMT concentration (µg/m³) in ambient air

Norme de qualité de l'air : 120 µg/m³
Ambient air quality criteria: 120 µg/m³

Limite
Limit

Empreinte du projet / Project Foot print

Affectation
Land Allocation

Expansion industrielle / Industrial Expansion

Réserve industrielle / Industrial Reserve

Portuaire / Port Use

Modèle de dispersion / Disperson model: AERMOD
Météorologie / Meteorology: Bagotville 2010-2014

Notes:
Les concentrations indiquées ne tiennent pas compte la concentration initiale de 65 ug/m^3. / The concentrations contour lines do not include the initial concentration of 65 ug/m^3.

NAIC

SNC-LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay / Pig Iron Production Plant - Saguenay

Figure D2.8

Concentrations (µg/m³) maximales journalières de PMT calculées dans l'air ambiant, scénario 1 et scénario 3 / Daily maximum concentration (µg/m³) of PMT calculated in ambient air, scenario 1 and scenario 3

Sources :
Toporama Web Map Service, RNCan
SDA, 1/20 000, MERN Québec, sept. 2013

Projet : 634451

Projection UTM, fuseau 19, NAD83

0 0,25 0,5 km

1/25 000

00	2016/07/25	Final / Final	L. Bathalon	L. Lachapelle
Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified

Format 11x17

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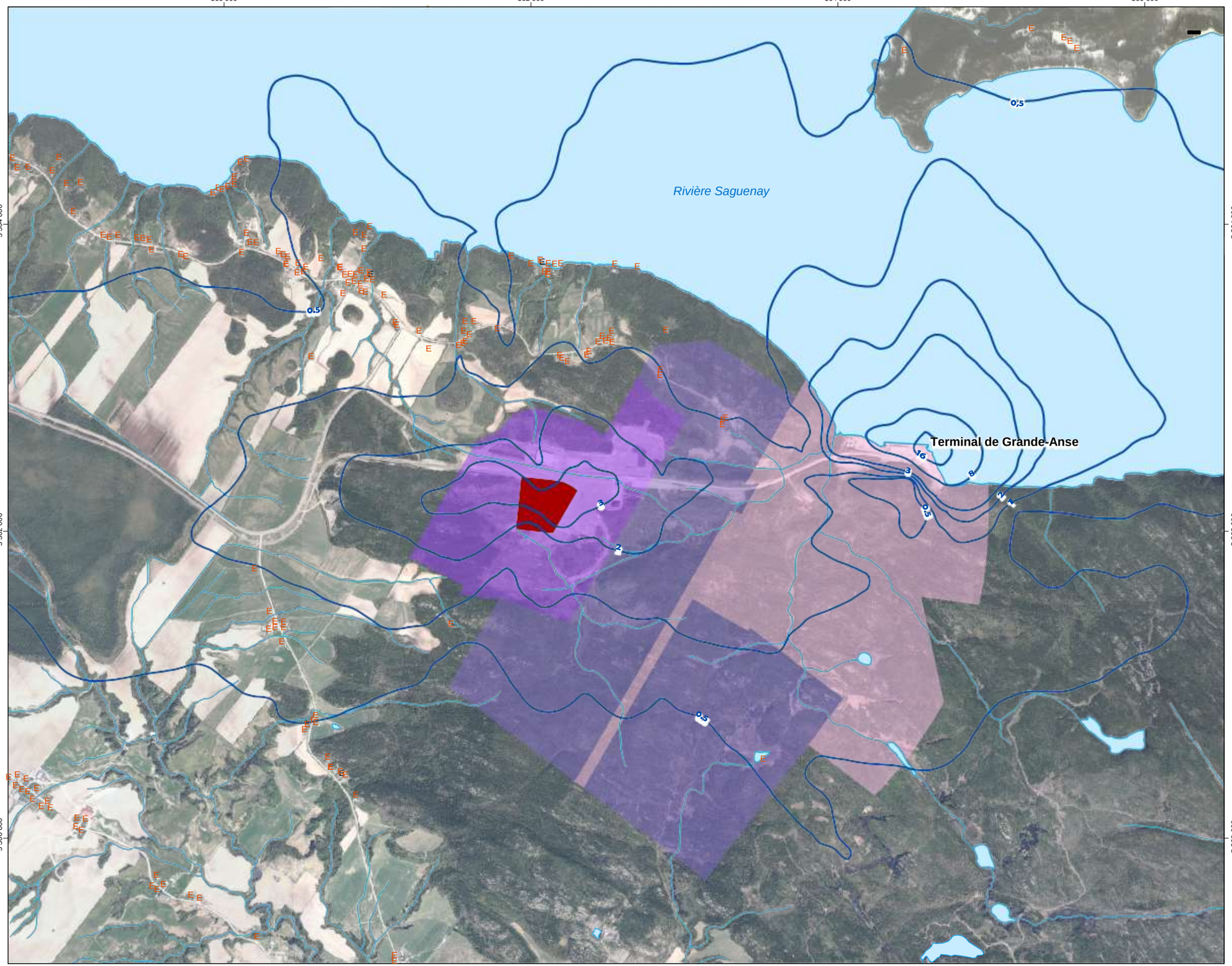

Qualité de l'air
Air Quality

E Récepteurs résidence / Residence Receptors

Concentration de PMT dans l'air ambiant (µg/m³) / PMT concentration (µg/m³) in ambient air

Norme de qualité de l'air : 30 µg/m³
Ambient air quality criteria: 30 µg/m³

Limite
Limit

Empreinte du projet / Project Footprint

Affectation
Land Allocation

Expansion industrielle / Industrial Expansion
Réserve industrielle / Industrial Reserve
Portuaire / Port Use

Modèle de dispersion / Disperson model: AERMOD
Météorologie / Meteorology: Bagotville 2010-2014

Notes :
Les concentrations indiquées ne tiennent pas compte la concentration initiale de 19,3 ug/m^3. / The concentrations contour lines do not include the initial concentration of 19.3 ug/m^3.

NAIC

SNC·LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Figure D2.9
Concentrations (µg/m³) maximales journalières de $PM_{2.5}$ calculées dans l'air ambiant, scénario 1 et scénario 3 / Daily maximum concentration (µg/m³) of PM2.5 calculated in ambient air, scenario 1 and scenario 3

Sources :
Toporama Web Map Service, RNCan
SDA, 1/20 000, MERN Québec, sept. 2013

Projet : 634451

Projection UTM, fuseau 19, NAD83

0 0,25 0,5 km

1/25 000

00	2016/07/25	Final / Final	L. Bathalon	L. Lachapelle
Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified

Format 11x17

Envir01: T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnD2-9_PM25_journalier_s1et3_att_tab_f00.mxd

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Appendix E

Surface Water

E1 – Description of Watercourses (French only)

E2 – Surface Water Quality – Analysis Results (French only)

E3 – Surface Water quality - Certificates of Analyses (French only)

Appendix E1 – Description of water course

Table des matières

E.1 Description des cours d'eau et hydrographie 1

E.1.1 Cours d'eau no 6 1

E.1.2 Cours d'eau no 7 2

E.1.3 Cours d'eau no 5 3

E.1.4 Cours d'eau no 8 9

E.1.5 Rivière Saguenay 11

Références 13

Liste des figures

Figure E1.1 Extrémité amont du cours d'eau #6 2

Figure E1.2 Cours d'eau #6 : Fossé de drainage 2

Figure E1.3 Cours d'eau #6 : Fossé de drainage 2

Figure E1.4 Tronçon situé près de la traversée du chemin 2

Figure E1.5 Ponceau de traversée du chemin du Quai-Marcel-Dionne (seuil infranchissable = 30 cm) 2

Figure E1.6 Extrémité amont cours d'eau #7 (vue face) 3

Figure E1.7 Extrémité amont cours d'eau #7 3

Figure E1.8 Cours d'eau #7 - permanent 3

Figure E1.9 Présence d'un ponceau 3

Figure E1.10 Extrémité amont du cours d'eau #5 4

Figure E1.11 Fossé de drainage longeant une terre agricole 4

Figure E1.12 Large bassin causé par un barrage de castors 4

Figure E1.13 Sucession de barrages de castors 4

Figure E1.14 Cours d'eau permanent rejoigant le cours d'eau #8 4

Figure E1.15 Cours d'eau permanent 9

Figure E1.16 Cours d'eau permanent 9

Figure E1.17 Présence d'un ponceau se déversant dans le cours d'eau #8 10

Figure E1.18 Présence d'un seuil infranchissable 10

Figure E1.19 L'intérieur du long ponceau présente une très faible profondeur d'eau 10

Figure E1.20 L'extrémité aval du ponceau est protégé et le radier n'est pas enfoui. 10

Figure E1.21 Chute naturelle constituant un obstacle infranchissable à la rencontre du cours d'eau no 8 et du cours d'eau non caractérisé (100m avant la rivière Saguenay) 11

Figure E1.22 Embouchure du cours d'eau no 8 sur la rivière Saguenay 11

E.1 Description des cours d'eau et hydrographie

Des visites sur le terrain incluant la prise de données sur les cours d'eau ont été réalisées sur les cours d'eau situés à proximité du site d'implantation et ont été présentées dans les documents suivants : Genivar (2010 et 2013), Groupe Hémisphères (2012) et Environnement illimité (2011). Ces visites de terrain ont été effectuées dans le cadre de projets distincts pour l'APS et autres promoteurs privés. La prise de donnée était concentrée sur des aspects physiques (longueur, largeur, superficie du littoral et de la bande riveraine, pente, substrat et végétation, etc.) en plus d'une pêche pour vérifier la présence de poissons. Aucune mesure physicochimique (température, pH, O_2, dureté, conductivité/salinité, etc.) n'a été prise lors de ces campagnes de terrain.

Les cours d'eau situés les plus près du site de construction de l'usine et qui ont été identifiés en tant que point de rejet potentiel sont numérotés (#6, #5, #7 et #8) et localisés sur la carte 4.3. Le cours d'eau #6 fait partir du bassin versant (BV) de la Rivière Saguenay, drainant plus de 8 millions d'hectares de terrain tandis que les trois autres font partie du sous-bassin versant du cours d'eau 06F80000 (près de 680 ha) se jetant ultimement dans la rivière Saguenay. La description de ces cours d'eau ainsi que le tronçon immédiatement situé en aval de ces effluents est présentée séparément dans les sections suivantes. La description et les photographies ont été tirées des informations principalement issues des campagnes de terrain citées précédemment ainsi que de la visite de caractérisation pour la qualité de l'eau effectuée dans le cadre de l'étude d'impact. Les cours d'eau #5 et #8 sont présentés plus en détails puisqu'ils représentent les cours d'eau récepteurs pour l'effluent industriel considérant la topographie du terrain et localisation des équipements de traitement des eaux usées.

E.1.1 Cours d'eau no 6

Le cours d'eau #6 débute sur la ligne de partage des eaux et est situé dans le BV de la rivière Sagnenay. Il est alimenté par les eaux de drainage de la zone aménagée pour le développement de la gare intermodale, issues d'un ponceau (figure E1.1). Ce tronçon possède une profondeur moyenne de 5 cm et une largeur de 50 cm. Il s'écoule en direction ouest où il rejoint un fossé de drainage longeant le chemin du Quai-Marcel-Dionne (#6, carte 4.3). À cet endroit, le cours d'eau atteint une profondeur moyenne de 15 cm et une largeur de 90 cm (Envill 2011) et les pentes des rives sont supérieures à 30% (Groupe Hémisphères 2012). Ce fossé aurait été redressé pour la construction du chemin d'accès (figures E1.2 et E1.3) et rejoint deux petits cours d'eau permanents d'environ 100 m et 200 m. Le segment du cours d'eau #6, de l'extrémité amont jusqu'au chemin du Quai-Marcel-Dionne, cours sur 805 m (Envill 2011).

Ce réseau de petits cours d'eau est associé à un milieu humide (MH3) et s'écoule vers l'ouest avant de traverser le chemin du Quai-Marcel-Dionne (figure E1.3 à E1.5) et se jeter dans la rivière Saguenay, environ 1,3 km plus loin. Le substrat est dominé par le sable, le limon et l'argile avec présence de gravier et de cailloux. L'eau y est claire et aucune végétation aquatique n'y a été notée (Envill 2011).

La colonisation potentielle par les poissons du tronçon de ce cours d'eau situé au sud du chemin du Quai-Marcel-Dionne, est rendue impossible par la présence d'un jet plongeant de 30 cm à la sortie du ponceau permettant la traversée du chemin. D'ailleurs, aucune capture n'y a été réalisée lors de l'inventaire ichtyologique. Le potentiel d'habitat y a été jugé nul (Envill 2011).

Figure E1.1 Extrémité amont du cours d'eau #6

Figure E1.2 Cours d'eau #6 : Fossé de drainage

Figure E1.3 Cours d'eau #6 : Fossé de drainage

Figure E1.4 Tronçon situé près de la traversée du chemin

Figure E1.5 Ponceau de traversée du chemin du Quai-Marcel-Dionne (seuil infranchissable = 30 cm)

E.1.2 Cours d'eau no 7

Le cours d'eau permanent #7 se trouve au droit des limites est de la gare intermodale à environ 60 m au sud du chemin du quai Marcel-Dionne. Ce cours d'eau, situé dans le sous-bassin versant du cours d'eau 06F80000, est légèrement sinueux et s'écoule vers le sud-est dans pour se jeter dans le cours d'eau #8, sous un couvert végétal principalement de type arborescent.

Ce cours d'eau prend naissance à partir d'un ponceau situé sous un remblai de gravier correspondant à l'aire aménagée de la gare intermodale (figures E1.6 et E1.7). La pente des rives est inférieure à 30% plus loin vers l'aval, la largeur moyenne est de 1,2 m pour une profondeur moyenne de 0,15 pouvant atteindre 25 cm lorsque le niveau est maximal (figure E1.8). Le substrat est principalement composé de sable et de limon ainsi que de gravier épars (Génivar, 2013; Envill 2011).

Ce cours d'eau présente de nombreux obstacles à la migration du poisson dont un ponceau situé à une centaine de mètres en aval (figure E1.9), considéré comme infranchissable (jet plongeant de 12 cm). La difficulté d'accéder et de circuler dans le cours d'eau pour les espèces de poissons susceptibles d'utiliser ce secteur, associée aux résultats de capture nuls suggèrent fortement que le potentiel d'habitat est également nul pour le poisson (Envill 2011).

Figure E1.6 Extrémité amont cours d'eau #7 (vue face)

Figure E1.7 Extrémité amont cours d'eau #7 (vue vers l'aval)

Figure E1.8 Cours d'eau #7 - permanent

Figure E1.9 Présence d'un ponceau

E.1.3 Cours d'eau no 5

Le cours d'eau #5 prend sa source dans des terres humides et à partir de l'eau drainée de terres cultivées et de l'écoulement du boisé (figure E1.10). L'extrémité amont touche au site prévu pour l'implantation du projet. Ses eaux se déversent dans un fossé de drainage longeant un terrain agricole (figure E1.11). Les pentes des rives y sont inférieures à 30%, la profondeur moyenne est de 50 cm et l'eau y est quasi-stagnante.

Plus en aval, ce cours d'eau comporte un bassin d'une largeur de 15 m créé par un premier barrage de castor (figure E1.12). Le couvert végétal y est mi-arborescent, mi-arbustif et le substrat est composé principalement de matières organiques et d'argile. Une succession de

barrages de castor se trouve également à la suite de ce bassin (figure E1.13) pour rejoindre la jonction du cours d'eau #8 via un petit chenal (figure E1.14) à faible débit d'une largeur de 1 m. Le substrat de ce petit chenal est composé de sable, gravier, cailloux, galets, blocs et de plantes aquatiques (Génivar, 2013).

L'eau est turbide dans les secteurs influencés par les barrages des castors, mais claire dans le tronçon aval, rejoignant le cours d'eau #8. À l'exception d'herbes parcourant le lit des segments peu profonds situés à l'extrémité amont, aucune végétation aquatique n'a été notée. Il est impossible pour les poissons de remonter ce cours d'eau principalement à cause de la présence de plusieurs barrages de castors actifs (70 à 170 cm de hauteur). Le potentiel d'habitat pour le poisson y a été jugé nul (Envill 2011).

Figure E1.10 Extrémité amont du cours d'eau #5

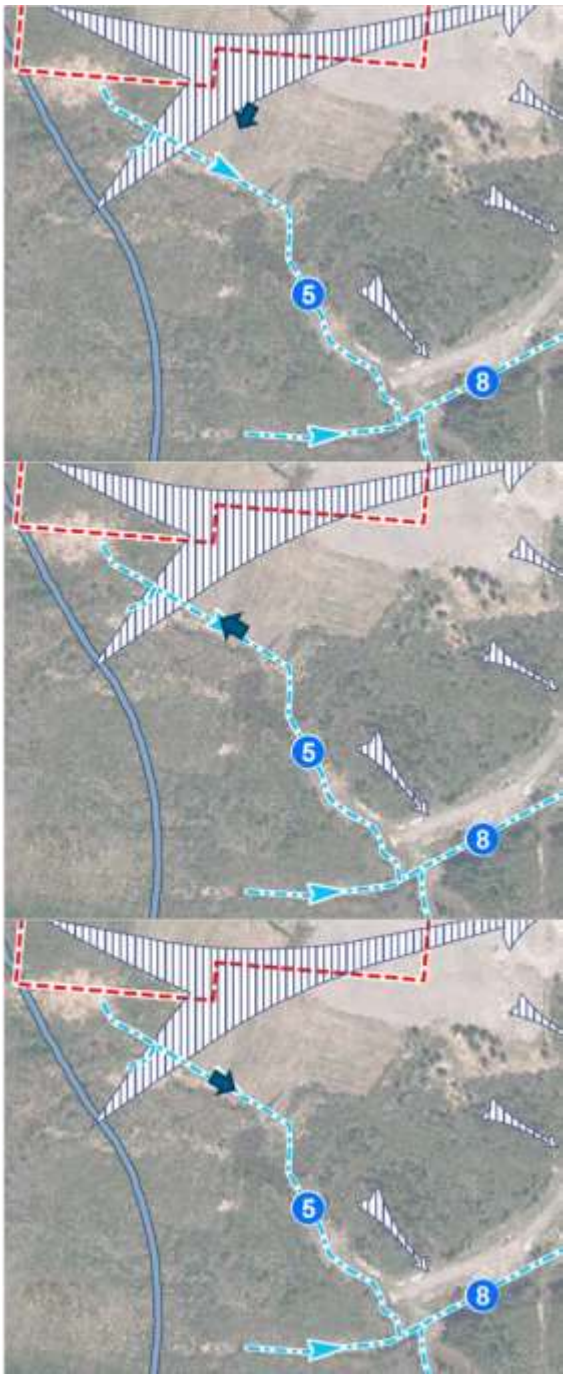
Figure E1.11 Fossé de drainage longeant une terre agricole

Figure E1.12 Large bassin causé par un barrage de castors

Figure E1.13 Sucession de barrages de castors

Figure E1.14 Cours d'eau permanent rejoigant le cours d'eau #8

La séquence d'images suivantes présente l'évolution du cours d'eau #5 à partir de sa source jusqu'à sa confluence avec le cours d'eau #8. La flèche bleu foncé indique la localisation et le sens du point de vue.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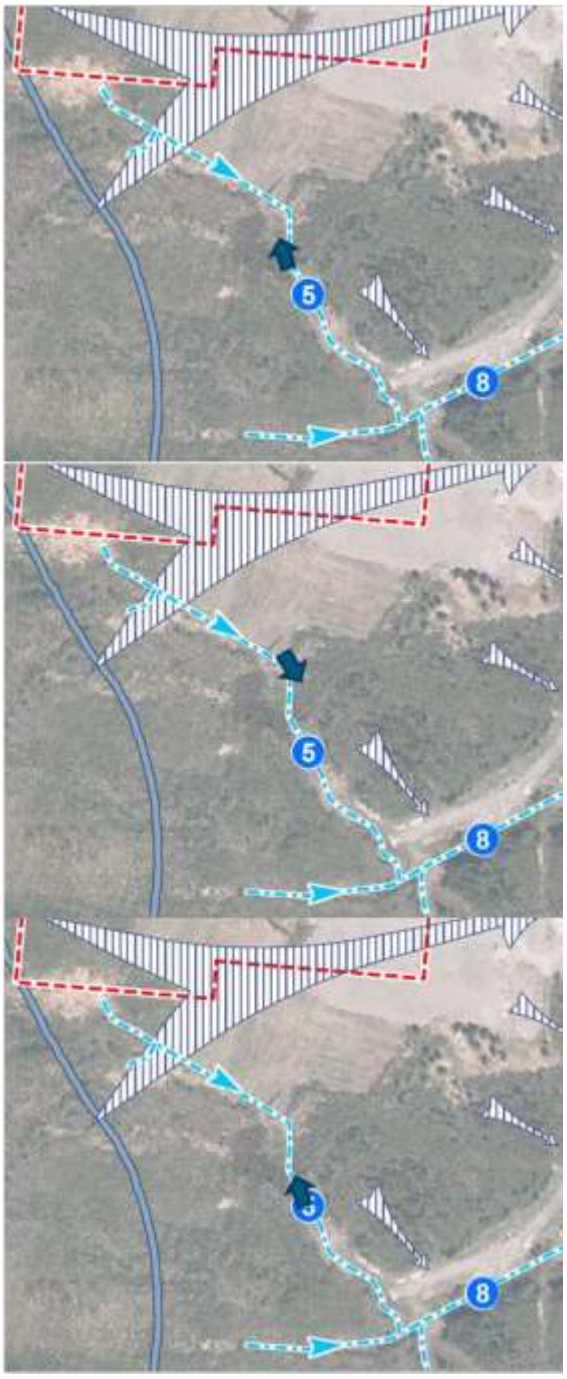
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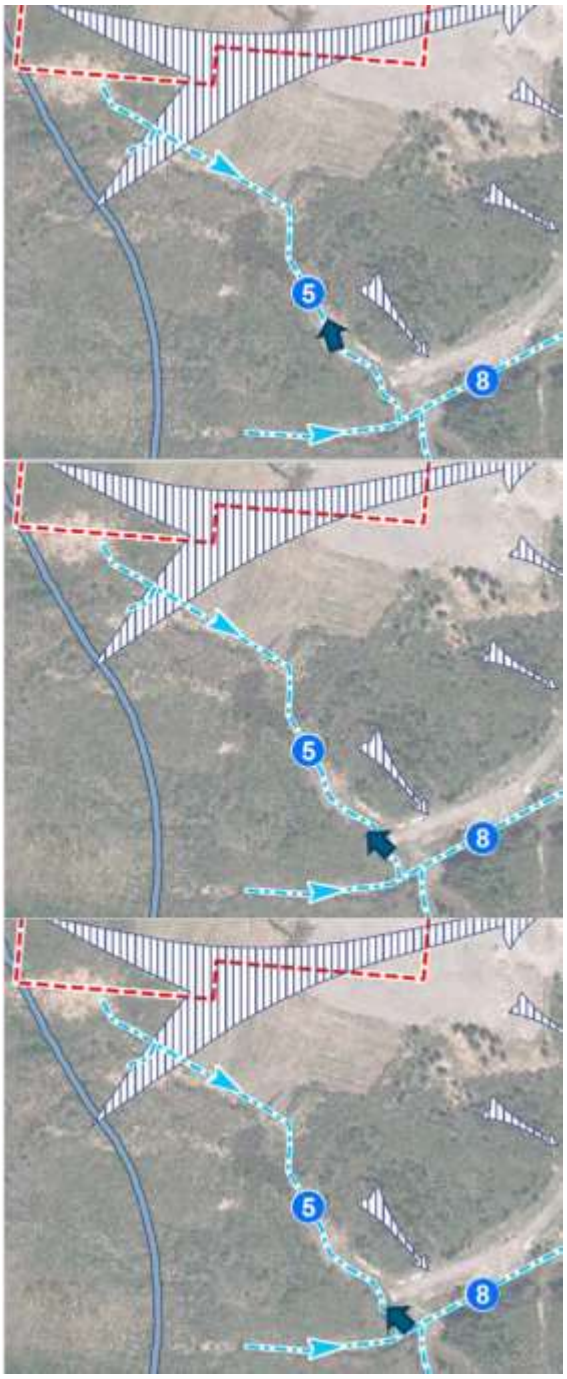
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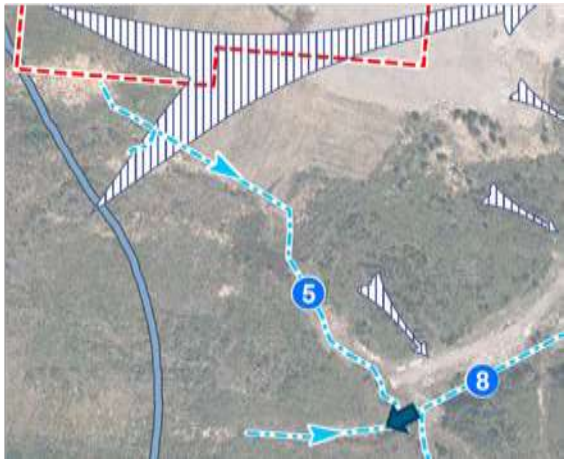

E.1.4 Cours d'eau no 8

Ce cours d'eau se situe dans le sous-bassin versant du cours d'eau 06F80000, les eaux s'écoulant vers le nord-est, en milieu forestier (figure E1.15) et se jettent dans la rivière Saguenay. Au point de déversement du cours d'eau #5 dans le cours d'eau #8, la végétation y a été perturbée par la présence de castor et de débris de coupe (Groupe Hémisphères, 2012). L'eau y est claire, le débit est permanent et les pentes des rives sont supérieures à 30% pour une hauteur de 10 m. La profondeur moyenne est de 15 cm et la largeur de 150 cm. Le substrat dominant est constitué de galets (figure E1.16) avec présence de gravier, d'argile et de cailloux (Envill 2011).

Un obstacle infranchissable pour le poisson a été identifié à une distance de 85 m à partir de l'intersection avec le cours d'eau #5 (figure E1.18) et l'habitat situé dans les cours d'eau approvisionnant le cours d'eau #8 n'a pas été jugé comme un habitat potentiel pour le poisson (Envill 2011).

Figure E1.15 Cours d'eau permanent

Figure E1.16 Cours d'eau permanent

Figure E1.17 Présence d'un ponceau se déversant dans le cours d'eau #8

Figure E1.18 Présence d'un seuil infranchissable

Le ponceau permettant au cours d'eau no 8 de traverser le chemin du quai Marcel-Dionne est également considéré comme un obstacle infranchissable (figures E1.19 et E1.20).

Figure E1.19 L'intérieur du long ponceau présente une très faible profondeur d'eau

Figure E1.20 L'extrémité aval du ponceau est protégé et le radier n'est pas enfoui.

En aval du ponceau, se succèdent plusieurs obstacles jusqu'à se que le cours d'eau no 8 rencontre un cours d'eau permanent (non caractérisé), 100 m avant de se jeter dans la rivière Saguenay. À cet endroit, une chute de plus de 1 m est considérée comme un obstacle infranchissable. Il est alors considéré que le poisson est absent dans totalité du tronçon en amont de cette chute (figure E1.21). Cependant, à partir de cette confluence jusqu'à la rivière Saguenay, il y a un potentiel d'habitat pour le poisson. Toutefois, ce tronçon n'est pas facilement accessible à toutes les espèces puisque la faible profondeur de l'eau y est faible à l'entrée et il y a des blocs de pierres à l'embouchure du cours d'eau (figure E1.22).

Figure E1.21 Chute naturelle constituant un obstacle infranchissable à la rencontre du cours d'eau no 8 et du cours d'eau non caractérisé (100m avant la rivière Saguenay)

Figure E1.22 Embouchure du cours d'eau no 8 sur la rivière Saguenay

E.1.5 Rivière Saguenay

La rivière Saguenay est le cours d'eau récepteur des effluents correspondant aux cours d'eau intermittents décrits dans les sections précédentes (E.1.1 à E.1.4). Tandis que les petits cours d'eau environnant le site projeté pour la construction de l'usine sont de nature intermittente et possèdent un débit d'étiage non significatif, étant à sec en saison estivale, la rivière Saguenay possède un débit moyen de 1 750 m^3/s et draine un bassin versant de plus de 8,7 millions d'hectares. À la hauteur du terminal de Grande-Anse, la profondeur et la largeur de la rivière Saguenay est de 13,8 m et 2 200 m, respectivement (AECOM et IBI/DAA, 2011; Administration portuaire de Saguenay, 2005).

Une station de mesure (06290002) pour la qualité de l'eau est positionnée à une distance de 1,5 km en amont de la zone d'étude, au pont piétonnier Sainte-Anne à Ville (BQMA, 2015). L'indice de qualité bactériologique et physico-chimique (2012-2014), englobant plusieurs paramètres de mesure, est considéré bon et permet donc tous les usages, dont la baignade (MDDELCC, 2016a). Les analyses en métaux ont également généré des résultats en deçà des critères de qualité de l'eau de surface (MDDELCC, 2016b). Les valeurs moyennes pour la dureté est de 13 mg/l, de 521,7 µg/l pour l'aluminium extractible, et de 473,3 µg/l pour le fer extractible. La température de l'eau varie de 4,4 à 16,8 °C alors que le pH est neutre à une valeur pratiquement constante de 7,2. Les matières en suspension sont relativement basses à une concentration moyenne de 3 mg/l. Aucun dépassement des critères courants n'a été noté démontrant une bonne qualité de l'eau à cet endroit.

C'est également sur la rivière Saguenay que des sites jugés sensibles sont situés, en aval des points de rejets potentiels. À la confluence avec le cours d'eau #6, se trouve une aire de reproduction de l'éperlan. Également, à plus de 10 km en aval du point de confluence avec le cours d'eau #8 débute la zone protégée du parc marin du Saguenay-Saint-Laurent, à la pointe du territoire de Cap à l'Est.

D'un point de vue humain, on retrouve quelques plages où la baignade est pratiquée, mais à de bonnes distances du site d'implantation de l'usine. Le site répertorié le plus près (Tourisme Saguenay, 2012), en aval des points de confluence avec les cours d'eau #6 et #8, est le site du

Parc Aventure Cap Jaseux. La plage est cependant localisée en rive Nord, face au site prévu d'implantation de l'usine et peu sujette à être influencée par des rejets en provenance des cours d'eau ciblés. La pêche sportive est pratiquée à différents endroits sur son cours, non officiellement localisée. Les activités hivernales de pêche blanche sont officiellement localisées dans la Baie des Ha! Ha! (Anse à Benjamin et Grande Baie), secteurs qui ne reçoivent pas l'influence de cours d'eau ciblés. Ce type de pêche est cependant autorisé à partir de la flèche littorale de Saint-Fulgence en se dirigeant vers l'aval. Le fjord du Saguenay n'est pas une zone de pêche commerciale.

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MINISTERE DU DEVELOPPEMENT DURABLE, DE L'ENVIRONNEMENT ET DE LA LUTTE CONTRE LES CHANGEMENTS CLIMATIQUES (MDDELCC) 2016b. Banque de données sur la qualité du milieu aquatique. Direction du suivi de l'état de l'Environnement. Station 06290002. Métaux. Tableur de données.

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Appendix E2 – Surface Water Quality – Analysis Results (French only)

Annexe E2 - Tableaux de résultats

Paramètre	Unités	Limite de quantification de la méthode	CVAA note 1	CVAC note 2	Station #1	Station #2	Station #2 DUP
Date de prélèvement	06-juin						
Inorganiques							
Alcalinité totale (CaCO3)	mg/L	0,02	-	Note 10	-	55	56
Azote ammoniacal (N-NH3) Note 3	mg/L	0,02	**20**	**1,55**	-	0,22	0,21
Azote totale (N)	mg/L	0,02	-	-	-	0,24	0,34
Carbone organique dissous	mg/L	0,2	-	-	-	16	17
Conductivité (à 25 °C)	mS/cm	0,001	-	-	-	0,12	0,12
Dureté ($CaCO_3$)	mg/L	1	-	-	-	56	57
Fluorures	mg/L	0,03	**4**	**0,20**	-	0,19	0,20
Matières en suspension	mg/L	0,3	Note 12	Note 13	4,6	12	11
pH	pH	-	Note 14	**6,5 à 9,0** (Note 15)	-	6,98	7,13
Phosphore total	mg/L	0,002	-	**0,03**	-	**0,048**	**0,049**
Solides dissous totaux	mg/L	1	-	-	-	110	100
Turbidité	UTN	0,1	Note 16	Note 17	-	20	18
Oxygène dissous (terrain) Note 4	%	0	-	**54,90%**	67%	75%	75%
Température (terrain)	°C	-	-	Note 18	16,40	16,67	16,67
Anions							
Bromures	mg/L	0,1	-	-	-	<0,1	<0,1
Chlorures	mg/L	0,05	**860**	**230**	-	1,2	1,2
Nitrites Note 5	mg/L	-	**0,06**	**0,02**	-	-	-
Nitrates	mg/L	-	-	**2,9**	-	-	-
Nitrites-nitrates Note 6	mg/L	0,02	-	-	-	0,04	0,05
Sulfates Note 7	mg/L	0,3	**500**	**500**	-	1,6	1,5
Microbiologie							
Coliformes fécaux	UFC/100ml	2	-	-	-	31	34
Métaux							
Aluminium	µg/L	0,5	**750** (Note 19)	**87** (Note 20)	-	**830**	**840**
Antimoine	µg/L	0,005	**1100**	**240**	-	0,042	0,043
Argent Note 8	µg/L	0,003	**0,760**	**0,100**	-	0,006	0,005
Arsenic	µg/L	0,09	**340**	**150**	-	0,41	0,43
Baryum Note 8	µg/L	0,03	**680**	**239**	-	14	14
Béryllium Note 8	µg/L	0,01	**5,08**	**0,57**	-	0,03	0,03
Bore	µg/L	0,3	**28000**	**5000**	-	7,7	7,7
Cadmium Note 8	µg/L	0,006	**1,20**	**0,00**	-	0,019	0,02
Calcium	µg/L	0,02	-	Note 21	-	18000	18000
Chrome Note 9	µg/L	0,04	**16**	**11**	-	1,1	1,1
Cobalt	µg/L	0,008	**370**	**100**	-	0,9	0,88
Cuivre Note 8	µg/L	0,07	**8,2**	**5,7**	-	1,7	1,7
Fer	µg/L	0,5	**3400**	**1300**	-	1300	1200
Magnésium	µg/L	0,02	-	-	-	3000	3000
Manganèse Note8	µg/L	0,03	**2500**	**1170**	-	200	200
Molybdène	µg/L	0,01	**29000**	**3200**	-	0,28	0,28
Nickel Note 8	µg/L	0,05	**290**	**32**	-	1,5	1,5
Plomb Note8	µg/L	0,03	**39**	**1,54**	-	0,34	0,33
Potassium	µg/L	0,03	-	-	-	1600	1600
Sodium	µg/L	0,02	-	-	-	3900	3900
Vanadium	µg/L	0,1	**110**	**12**	-	2,6	2,5
Zinc Note 8	µg/L	0,7	**74**	**74**	-	5,0	5,0

Appendix E3 – Surface Water quality - Certificates of Analyses (French only)

Maxxam
Une société du Groupe Bureau Veritas

Le succès par la science®

Votre # de commande: Q105717
Votre # du projet: 634451
Adresse du site: NAIC
Votre # Bordereau: E-2016-06-02

Attention:Claude Fortin

SNC-Lavalin GEM Québec Inc.
3306, Boulevard St-Francois
Saguenay, QC
CANADA G7X2W9

Date du rapport: 2016/07/07
Rapport: R2161197
Version: 1 - Finale

CERTIFICAT D'ANALYSES

 # DE DOSSIER MAXXAM: B633301

Reçu: 2016/06/02, 14:49

Matrice: EAU DE SURFACE
Nombre d'échantillons reçus: 5

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Référence Primaire
Alcalinité totale (pH final 4.5)***	2	N/A	2016/06/03	STL SOP-00038	SM 22 2320-B m
Anions*	2	N/A	2016/06/09	STL SOP-00014	MA300-Ions 1.3 R3 m
Anions (1)	2	N/A	N/A		
Coliformes fécaux (2)*	2	N/A	2016/06/03	QUE SOP-00303	MA.700-Fec.Ec 1.0
Conductivité*	2	N/A	2016/06/03	STL SOP-00038	SM 22 2510-B m
Carbone Organique Dissous (3)***	2	2016/06/03	2016/06/06	STL SOP-00243	SM 22 5310-B m
Fluorures (Basse limite) (4)***	2	N/A	2016/06/07	STL SOP-00038	SM 4500-F C m
Matières en suspension*	3	2016/06/07	2016/06/08	STL SOP-00015	MA104 - S.S. 2.0 m MA200–Mét 1.2 R5 m
Métaux extractibles totaux(basse limite)*	2	2016/06/07	2016/06/07	STL SOP-00006	
Azote ammoniacal*	2	N/A	2016/06/08	STL SOP-00040	MA300–N 2.0 R2 m
pH*	2	N/A	2016/06/03	STL SOP-00038	MA100- pH 1.1 R3 m
Phosphore total basse limite par ICP-MS (2)*	2	2016/06/06	2016/06/10	QUE SOP-00132	MA 200-Met 1.2 R5 m
Solides totaux dissous*	2	2016/06/06	2016/06/06	STL SOP-00050	MA115–S.D. 1.0 R4 m
Azote total KJELDAHL (TKN) (1)	2	2016/07/07	N/A		
Turbidité*	2	N/A	2016/06/03	STL SOP-00022	MA103-Tur. 1.0 R5 m

Lorsque la méthode de référence comprend un suffixe « m », cela signifie que la méthode d'analyse du laboratoire contient des modifications validées et appliquées afin d'améliorer la performance de la méthode de référence.

Notez: Les données brutes sont utilisées pour le calcul du RPD (% d'écart relatif). L'arrondissement des résultats finaux peut expliquer la variation apparente.

(1) Cette analyse a été effectuée par CEAEQ - Ste-Foy
(2) Cette analyse a été effectuée par Maxxam - Québec
(3) Le COD présent dans l'échantillon réfère au carbone organique dissous non volatil.
(4) Veuillez noter que l'analyse des fluorures à basse limite est sensible à la présence des cations polyvalents, ce qui peut se traduire par une sous-évaluation des résultats.

* Maxxam détient l'accréditation pour cette analyse selon le programme du MDDELCC.
*** Cette analyse ne fait pas partie du programme d'accréditation du MDDELCC.

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CERTIFICAT D'ANALYSES

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Reçu: 2016/06/02, 14:49

clé de cryptage

Veuillez adresser toute question concernant ce certificat d'analyse à votre chargé(e) de projets
Martine Lepage, M.Sc.A chimiste, Chargée de projets
Courriel: MLepage@maxxam.ca
Téléphone (418)543-3788 Ext:6201

==========

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Date du rapport: 2016/07/07

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105717
Initiales du préleveur: CF

MÉTAUX EXTRACTIBLES TOTAUX (EAU DE SURFACE)

ID Maxxam		CL0529	CL0529	CL0578		
Date d'échantillonnage		2016/06/02	2016/06/02	2016/06/02		
# Bordereau		E-2016-06-02	E-2016-06-02	E-2016-06-02		
	Unités	STATION #2	STATION #2 Dup. de Lab.	STATION #2DUP	LDR	Lot CQ
MÉTAUX						
Phosphore total	mg/L	0.048	0.051	0.049	0.002	1614889
MÉTAUX ICP-MS						
Calcium (Ca)	ug/L	18000	N/A	18000	500	1615466
Dureté totale (CaCO3)	ug/L	56000	N/A	57000	1000	1615466
Magnésium (Mg)	ug/L	3000	N/A	3000	100	1615466
Potassium (K)	ug/L	1600	N/A	1600	500	1615466
Sodium (Na)	ug/L	3900	N/A	3900	500	1615466

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
Duplicata de laboratoire
N/A = Non Applicable

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SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105717
Initiales du préleveur: CF

PARAMÈTRES CONVENTIONNELS (EAU DE SURFACE)

ID Maxxam		CL0529		CL0578		CL0622		
Date d'échantillonnage		2016/06/02		2016/06/02		2016/06/02		
# Bordereau		E-2016-06-02		E-2016-06-02		E-2016-06-02		
	Unités	STATION #2	LDR	STATION #2DUP	LDR	STATION #1	LDR	Lot CQ
CONVENTIONNELS								
Azote ammoniacal (N-NH3)	mg/L	0.07	0.02	0.07	0.02	N/A	0.02	1615609
Carbone organique dissous	mg/L	16	1	17	1	N/A	1	1614472
Conductivité	mS/cm	0.12	0.001	0.12	0.001	N/A	0.001	1614444
Fluorure (F)	mg/L	0.19	N/A	0.20	N/A	N/A	N/A	1614901
pH	pH	6.98	N/A	7.13	N/A	N/A	N/A	1614440
Turbidité	NTU	20	0.1	18	0.1	N/A	0.1	1614371
Alcalinité Totale (en CaCO3) pH 4.5	mg/L	55	1	56	1	N/A	1	1614445
Bromure (Br-)	mg/L	<0.1	0.1	<0.1	0.1	N/A	0.1	1615476
Chlorures (Cl)	mg/L	1.2	0.05	1.2	0.05	N/A	0.05	1615476
Nitrate(N) et Nitrite(N)	mg/L	0.04	0.02	0.05	0.02	N/A	0.02	1615476
Matières en suspension (MES)	mg/L	12	0.3	11	0.4	4.6	0.8	1615375
Solides dissous totaux	mg/L	110	10	100	10	N/A	N/A	1614998

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

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Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105717
Initiales du préleveur: CF

MICROBIOLOGIE (EAU DE SURFACE)

ID Maxxam		CL0529	CL0578		
Date d'échantillonnage		2016/06/02	2016/06/02		
# Bordereau		E-2016-06-02	E-2016-06-02		
	Unités	STATION #2	STATION #2DUP	LDR	Lot CQ
TESTS MICROBIOLOGIQUES					
Coliformes fécaux	UFC/100ml	31	34	1	1614763

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité

2016/07/07 17:01

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Date du rapport: 2016/07/07

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105717
Initiales du préleveur: CF

REMARQUES GÉNÉRALES

État des échantillons à l'arrivée: BON

MÉTAUX EXTRACTIBLES TOTAUX (EAU DE SURFACE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.

PARAMÈTRES CONVENTIONNELS (EAU DE SURFACE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.
Veuillez noter que l'analyse des fluorures à basse limites sont sensibles à la présence de cations polyvalents. Cela peut représenter un biais négatif aux résultats.
Les limites de détections indiquées sont multipliées par les facteurs de dilution utilisés pour l'analyse des échantillons.

Les résultats ne se rapportent qu'aux échantillons soumis pour analyse

2016/07/07 17:01

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Dossier Maxxam: B633301
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SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105717
Initiales du préleveur: CF

RAPPORT ASSURANCE QUALITÉ

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
1614371	SDO	Blanc fortifié	Turbidité	2016/06/03		110	%
1614371	SDO	Blanc de méthode	Turbidité	2016/06/03	<0.1		NTU
1614440	OZP	Blanc fortifié	pH	2016/06/03		102	%
1614444	OZP	Blanc fortifié	Conductivité	2016/06/03		105	%
1614444	OZP	Blanc de méthode	Conductivité	2016/06/03	<0.001		mS/cm
1614445	OZP	Blanc fortifié	Alcalinité Totale (en CaCO3) pH 4.5	2016/06/03		99	%
1614445	OZP	Blanc de méthode	Alcalinité Totale (en CaCO3) pH 4.5	2016/06/03	<1		mg/L
1614472	JL1	Blanc fortifié	Carbone organique dissous	2016/06/06		103	%
1614472	JL1	Blanc de méthode	Carbone organique dissous	2016/06/06	<0.2		mg/L
1614889	NS	MRC	Phosphore total	2016/06/10		106	%
1614889	NS	Blanc de méthode	Phosphore total	2016/06/10	<0.002		mg/L
1614901	MR4	Blanc fortifié	Fluorure (F)	2016/06/07		96	%
1614901	MR4	Blanc de méthode	Fluorure (F)	2016/06/07	<0.01		mg/L
1614998	ACH	Blanc fortifié	Solides dissous totaux	2016/06/06		96	%
1614998	ACH	Blanc fortifié DUP	Solides dissous totaux	2016/06/06		100	%
1614998	ACH	Blanc de méthode	Solides dissous totaux	2016/06/06	<10		mg/L
1615375	FP1	Blanc fortifié	Matières en suspension (MES)	2016/06/08		99	%
1615375	FP1	Blanc de méthode	Matières en suspension (MES)	2016/06/08	0.2, LDR=0.2		mg/L
1615466	JS2	Blanc fortifié	Calcium (Ca)	2016/06/07		96	%
			Magnésium (Mg)	2016/06/07		102	%
			Potassium (K)	2016/06/07		97	%
			Sodium (Na)	2016/06/07		105	%
1615466	JS2	Blanc de méthode	Calcium (Ca)	2016/06/07	<500		ug/L
			Dureté totale (CaCO3)	2016/06/07	<1000		ug/L
			Magnésium (Mg)	2016/06/07	<100		ug/L
			Potassium (K)	2016/06/07	<500		ug/L
			Sodium (Na)	2016/06/07	<500		ug/L
1615476	JL1	Blanc fortifié	Bromure (Br-)	2016/06/09		110	%
			Chlorures (Cl)	2016/06/09		113	%
			Nitrate(N) et Nitrite(N)	2016/06/09		113	%
1615476	JL1	Blanc de méthode	Bromure (Br-)	2016/06/09	<0.1		mg/L
			Chlorures (Cl)	2016/06/09	<0.05		mg/L
			Nitrate(N) et Nitrite(N)	2016/06/09	<0.02		mg/L
1615609	DKH	Blanc fortifié	Azote ammoniacal (N-NH3)	2016/06/08		99	%
1615609	DKH	Blanc de méthode	Azote ammoniacal (N-NH3)	2016/06/08	<0.02		mg/L

LDR = Limite de détection rapportée

MRC: Un échantillon de concentration connue préparé dans des conditions rigoureuses par un organisme externe. Utilisé pour vérifier la justesse de la méthode.

Blanc fortifié: Un blanc, d'une matrice exempte de contaminants, auquel a été ajouté une quantité connue d'analyte provenant généralement d'une deuxième source. Utilisé pour évaluer la précision de la méthode.

Blanc de méthode: Une partie aliquote de matrice pure soumise au même processus analytique que les échantillons, du prétraitement au dosage. Sert à évaluer toutes contaminations du laboratoire.

Réc = Récupération

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Dossier Maxxam: B633301
Date du rapport: 2016/07/07

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105717
Initiales du préleveur: CF

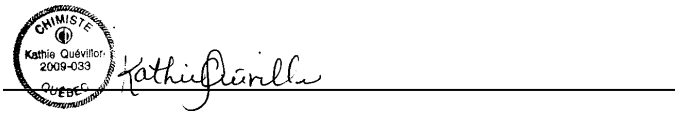
PAGE DES SIGNATURES DE VALIDATION

Les résultats analytiques ainsi que les données de contrôle-qualité contenus dans ce rapport furent vérifiés et validés par les personnes suivantes:

Dochka Koleva Hristova, B.Sc., Chimiste

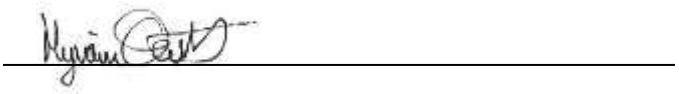
David Provencher, B.Sc., Chimiste, Québec

Faouzi Sarsi, B. Sc. Chimiste



Kathie Quevillon, B.Sc., Chimiste

Madina Hamrouni, B.Sc., Chimiste



Myriam Ouellet, M.Sc., Microbiologiste

Olga Zlatov Polevoi

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

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Dossier Maxxam: B633301
Date du rapport: 2016/07/07

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105717
Initiales du préleveur: CF

PAGE DES SIGNATURES DE VALIDATION (SUITE)

Les résultats analytiques ainsi que les données de contrôle-qualité contenus dans ce rapport furent vérifiés et validés par les personnes suivantes:

Veronic Beausejour, B.Sc., Chimiste, Superviseur

Maxxam a mis en place des procédures qui protègent contre l'utilisation non autorisée de la signature électronique et emploie les «signataires» requis, conformément à la section 5.10.2 de la norme ISO/CEI 17025:2005(E). Veuillez vous référer à la page des signatures de validation pour obtenir les détails des validations pour chaque division.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

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Centre d'e,cpertise
en analyse
envlronnementale
n-<--ue ec en au

Direction de !'analyse chimique
2700 rue Einstein
Quebec (Quebec) G lP 3W8
Tel.: 418 643-1301
Fax: 418 528-1091

Certificat d'analyse

Client: Maxxam Analytique-Montreal
889, Montee de Liesse
Saint-Laurent (Quebec) H4T 1P5

Norn de projet:	Maxxam Analytique inc. (MTL)	Date de reception:	7 juin 2016
Responsable:	Maxxam Analytics	Numero de dossier:	L037241
Telephone:	514-448-9001	Bon de commande:	8633301
Code projet client:		Code projet CEAEQ:	1199

Numero de l'echantillon : L037241-01

Preleveur:
Date de prelevement: 2 juin 2016
Description de l'echantillon: CL0529-06R\STATION #2
Description de prelevement:
Point de prelevement:
Nature de l'echantillon: eau naturelle de surface

Nutriment

Methode: **MA.** 303 - Nutriments
Date d'analyse: 23 juin 2016

	Resultat	Unite	LDM
Nitrate et nitrite	0,03	mg/IN	0,02
Azote ammoniacal	0,22	mg/IN	0,02
Azote total	0,24	mg/IN	0,02

Numero de l'echantillon: L037241-02

Preleveur:
Date de prelevement: 2 juin 2016
Description de l'echantillon: CL0562-01R\STATION #2
Description de prelevement:
Point de prelevement:
Nature de l'echantillon: eau naturelle de surface

Sulfates

Methode: **MA.** 303 - Anions 1.1
Date d'analyse: 20 juin 2016

	Resultat	Unite	LDM
Sulfates	1,6	mg/l	0,3

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Certificat d'analyse (suite de l'echantillon numero: L037241-03)

Numero de l'echantillon: L037241-03

Preleveur:
Date de prelevement : 2 juin 2016
Description de l'echantillon: CL0578-06R\STATION #2DUP
Description de prelevement:
Point de prelevement:
Nature de l'echantillon: eau naturelle de surface

Nutriment

Methode: **MA.** 303 - Nutriments Date d'analyse: 23 juin 2016	Resultat	Unite	LDM
Nitrate et nitrite	<0,02	mg/IN	0,02
Azote ammoniacal	0,21	mg/IN	0,02
Azote total	0,34	mg/IN	0,02

Numero de l'echantillon : L037241-04

Preleveur:
Date de prelevement: 2 juin 2016
Description de l'echantillon: CL0585-01R\STATION #2DUP
Description de prelevement:
Point de prelevement:
Nature de l'echantillon: eau naturelle de surface

Sulfates

Methode: **MA.** 303 -Anions 1.1 Date d'analyse: 20 juin 2016	Resultat	Unite	LDM
Sulfates	1,5	mg/l	0,3

Les resultats ne se rapportent qu'a l'echantillon soumis a /'analyse.

J'atteste avoir formellement constate ces faits

Certificat approuve le 5 juillet 2016

Jean-Luc Pilote, M.Sc. Chimiste
Division chimie inorganique, Quebec

Legende:
ABS: Absence
DNQ: Resultat entre la LDM et la LQM
INT: Interferences - Analyse impossible
ND: Non detecte
ST: Sous-traitance
PR: Presence
RNF: Resultat non disponible
NOR: Detecte - Mais ne satisfait pas le rapport isotopique
TN /: Colonies trap nombreuses pour etre identiffees
VR: Vair remarque

Ce certifi cat ne doit pas etre reproduit , sinon en entier, sa ns le con sentement ecrit du CEAEQ

Version 1 (1092881)

Appendix F

Soil and Groundwater

F1 – Soil Quality (French only)

F2 – Groundwater Quality (French only)

F3 – Calculation of DRASTIC Vulnerability Index (French only)

Appendix F1 – Soil Quality

- Location map
- Table of analytical results
- Contamination criteria note of explanation
- Certificates of analysis
- Simplified stratigraphy

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277 600 278 000 278 400

5 362 400 5 362 000

4 012 449 5 671 035 4 012 450 4 794 590 4 012 451 5 671 035 4 012 453 4 242 266 4 242 423 4 242 207 4 242 269 4 012 439 4 012 438

Entrepôt de transit
Port Merchandise Warehouse

Chemin du Quai-Marcel-Dionne

Plateforme de roc dynamité/
Blast Rock

Entreposage de sel en vrac /
Bulk Salt Storage

Ancienne terre agricole /
Former Agricultural Land

TP-24-16 El. 150.34 m
BH-01-16 El. 137.10 m
BH-02-16 El. 138.39 m
MW-03-16 El. 138.66 m
El. eau A 130.13 m
El. eau à sec
TP-27-16 El. 143.79 m
BH-04-16 El. 139.61 m
BH-18-16 El. 139.4 m
BH-19-16 El. 139.58 m
TP-25-16 El. 148.78 m
BH-05-16 El. 140.1 m
BH-06-16 El. 140.78 m
BH-20-16 El. 139.94 m
TP-26-16 El. 146.76 m
MW-07-16 El. 140.41 m
El. eau 136.70 m
BH-21-16 El. 139.79 m
BH-07-16 El. 140.41 m
BH-16-16 El. 142.16 m
BH-15-16 El. 141.98 m
MW-09-16 El. 142.11 m
El. eau à sec
BH-22-16 El. 140.30 m
BH-08-16 El. 139.63 m
BH-14-16 El. 141.97 m
BH-17-16 El. 142.09 m
BH-23-16 El. 139.89 m
BH-13-16 El. 141.73 m
MW-10-16 El. 139.41 m
El. eau A 138.95 m
El. eau B 138.80 m
BH-12-16 El. 141.65 m
BH-11-16 El. 141.64 m

Composantes du projet / Project Components

- Aire de projet / Project Area
- Lot à l'étude / Studied Lot

Stations de mesure / Sampling Stations

BH-01-16 El. 137.10 m — **Forage / Borehole** — Élévation du sol / Ground Elevation

MW-03-16 El. 138.66 m — **Puits d'observation / Monitoring Well** — Élévation du sol / Ground Elevation
El. eau A 130.12 m — Élévation de l'eau souterraine / Groundwater Elevation
El. 150.34 m — Élévation du sol / Ground Elevation
Relevée le 2016-01-21 / Groundwater Elevation

TP-24-16 — **Puits d'exploration / Test Pit**

Résultat - dépassement observé / Result - observed exeedance

- Dépassement du critère A / Exceedance of A Criteria (Ba, Cr, Co, Ni)
- Dépassement du critère aux fins de consommation / Exceedance of Human Consumption Criteria (Mn et sulfures totaux / Mn and Total Sulfides)

Limite / Boundary

- Ligne de cadastre / Cadastral Line
- 4 012 439 Numéro de lot / Lot Number

Milieu environnant / Surrounding Environment

- Identifiant des cours d'eau caractérisés / Caracterised Watercourse Identifier
- Ruisseau ou fossé de drainage / Stream or Drainage Ditch
- Ligne de nivellement (2,5 m) / Contour Line (2.5 m)
- Écoulement des eaux souterraines / Groundwater Flow Direction
- Bassin versant de niveau 2 / Level 2 Watershed

NAIC — SNC·LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay / Pig Iron Production Plant - Saguenay

Carte F1 / Map F1

Localisation des stations de mesures et dépassements observés
Sampling Stations and Observed Exceedances

Sources :
Inventaire, SNC-Lavalin inc., 2016
Ville de Saguenay, 2016
CanVec, 1/50 000, 2016
Bassins hydrographiques du Québec, MDDEP Québec, 2011

Projet / Project : 634451

Projection MTM, fuseau 7, NAD83

0 40 80 m

Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified
00	2016/06/27	Finale / Final	L. Bathalon	C. Martineau

Format 11x17

Envir01: T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnF_localisation_forage_f00.mxd

				[1]Métaux															
Échantillons	**Date**	**HP C10-C50**	**Identification du produit pétrolier (IPP)**	**Argent**	**Arsenic**	**Baryum**	**Cadmium**	**Chrome**	**Cobalt**	**Cuivre**	**Étain**	**Fer**	**Manganèse**	**Mercure**	**Molybdène**	**Nickel**	**Plomb**	**Sélénium**	**Zinc**
	Unité	mg/kg	-	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Critère A	*300*	-	***2***	***10***	***200***	***0,9***	***45***	***15***	***50***	***5***	***-***	***1000***	***0,4***	***6***	***30***	***50***	***3***	***100***
	Critère B	**700**	-	**20**	**30**	**500**	**5**	**250**	**50**	**100**	**50**	**-**	**1000**	**2**	**10**	**100**	**500**	**3**	**500**
	Critère C	**3 500**	-	**40**	**50**	**2000**	**20**	**800**	**300**	**500**	**300**	**-**	**2200**	**10**	**40**	**500**	**1000**	**10**	**1500**
	RESC	***10 000***	-	***200***	***250***	***10000***	***100***	***4000***	***1500***	***2500***	***1500***	***-***	***11000***	***50***	***200***	***2500***	***5000***	***50***	***7500***
BH-02-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	95	nd	nd	nd	nd	nd	28000	243	nd	nd	nd	nd	nd	nd
MW-03-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	52	nd	nd	nd	nd	nd	19100	171	nd	nd	nd	nd	nd	nd
BH-06-16 / VR-1 / 0.00-0.10	2016-01-15	--	--	nd	nd	67	nd	nd	nd	nd	nd	18200	196	nd	nd	nd	nd	nd	nd
BH-08-16 / CF-1 / 0.00-0.60	2016-01-15	--	--	nd	nd	***226***	nd	***46***	***15***	nd	nd	40400	529	nd	nd	***34***	nd	nd	nd
BH-08-16 / CF-3 / 1.50-2.10	2016-01-15	--	--	nd	nd	182	nd	nd	nd	nd	nd	34000	425	nd	nd	nd	nd	nd	nd
BH-08-16 / CF-5 / 3.00-3.60	2016-01-15	--	--	nd	nd	167	nd	nd	nd	nd	nd	31100	416	nd	nd	nd	nd	nd	nd
MW-09-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	65	nd	nd	nd	nd	nd	22200	191	nd	2	nd	nd	nd	nd
MW-10-16 / CF-1 / 0.00-0.60	2016-01-13	nd	nd	nd	nd	168	nd	nd	***17***	nd	nd	31200	619	nd	nd	nd	nd	nd	nd
MW-10-16 / CF-3 / 1.50-2.10	2016-01-13	--	--	nd	nd	162	nd	nd	nd	nd	nd	31600	428	nd	nd	nd	nd	nd	nd
MW-10-16 / CF-5 / 3.00-3.60	2016-01-13	--	--	nd	nd	161	nd	nd	nd	nd	nd	29000	402	nd	nd	nd	nd	nd	nd
BH-13-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	160	nd	***99***	nd	nd	nd	26400	221	nd	nd	***37***	nd	nd	nd
BH-15-16 / VR-1 / 0.00-0.10	2016-01-15	--	--	nd	nd	154	nd	nd	nd	nd	nd	27400	352	nd	nd	nd	nd	nd	nd
BH-16-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	91	nd	nd	nd	nd	nd	22500	176	nd	nd	nd	nd	nd	nd

[1] Les valeurs du critère A de certains métaux et métalloïdes ont été ajustés selon la province géologique de Grenville (MDDELCC).

		HAP																											
Échantillons	**Date**	**Acénaphtène**	**Acénaphtylène**	**Anthracène**	**Benzo(a)anthracène**	**Benzo(a)pyrène**	**Benzo(b)fluoranthène**	**Benzo(c)phénanthrène**	**Benzo(e)pyrène**	**Benzo(g,h,i)pérylène**	**Benzo(j)fluoranthène**	**Benzo(k)fluoranthène**	**Chrysène**	**Dibenzo(a,h)anthracène**	**Dibenzo(a,h)pyrène**	**Dibenzo(a,i)pyrène**	**Dibenzo(a,l)pyrène**	**Diméthyl-1,3 naphtalène**	**Diméthyl-7,12 benzo(a)anthracène**	**Fluoranthène**	**Fluorène**	**Indéno(1,2,3-cd)pyrène**	**Méthyl-1 naphtalène**	**Méthyl-2 naphtalène**	**Méthyl-3 cholanthrène**	**Naphtalène**	**Phénanthrène**	**Pyrène**	**Triméthyl-2,3,5 naphtalène**
	Unité	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	Critère A	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	**-**	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***	***0,1***
	Critère B	**10**	**10**	**10**	**1**	**1**	**1**	**1**	**-**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**10**	**10**	**1**	**1**	**1**	**1**	**5**	**5**	**10**	**1**
	Critère C	**100**	**100**	**100**	**10**	**10**	**10**	**10**	**-**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**100**	**100**	**10**	**10**	**10**	**10**	**50**	**50**	**100**	**10**
	RESC	***100***	***100***	***100***	***34***	***34***	***136***	***56***	**-**	***18***	***136***	***136***	***34***	***82***	***34***	***34***	***34***	***56***	***34***	***100***	***100***	***34***	***56***	***56***	***56***	***150***	***56***	***100***	***56***
BH-02-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BH-06-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MW-03-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BH-08-16 / CF-1 / 0.00-0.60	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BH-08-16 / CF-3 / 1.50-2.10	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BH-08-16 / CF-5 / 3.00-3.60	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MW-09-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MW-10-16 / CF-1 / 0.00-0.60	2016-01-13	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MW-10-16 / CF-3 / 1.50-2.10	2016-01-13	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
MW-10-16 / CF-5 / 3.00-3.60	2016-01-13	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BH-13-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	0,1	nd	nd
BH-15-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
BH-16-16 / VR-1 / 0.00-0.10	2016-01-15	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

NOTES EXPLICATIVES ACCOMPAGNANT LES TABLEAUX DE RÉSULTATS D'ANALYSES CHIMIQUES DES SOLS.

LÉGENDE

ND : Non détecté, résultat inférieur à la limite de détection du laboratoire.

- : Aucune valeur établie par le MDDELCC. L'absence de critère pour un paramètre ne signifie pas qu'il est sans risque pour la santé humaine et pour l'environnement.

-- : Paramètre non analysé.

CRITÈRES DE CONTAMINATION GÉNÉRIQUES POUR LES SOLS

Le Ministère du Développement durable, de l'Environnement et de la Lutte contre les Changements Climatiques du Québec (MDDELCC) prévoit trois niveaux de critères génériques des sols pour plusieurs substances. Les niveaux (A, B, C) peuvent être définis comme suit:

- **Critère A:** Teneurs de fond pour les paramètres inorganiques et limite de quantification pour les paramètres organiques. La limite de quantification est définie comme la concentration minimale qui peut être quantifiée à l'aide d'une méthode d'analyse avec une fiabilité définie;

- **Critère B:** Limite maximale acceptable pour des terrains à vocation résidentielle, récréative et institutionnelle. Sont également inclus les terrains à vocation commerciale situés dans un secteur résidentiel;

  L'usage institutionnel regroupe les utilisations telles que les hôpitaux, les écoles et les garderies. L'usage récréatif regroupe un grand nombre de cas possibles qui présentent différentes sensibilités. Ainsi, les usages sensibles, comme les terrains de jeu, devront être gérés en fonction du niveau B. Pour leur part, les usages récréatifs considérés moins sensibles comme les pistes cyclables peuvent être associées au niveau C;

- **Critère C:** Limite maximale acceptable pour des terrains à vocation commerciale, non situés dans un secteur résidentiel, et pour des terrains à usage industriel.

RÉFÉRENCE: Politique de protection des sols et de réhabilitation des terrains contaminés 1999 (mise à jour sur le site Internet du MDDELCC lors de l'émission de ce rapport).

RÈGLEMENT SUR L'ENFOUISSEMENT DES SOLS CONTAMINÉS (RESC)

CRITÈRE D : Valeurs maximales pour les paramètres listés à l'annexe 1 du RESC, au-delà desquelles un sol ne peut être disposé dans un site d'enfouissement de sols contaminés.

RÉFÉRENCE : Règlement sur l'enfouissement des sols contaminés c.Q-2, r.6.01, article 4.1º.

MISE EN GARDE : Si les résultats inscrits dans le tableau diffèrent de ceux inscrits dans les certificats d'analyses du laboratoire, ce sont les résultats inscrits dans les certificats d'analyses du laboratoire qui prévalent.

AGAT Laboratoires

350, rue Franquet
Québec, Québec
CANADA G1P 4P3
TEL (418)266-5511
FAX (418)653-2335
http://www.agatlabs.com

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
3306 BOUL ST-FRANCOIS
JONQUIERE, QC G7X2W9
(418) 547-5716

À L'ATTENTION DE: M. MARC MUNGER

N° DE PROJET: 634451

N° BON DE TRAVAIL: 16A062480

ANALYSE DES SOLS VÉRIFIÉ PAR: Frédéric Drouin, chimiste

ORGANIQUE DE TRACE VÉRIFIÉ PAR: Véronique Paré, chimiste

DATE DU RAPPORT: 2016-01-29

VERSION*: 1

NOMBRE DE PAGES: 23

Si vous désirez de l'information concernant cette analyse, S.V.P. contacter votre chargé de projets au (418) 266-5511.

*NOTES

Nous disposerons des échantillons dans les 30 jours suivants les analyses. S.V.P. Contactez le laboratoire si vous désirez avoir un délai d'entreposage.
Cette version remplace et annule toute version, le cas échéant. Ce document ne doit pas être reproduit, sinon en entier, sans l'autorisation écrite du laboratoire. Les résultats ne se rapportent qu'aux échantillons soumis pour analyse.

AGAT Laboratoires

350, rue Franquet
Québec, Québec
CANADA G1P 4P3
TEL (418)266-5511
FAX (418)653-2335
http://www.agatlabs.com

Certificat d'analyse

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Balayage - 15 Métaux extractibles totaux + Hg

DATE DE RÉCEPTION: 2016-01-25

DATE DU RAPPORT: 2016-01-29

							IDENTIFICATION DE L'ÉCHANTILLON:		MW-03-16/VR-	BH-06-16/VR-
							BH-02-16/VR-1/0,00-0,10		1/0,00-0,10	1/0,00-0,10
							MATRICE: sol		sol	sol
							DATE D'ÉCHANTILLONNAGE: 2016-01-15		2016-01-15	2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347214	LDR	7347236	7347237
Argent	mg/kg	2	20	40	200	0.5	<0.5[<A]	0.5	<0.5[<A]	<0.5[<A]
Arsenic	mg/kg	10	30	50	250	5	<5[<A]	5	<5[<A]	<5[<A]
Baryum	mg/kg	200	500	2000	10000	20	95[<A]	20	52[<A]	67[<A]
Cadmium	mg/kg	0.9	5	20	100	0.9	<0.9[<A]	0.9	<0.9[<A]	<0.9[<A]
Chrome	mg/kg	45	250	800	4000	45	<45[<A]	45	<45[<A]	<45[<A]
Cobalt	mg/kg	15	50	300	1500	15	<15[<A]	15	<15[<A]	<15[<A]
Cuivre	mg/kg	50	100	500	2500	40	<40[<A]	40	<40[<A]	<40[<A]
Étain	mg/kg	5	50	300	1500	5	<5[<A]	5	<5[<A]	<5[<A]
Fer	mg/kg					25000	28000	5000	19100	18200
Manganèse	mg/kg	1000	1000	2200	11000	10	243[<A]	10	171[<A]	196[<A]
Mercure	mg/kg	0.4	2	10	50	0.2	<0.2[<A]	0.2	<0.2[<A]	<0.2[<A]
Molybdène	mg/kg	6	10	40	200	2	<2[<A]	2	<2[<A]	<2[<A]
Nickel	mg/kg	30	100	500	2500	30	<30[<A]	30	<30[<A]	<30[<A]
Plomb	mg/kg	50	500	1000	5000	30	<30[<A]	30	<30[<A]	<30[<A]
Sélénium	mg/kg	3	3	10	50	1.0	<1.0[<A]	1.0	<1.0[<A]	<1.0[<A]
Zinc	mg/kg	100	500	1500	7500	100	<100[<A]	100	<100[<A]	<100[<A]

Certifié par:

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
À L'ATTENTION DE: M. MARC MUNGER
PRÉLEVÉ PAR:
LIEU DE PRÉLÈVEMENT:

Balayage - 15 Métaux extractibles totaux + Hg

DATE DE RÉCEPTION: 2016-01-25
DATE DU RAPPORT: 2016-01-29

					IDENTIFICATION DE L'ÉCHANTILLON:		BH-08-16/CF-1/0,00-0,60	BH-08-16/CF-3/1,50-2,10	BH-08-16/CF-5/3,00-3,60		MW-09-16/VR-1/0,00-0,10
					MATRICE:		sol	sol	sol		sol
					DATE D'ÉCHANTILLONNAGE:		2016-01-15	2016-01-15	2016-01-15		2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347238	7347240	7347242	LDR	7347243
Argent	mg/kg	2	20	40	200	0.5	<0.5[<A]	<0.5[<A]	<0.5[<A]	0.5	<0.5[<A]
Arsenic	mg/kg	10	30	50	250	5	<5[<A]	<5[<A]	<5[<A]	5	<5[<A]
Baryum	mg/kg	200	500	2000	10000	20	226[A-B]	182[<A]	167[<A]	20	65[<A]
Cadmium	mg/kg	0.9	5	20	100	0.9	<0.9[<A]	<0.9[<A]	<0.9[<A]	0.9	<0.9[<A]
Chrome	mg/kg	45	250	800	4000	45	46[A-B]	<45[<A]	<45[<A]	45	<45[<A]
Cobalt	mg/kg	15	50	300	1500	15	15[A]	<15[<A]	<15[<A]	15	<15[<A]
Cuivre	mg/kg	50	100	500	2500	40	<40[<A]	<40[<A]	<40[<A]	40	<40[<A]
Étain	mg/kg	5	50	300	1500	5	<5[<A]	<5[<A]	<5[<A]	5	<5[<A]
Fer	mg/kg					25000	40400	34000	31100	5000	22200
Manganèse	mg/kg	1000	1000	2200	11000	10	529[<A]	425[<A]	416[<A]	10	191[<A]
Mercure	mg/kg	0.4	2	10	50	0.2	<0.2[<A]	<0.2[<A]	<0.2[<A]	0.2	<0.2[<A]
Molybdène	mg/kg	6	10	40	200	2	<2[<A]	<2[<A]	<2[<A]	2	2[<A]
Nickel	mg/kg	30	100	500	2500	30	34[A-B]	<30[<A]	<30[<A]	30	<30[<A]
Plomb	mg/kg	50	500	1000	5000	30	<30[<A]	<30[<A]	<30[<A]	30	<30[<A]
Sélénium	mg/kg	3	3	10	50	1.0	<1.0[<A]	<1.0[<A]	<1.0[<A]	1.0	<1.0[<A]
Zinc	mg/kg	100	500	1500	7500	100	<100[<A]	<100[<A]	<100[<A]	100	<100[<A]

Certifié par:

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
À L'ATTENTION DE: M. MARC MUNGER
PRÉLEVÉ PAR:
LIEU DE PRÉLÈVEMENT:

Balayage - 15 Métaux extractibles totaux + Hg

DATE DE RÉCEPTION: 2016-01-25
DATE DU RAPPORT: 2016-01-29

							MW-10-16/CF-1/0,00-0,60	MW-10-16/CF-3/1,50-2,10	MW-10-16/CF-5/3,00-3,60	BH-13-16/VR-1/0,00-0,10	BH-15-16/VR-1/0,00-0,10
IDENTIFICATION DE L'ÉCHANTILLON:											
MATRICE:							sol	sol	sol	sol	sol
DATE D'ÉCHANTILLONNAGE:							2016-01-13	2016-01-13	2016-01-13	2016-01-15	2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347244	7347246	7347249	7347250	7347252
Argent	mg/kg	2	20	40	200	0.5	<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]	<0.5[<A]
Arsenic	mg/kg	10	30	50	250	5	<5[<A]	<5[<A]	<5[<A]	<5[<A]	<5[<A]
Baryum	mg/kg	200	500	2000	10000	20	168[<A]	162[<A]	161[<A]	160[<A]	154[<A]
Cadmium	mg/kg	0.9	5	20	100	0.9	<0.9[<A]	<0.9[<A]	<0.9[<A]	<0.9[<A]	<0.9[<A]
Chrome	mg/kg	45	250	800	4000	45	<45[<A]	<45[<A]	<45[<A]	99[A-B]	<45[<A]
Cobalt	mg/kg	15	50	300	1500	15	17[A-B]	<15[<A]	<15[<A]	<15[<A]	<15[<A]
Cuivre	mg/kg	50	100	500	2500	40	<40[<A]	<40[<A]	<40[<A]	<40[<A]	<40[<A]
Étain	mg/kg	5	50	300	1500	5	<5[<A]	<5[<A]	<5[<A]	<5[<A]	<5[<A]
Fer	mg/kg					25000	31200	31600	29000	26400	27400
Manganèse	mg/kg	1000	1000	2200	11000	10	619[<A]	428[<A]	402[<A]	221[<A]	352[<A]
Mercure	mg/kg	0.4	2	10	50	0.2	<0.2[<A]	<0.2[<A]	<0.2[<A]	<0.2[<A]	<0.2[<A]
Molybdène	mg/kg	6	10	40	200	2	<2[<A]	<2[<A]	<2[<A]	<2[<A]	<2[<A]
Nickel	mg/kg	30	100	500	2500	30	<30[<A]	<30[<A]	<30[<A]	37[A-B]	<30[<A]
Plomb	mg/kg	50	500	1000	5000	30	<30[<A]	<30[<A]	<30[<A]	<30[<A]	<30[<A]
Sélénium	mg/kg	3	3	10	50	1.0	<1.0[<A]	<1.0[<A]	<1.0[<A]	<1.0[<A]	<1.0[<A]
Zinc	mg/kg	100	500	1500	7500	100	<100[<A]	<100[<A]	<100[<A]	<100[<A]	<100[<A]

Certifié par:

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Balayage - 15 Métaux extractibles totaux + Hg

DATE DE RÉCEPTION: 2016-01-25

DATE DU RAPPORT: 2016-01-29

							BH-16-16/VR-1/0,00-0,10
IDENTIFICATION DE L'ÉCHANTILLON:							
MATRICE:							sol
DATE D'ÉCHANTILLONNAGE:							2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347253
Argent	mg/kg	2	20	40	200	0.5	<0.5[<A]
Arsenic	mg/kg	10	30	50	250	5	<5[<A]
Baryum	mg/kg	200	500	2000	10000	20	91[<A]
Cadmium	mg/kg	0.9	5	20	100	0.9	<0.9[<A]
Chrome	mg/kg	45	250	800	4000	45	<45[<A]
Cobalt	mg/kg	15	50	300	1500	15	<15[<A]
Cuivre	mg/kg	50	100	500	2500	40	<40[<A]
Étain	mg/kg	5	50	300	1500	5	<5[<A]
Fer	mg/kg					5000	22500
Manganèse	mg/kg	1000	1000	2200	11000	10	176[<A]
Mercure	mg/kg	0.4	2	10	50	0.2	<0.2[<A]
Molybdène	mg/kg	6	10	40	200	2	<2[<A]
Nickel	mg/kg	30	100	500	2500	30	<30[<A]
Plomb	mg/kg	50	500	1000	5000	30	<30[<A]
Sélénium	mg/kg	3	3	10	50	1.0	<1.0[<A]
Zinc	mg/kg	100	500	1500	7500	100	<100[<A]

Commentaires: LDR - Limite de détection rapportée; C / N - Critères Normes: A se réfère QC-PTC A (Grenville), B se réfère QC-PTC (B), C se réfère QC-PTC (C), D se réfère QC RESC (Annexe 1)

Certifié par:

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
À L'ATTENTION DE: M. MARC MUNGER
PRÉLEVÉ PAR:
LIEU DE PRÉLÈVEMENT:

HAP + Séparation Benzo (b,j,k) fluoranthène (Sol)

DATE DE RÉCEPTION: 2016-01-25
DATE DU RAPPORT: 2016-01-29

							BH-02-16/VR-1/0,00-0,10	MW-03-16/VR-1/0,00-0,10	BH-06-16/VR-1/0,00-0,10	BH-08-16/CF-1/0,00-0,60	BH-08-16/CF-3/1,50-2,10
					IDENTIFICATION DE L'ÉCHANTILLON:						
					MATRICE:		sol	sol	sol	sol	sol
					DATE D'ÉCHANTILLONNAGE:		2016-01-15	2016-01-15	2016-01-15	2016-01-15	2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347214	7347236	7347237	7347238	7347240
Acénaphtène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Acénaphtylène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Anthracène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (a) anthracène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (a) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (e) pyrène	mg/kg					0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo (b) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (j) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (k) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (c) phénanthrène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (g,h,i) pérylène	mg/kg	0.1	1	10	18	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Chrysène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,h) anthracène	mg/kg	0.1	1	10	82	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,i) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,h) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,l) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Diméthyl-7,12 benzo (a) anthracène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Fluoranthène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Fluorène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Indéno (1,2,3-cd) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-3 cholanthrène	mg/kg	0.1	1	10	150	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Naphtalène	mg/kg	0.1	5	50	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Phénanthrène	mg/kg	0.1	5	50	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Pyrène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-1 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-2 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Diméthyl-1,3 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]

Certifié par: Véronique Paré

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

HAP + Séparation Benzo (b,j,k) fluoranthène (Sol)

DATE DE RÉCEPTION: 2016-01-25

DATE DU RAPPORT: 2016-01-29

						IDENTIFICATION DE L'ÉCHANTILLON:	BH-02-16/VR-1/0,00-0,10	MW-03-16/VR-1/0,00-0,10	BH-06-16/VR-1/0,00-0,10	BH-08-16/CF-1/0,00-0,60	BH-08-16/CF-3/1,50-2,10
						MATRICE:	sol	sol	sol	sol	sol
						DATE D'ÉCHANTILLONNAGE:	2016-01-15	2016-01-15	2016-01-15	2016-01-15	2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347214	7347236	7347237	7347238	7347240
Triméthyl-2,3,5 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Étalon de recouvrement	Unités			Limites							
Rec. Acénaphtène-d10	%			40-140			84	76	78	88	82
Rec. Benzo(a)anthracène-d12	%			40-140			90	82	85	91	85
Rec. Pyrène-d10	%			40-140			87	78	82	88	85

Certifié par: Véronique Paré

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
À L'ATTENTION DE: M. MARC MUNGER
PRÉLEVÉ PAR:
LIEU DE PRÉLÈVEMENT:

HAP + Séparation Benzo (b,j,k) fluoranthène (Sol)

DATE DE RÉCEPTION: 2016-01-25
DATE DU RAPPORT: 2016-01-29

							BH-08-16/CF-5/3,00-3,60	MW-09-16/VR-1/0,00-0,10	MW-10-16/CF-1/0,00-0,60	MW-10-16/CF-3/1,50-2,10	MW-10-16/CF-5/3,00-3,60
						IDENTIFICATION DE L'ÉCHANTILLON:					
						MATRICE:	sol	sol	sol	sol	sol
						DATE D'ÉCHANTILLONNAGE:	2016-01-15	2016-01-15	2016-01-13	2016-01-13	2016-01-13
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347242	7347243	7347244	7347246	7347249
Acénaphtène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Acénaphtylène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Anthracène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (a) anthracène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (a) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (e) pyrène	mg/kg					0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo (b) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (j) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (k) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (c) phénanthrène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (g,h,i) pérylène	mg/kg	0.1	1	10	18	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Chrysène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,h) anthracène	mg/kg	0.1	1	10	82	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,i) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,h) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,l) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Diméthyl-7,12 benzo (a) anthracène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Fluoranthène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Fluorène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Indéno (1,2,3-cd) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-3 cholanthrène	mg/kg	0.1	1	10	150	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Naphtalène	mg/kg	0.1	5	50	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Phénanthrène	mg/kg	0.1	5	50	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Pyrène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-1 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-2 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Diméthyl-1,3 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]

Certifié par: Véronique Paré

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

HAP + Séparation Benzo (b,j,k) fluoranthène (Sol)

DATE DE RÉCEPTION: 2016-01-25

DATE DU RAPPORT: 2016-01-29

							BH-08-16/CF-	MW-09-16/VR-	MW-10-16/CF-	MW-10-16/CF-	MW-10-16/CF-
						IDENTIFICATION DE L'ÉCHANTILLON:	5/3,00-3,60	1/0,00-0,10	1/0,00-0,60	3/1,50-2,10	5/3,00-3,60
						MATRICE:	sol	sol	sol	sol	sol
						DATE D'ÉCHANTILLONNAGE:	2016-01-15	2016-01-15	2016-01-13	2016-01-13	2016-01-13
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347242	7347243	7347244	7347246	7347249
Triméthyl-2,3,5 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]	<0.1[<A]
Étalon de recouvrement	Unités			Limites							
Rec. Acénaphtène-d10	%			40-140			89	76	86	86	91
Rec. Benzo(a)anthracène-d12	%			40-140			92	81	89	90	95
Rec. Pyrène-d10	%			40-140			92	79	87	90	93

Certifié par: Véronique Paré

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
À L'ATTENTION DE: M. MARC MUNGER
PRÉLEVÉ PAR:
LIEU DE PRÉLÈVEMENT:

HAP + Séparation Benzo (b,j,k) fluoranthène (Sol)

DATE DE RÉCEPTION: 2016-01-25
DATE DU RAPPORT: 2016-01-29

							BH-13-16/VR-	BH-15-16/VR-	BH-16-16/VR-
IDENTIFICATION DE L'ÉCHANTILLON:							1/0,00-0,10	1/0,00-0,10	1/0,00-0,10
MATRICE:							sol	sol	sol
DATE D'ÉCHANTILLONNAGE:							2016-01-15	2016-01-15	2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347250	7347252	7347253
Acénaphtène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Acénaphtylène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Anthracène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (a) anthracène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (a) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (e) pyrène	mg/kg					0.1	<0.1	<0.1	<0.1
Benzo (b) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (j) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (k) fluoranthène	mg/kg	0.1	1	10	136	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (c) phénanthrène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Benzo (g,h,i) pérylène	mg/kg	0.1	1	10	18	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Chrysène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,h) anthracène	mg/kg	0.1	1	10	82	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,i) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,h) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Dibenzo (a,l) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Diméthyl-7,12 benzo (a) anthracène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Fluoranthène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Fluorène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Indéno (1,2,3-cd) pyrène	mg/kg	0.1	1	10	34	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-3 cholanthrène	mg/kg	0.1	1	10	150	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Naphtalène	mg/kg	0.1	5	50	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Phénanthrène	mg/kg	0.1	5	50	56	0.1	0.1[A]	<0.1[<A]	<0.1[<A]
Pyrène	mg/kg	0.1	10	100	100	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-1 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Méthyl-2 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Diméthyl-1,3 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]

Certifié par: Véronique Paré

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

HAP + Séparation Benzo (b,j,k) fluoranthène (Sol)

DATE DE RÉCEPTION: 2016-01-25

DATE DU RAPPORT: 2016-01-29

							BH-13-16/VR-1/0,00-0,10	BH-15-16/VR-1/0,00-0,10	BH-16-16/VR-1/0,00-0,10
						IDENTIFICATION DE L'ÉCHANTILLON:			
						MATRICE:	sol	sol	sol
						DATE D'ÉCHANTILLONNAGE:	2016-01-15	2016-01-15	2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347250	7347252	7347253
Triméthyl-2,3,5 naphtalène	mg/kg	0.1	1	10	56	0.1	<0.1[<A]	<0.1[<A]	<0.1[<A]
Étalon de recouvrement	Unités			Limites					
Rec. Acénaphtène-d10	%			40-140			76	83	76
Rec. Benzo(a)anthracène-d12	%			40-140			83	89	84
Rec. Pyrène-d10	%			40-140			79	86	80

Commentaires: LDR - Limite de détection rapportée; C / N - Critères Normes: A se réfère QC PTC (Critère A), B se réfère QC PTC (Critère B), C se réfère QC PTC (Critère C), D se réfère QC RESC (Annexe 1)

Certifié par: Véronique Paré

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Humidité (S-HU) (Sol)

DATE DE RÉCEPTION: 2016-01-25

DATE DU RAPPORT: 2016-01-29

IDENTIFICATION DE L'ÉCHANTILLON:				BH-02-16/VR-1/0,00-0,10	MW-03-16/VR-1/0,00-0,10	BH-06-16/VR-1/0,00-0,10	BH-08-16/CF-1/0,00-0,60	BH-08-16/CF-3/1,50-2,10	BH-08-16/CF-5/3,00-3,60	MW-09-16/VR-1/0,00-0,10	MW-10-16/CF-1/0,00-0,60
MATRICE:				sol	sol	sol	sol	sol	sol	sol	sol
DATE D'ÉCHANTILLONNAGE:				2016-01-15	2016-01-15	2016-01-15	2016-01-15	2016-01-15	2016-01-15	2016-01-15	2016-01-13
Paramètre	Unités	C / N	LDR	7347214	7347236	7347237	7347238	7347240	7347242	7347243	7347244
% Humidité	%		0.2	10.9	8.3	14.6	27.2	23.4	24.6	10.8	23.7

IDENTIFICATION DE L'ÉCHANTILLON:				MW-10-16/CF-3/1,50-2,10	MW-10-16/CF-5/3,00-3,60	BH-13-16/VR-1/0,00-0,10	BH-15-16/VR-1/0,00-0,10	BH-16-16/VR-1/0,00-0,10
MATRICE:				sol	sol	sol	sol	sol
DATE D'ÉCHANTILLONNAGE:				2016-01-13	2016-01-13	2016-01-15	2016-01-15	2016-01-15
Paramètre	Unités	C / N	LDR	7347246	7347249	7347250	7347252	7347253
% Humidité	%		0.2	28.2	28.6	16.5	25.0	13.7

Commentaires: LDR - Limite de détection rapportée; C / N - Critères Normes

Certifié par: Véronique Paré

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Hydrocarbures pétroliers C10-C50 - IPP (Sol)

DATE DE RÉCEPTION: 2016-01-25

DATE DU RAPPORT: 2016-01-29

						IDENTIFICATION DE L'ÉCHANTILLON:	BH-02-16/VR-1/0,00-0,10	MW-03-16/VR-1/0,00-0,10	MW-09-16/VR-1/0,00-0,10	MW-10-16/CF-1/0,00-0,60	BH-13-16/VR-1/0,00-0,10
						MATRICE:	sol	sol	sol	sol	sol
						DATE D'ÉCHANTILLONNAGE:	2016-01-15	2016-01-15	2016-01-15	2016-01-13	2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347214	7347236	7347243	7347244	7347250
Hydrocarbures pétroliers C10 à C50	mg/kg	300	700	3500	10000	100	<100[<A]	<100[<A]	<100[<A]	<100[<A]	<100[<A]
IPP	NA					NA	NA	NA	NA	NA	NA
Étalon de recouvrement	Unités			Limites							
Rec. Nonane	%			40-140			105	94	98	110	100

						IDENTIFICATION DE L'ÉCHANTILLON:	BH-16-16/VR-1/0,00-0,10
						MATRICE:	sol
						DATE D'ÉCHANTILLONNAGE:	2016-01-15
Paramètre	Unités	C / N: A	C / N: B	C / N: C	C / N: D	LDR	7347253
Hydrocarbures pétroliers C10 à C50	mg/kg	300	700	3500	10000	100	<100[<A]
IPP	NA					NA	NA
Étalon de recouvrement	Unités			Limites			
Rec. Nonane	%			40-140			98

Commentaires: LDR - Limite de détection rapportée; C / N - Critères Normes: A se réfère QC PTC (Critère A), B se réfère QC PTC (Critère B), C se réfère QC PTC (Critère C), D se réfère QC RESC (Annexe 1)

Certifié par: Véronique Paré

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FAX (418)653-2335
http://www.agatlabs.com

Contrôle de qualité

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Analyse des Sols

Date du rapport: 2016-01-29

PARAMÈTRE	Lot	N° éch.	DUPLICATA			MATÉRIAU DE RÉFÉRENCE				BLANC FORTIFIÉ			ÉCH. FORTIFIÉ		
			Dup #1	Dup #2	% d'écart	Blanc de méthode	% Récup.	Limites		% Récup.	Limites		% Récup.	Limites	
								Inf.	Sup.		Inf.	Sup.		Inf.	Sup.
Balayage - 15 Métaux extractibles totaux + Hg															
Argent	7347242	7347242	<0.5	<0.5	NR	< 0.5	111%	80%	120%	105%	80%	120%	111%	70%	130%
Arsenic	7347242	7347242	<5	<5	NR	< 5	116%	80%	120%	112%	80%	120%	118%	70%	130%
Baryum	7347242	7347242	167	177	6,0%	< 20	97%	80%	120%	102%	80%	120%	NA	70%	130%
Cadmium	7347242	7347242	<0.9	<0.9	NR	< 0.9	104%	80%	120%	101%	80%	120%	109%	70%	130%
Chrome	7347242	7347242	<45	<45	NR	< 45	108%	80%	120%	107%	80%	120%	116%	70%	130%
Cobalt	7347242	7347242	<15	<15	NR	< 15	110%	80%	120%	106%	80%	120%	114%	70%	130%
Cuivre	7347242	7347242	<40	<40	NR	< 40	106%	80%	120%	103%	80%	120%	110%	70%	130%
Étain	7347242	7347242	<5	<5	NR	< 5	NA	80%	120%	99%	80%	120%	102%	70%	130%
Fer	7347242	7347242	31100	32800	NR	< 500	102%	80%	120%	105%	80%	120%	NA	70%	130%
Manganèse	7347242	7347242	416	444	6.5	< 10	104%	80%	120%	102%	80%	120%	107%	70%	130%
Mercure	7347214	7347214	<0.2	<0.2	NR	< 0.2	90%	80%	120%	104%	80%	120%	101%	70%	130%
Molybdène	7347242	7347242	<2	<2	NR	< 2	116%	80%	120%	101%	80%	120%	106%	70%	130%
Nickel	7347242	7347242	<30	<30	NR	< 30	107%	80%	120%	104%	80%	120%	112%	70%	130%
Plomb	7347242	7347242	<30	<30	NR	< 30	108%	80%	120%	102%	80%	120%	112%	70%	130%
Sélénium	7347242	7347242	<1.0	<1.0	NR	< 1.0	104%	80%	120%	104%	80%	120%	111%	70%	130%
Zinc	7347242	7347242	<100	<100	NR	< 100	103%	80%	120%	101%	80%	120%	110%	70%	130%

Certifié par:

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Contrôle de qualité

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
N° BON DE TRAVAIL: 16A062480
N° DE PROJET: 634451
À L'ATTENTION DE: M. MARC MUNGER
PRÉLEVÉ PAR:
LIEU DE PRÉLÈVEMENT:

Analyse organique de trace

Date du rapport: 2016-01-29

PARAMÈTRE	Lot	N° éch.	DUPLICATA			MATÉRIAU DE RÉFÉRENCE		Limites		BLANC FORTIFIÉ	Limites		ÉCH. FORTIFIÉ	Limites	
			Dup #1	Dup #2	% d'écart	Blanc de méthode	% Récup.	Inf.	Sup.	% Récup.	Inf.	Sup.	% Récup.	Inf.	Sup.
HAP + Séparation Benzo (b,j,k) fluoranthène (Sol)															
Acénaphtène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	89%	70%	130%	NA	100%	100%	80%	60%	140%
Acénaphtylène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	83%	70%	130%	NA	100%	100%	74%	60%	140%
Anthracène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	89%	70%	130%	NA	100%	100%	81%	60%	140%
Benzo (a) anthracène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	98%	70%	130%	NA	100%	100%	87%	60%	140%
Benzo (a) pyrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	99%	70%	130%	NA	100%	100%	86%	60%	140%
Benzo (e) pyrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	92%	70%	130%	NA	100%	100%	80%	60%	140%
Benzo (b) fluoranthène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	87%	70%	130%	NA	100%	100%	77%	60%	140%
Benzo (j) fluoranthène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	87%	70%	130%	NA	100%	100%	75%	60%	140%
Benzo (k) fluoranthène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	93%	70%	130%	NA	100%	100%	82%	60%	140%
Benzo (c) phénanthrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	93%	70%	130%	NA	100%	100%	81%	60%	140%
Benzo (g,h,i) pérylène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	92%	70%	130%	NA	100%	100%	79%	60%	140%
Chrysène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	91%	70%	130%	NA	100%	100%	79%	60%	140%
Dibenzo (a,h) anthracène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	84%	70%	130%	NA	100%	100%	73%	60%	140%
Dibenzo (a,i) pyrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	115%	70%	130%	NA	100%	100%	101%	60%	140%
Dibenzo (a,h) pyrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	94%	70%	130%	NA	100%	100%	83%	60%	140%
Dibenzo (a,l) pyrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	93%	70%	130%	NA	100%	100%	81%	60%	140%
Diméthyl-7,12 benzo (a) anthracène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	77%	70%	130%	NA	100%	100%	69%	60%	140%
Fluoranthène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	96%	70%	130%	NA	100%	100%	85%	60%	140%
Fluorène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	90%	70%	130%	NA	100%	100%	81%	60%	140%
Indéno (1,2,3-cd) pyrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	81%	70%	130%	NA	100%	100%	71%	60%	140%
Méthyl-3 cholanthrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	121%	70%	130%	NA	100%	100%	109%	60%	140%
Naphtalène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	79%	70%	130%	NA	100%	100%	71%	60%	140%
Phénanthrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	90%	70%	130%	NA	100%	100%	80%	60%	140%
Pyrène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	95%	70%	130%	NA	100%	100%	82%	60%	140%
Méthyl-1 naphtalène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	84%	70%	130%	NA	100%	100%	74%	60%	140%
Méthyl-2 naphtalène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	90%	70%	130%	NA	100%	100%	80%	60%	140%
Diméthyl-1,3 naphtalène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	86%	70%	130%	NA	100%	100%	78%	60%	140%
Triméthyl-2,3,5 naphtalène	1	7347236	< 0.1	< 0.1	0.0	< 0.1	98%	70%	130%	NA	100%	100%	90%	60%	140%
Rec. Acénaphtène-d10	1	7347236	76	73	4.0	84	83%	40%	140%	NA	100%	100%	76%	40%	140%
Rec. Benzo(a)anthracène-d12	1	7347236	82	78	5.0	95	93%	40%	140%	NA	100%	100%	82%	40%	140%
Rec. Pyrène-d10	1	7347236	78	75	3.9	91	88%	40%	140%	NA	100%	100%	78%	40%	140%
Hydrocarbures pétroliers C10-C50 - IPP (Sol)															
Hydrocarbures pétroliers C10 à C50	1	7347236	< 100	< 100	0.0	< 100	103%	70%	130%	NA	100%	100%	108%	60%	140%
Rec. Nonane	1	7347236	94	116	NA	102	105%	40%	140%	NA	100%	100%	100%	40%	140%

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Contrôle de qualité

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

Analyse organique de trace (Suite)

Date du rapport: 2016-01-29			DUPLICATA			MATÉRIAU DE RÉFÉRENCE				BLANC FORTIFIÉ			ÉCH. FORTIFIÉ		
PARAMÈTRE	Lot	N° éch.	Dup #1	Dup #2	% d'écart	Blanc de méthode	% Récup.	Limites		% Récup.	Limites		% Récup.	Limites	
								Inf.	Sup.		Inf.	Sup.		Inf.	Sup.

Certifié par:

Véronique Paré

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Sommaire de méthode

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

PARAMÈTRE	PRÉPARÉ LE	ANALYSÉ LE	AGAT P.O.N.	RÉFÉRENCE DE LITTÉRATURE	TECHNIQUE ANALYTIQUE
Analyse des Sols					
Argent	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Arsenic	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Baryum	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Cadmium	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Chrome	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Cobalt	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Cuivre	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Étain	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Fer	2016-01-27	2016-01-28	MET-161-6106F, 6108F, non accrédité MDDELCC	MA. 200 - Mét 1.2	ICP/MS
Manganèse	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Mercure	2016-01-28	2016-01-28	MET-161-6107F	EPA 245.5	VAPEUR FROIDE/AA
Molybdène	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Nickel	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Plomb	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Sélénium	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS
Zinc	2016-01-27	2016-01-27	MET-161-6106F, 6108F	MA. 200 - Mét 1.2	ICP/MS

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Sommaire de méthode

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

À L'ATTENTION DE: M. MARC MUNGER

PRÉLEVÉ PAR:

LIEU DE PRÉLÈVEMENT:

PARAMÈTRE	PRÉPARÉ LE	ANALYSÉ LE	AGAT P.O.N.	RÉFÉRENCE DE LITTÉRATURE	TECHNIQUE ANALYTIQUE
Analyse organique de trace					
Acénaphtène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Acénaphtylène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Anthracène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Benzo (a) anthracène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Benzo (a) pyrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Benzo (e) pyrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Benzo (b) fluoranthène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Benzo (j) fluoranthène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Benzo (k) fluoranthène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Benzo (c) phénanthrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Benzo (g,h,i) pérylène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Chrysène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Dibenzo (a,h) anthracène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Dibenzo (a,i) pyrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Dibenzo (a,h) pyrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Dibenzo (a,l) pyrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Diméthyl-7,12 benzo (a) anthracène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Fluoranthène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Fluorène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Indéno (1,2,3-cd) pyrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Méthyl-3 cholanthrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Naphtalène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Phénanthrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Pyrène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Méthyl-1 naphtalène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Méthyl-2 naphtalène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Diméthyl-1,3 naphtalène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Triméthyl-2,3,5 naphtalène	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Rec. Acénaphtène-d10	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Rec. Benzo(a)anthracène-d12	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
Rec. Pyrène-d10	2016-01-26	2016-01-26	ORG-160-5102F	MA. 400 - HAP 1.1	GC/MS
% Humidité	2016-01-26	2016-01-27	INOR-161-6006F	MA. 100 - S.T. 1.0	GRAVIMÉTRIE
Hydrocarbures pétroliers C10 à C50	2016-01-26	2016-01-26	ORG-160-5100F	MA. 400 - HYD. 1.1	GC/FID
Rec. Nonane	2016-01-26	2016-01-26	ORG-160-5100F	MA. 400 - HYD. 1.1	GC/FID
IPP	2016-01-26	2016-01-26	ORG-160-5101F	MA. 408 – IdePet 1.0	GC/FID

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Image du chromatogramme

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

À L'ATTENTION DE: M. MARC MUNGER

IMAGE001: 7347214, BH-02-16/VR-1/0,00-0,10

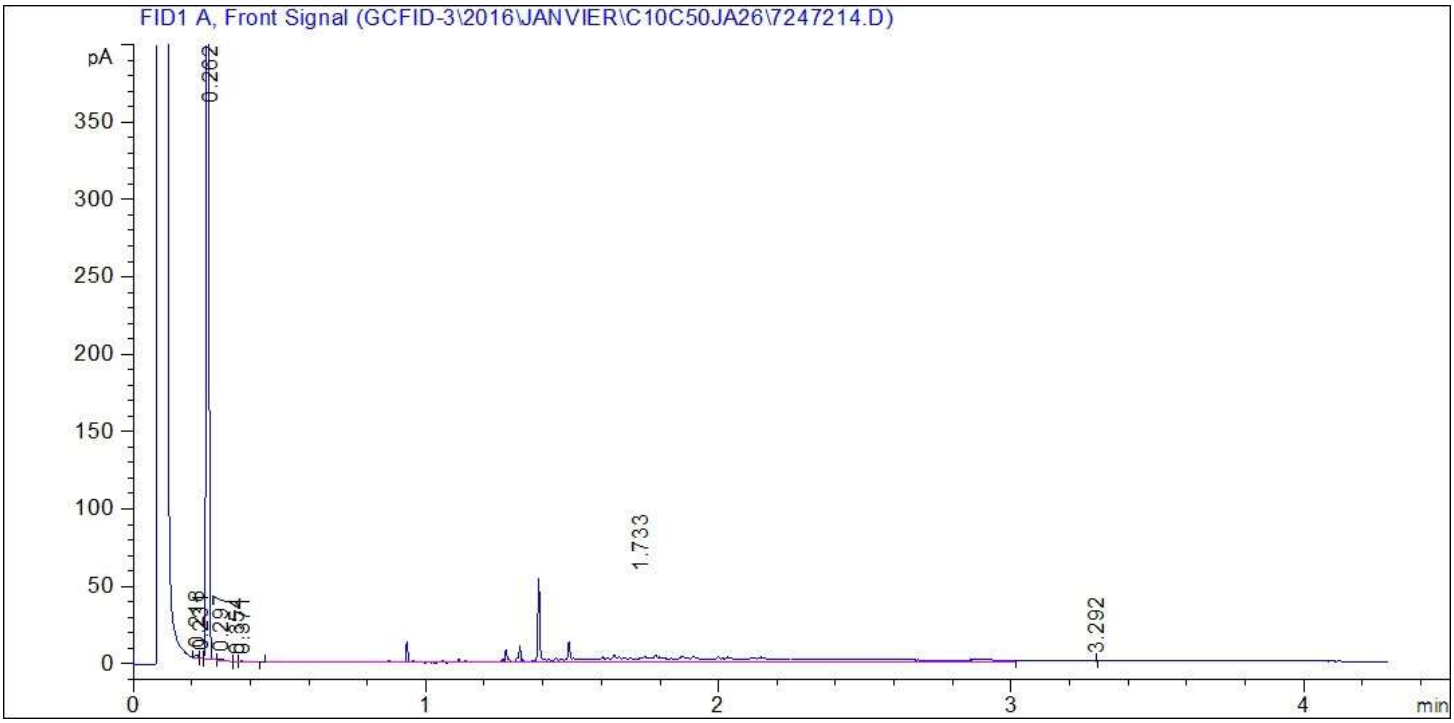

IMAGE002: 7347236, MW-03-16/VR-1/0,00-0,10

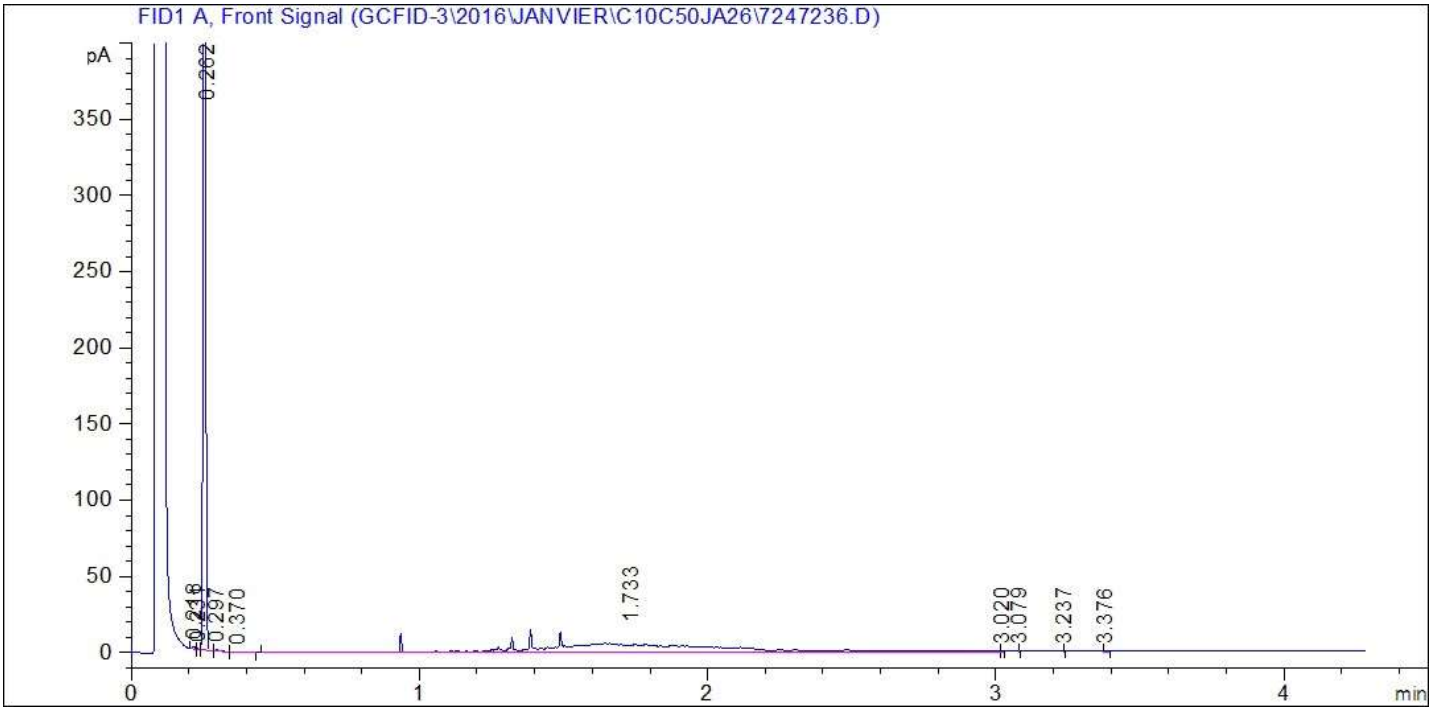

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Image du chromatogramme

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

À L'ATTENTION DE: M. MARC MUNGER

IMAGE003: 7347243, MW-09-16/VR-1/0,00-0,10

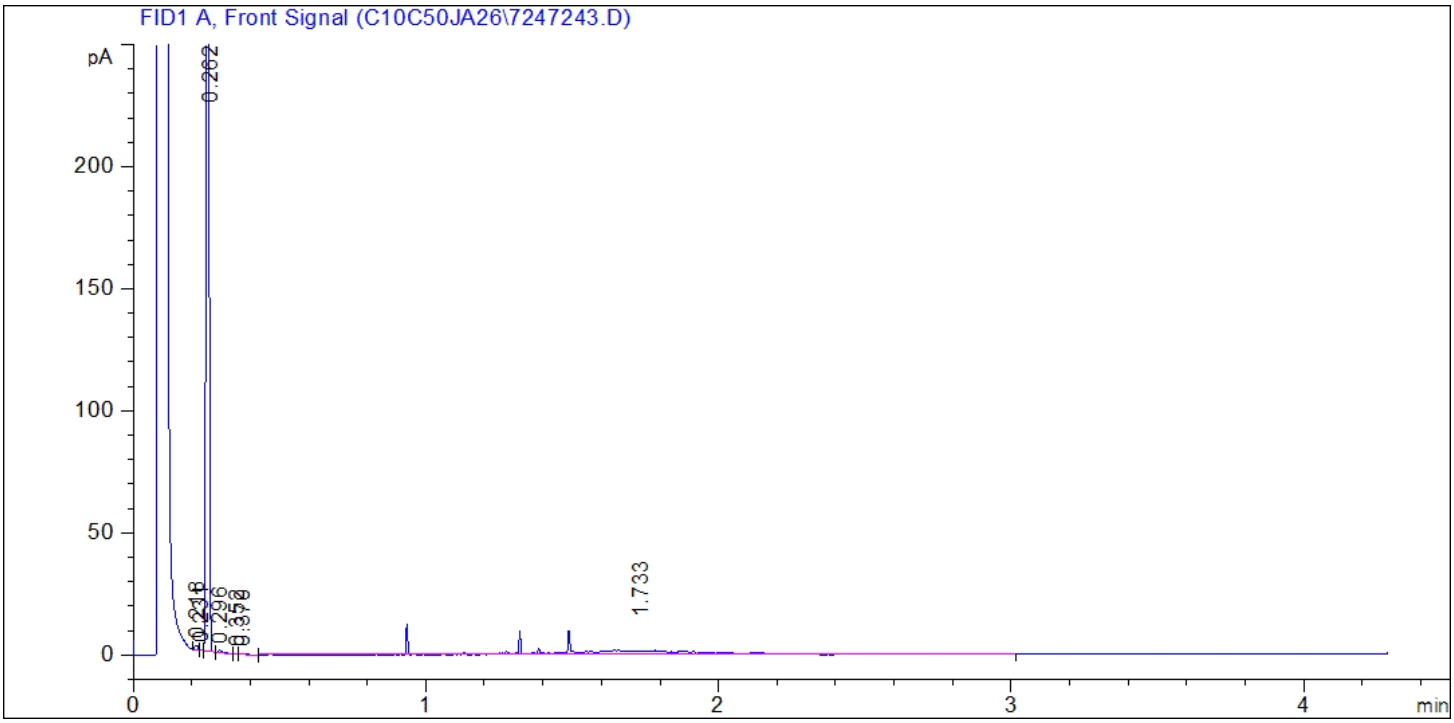
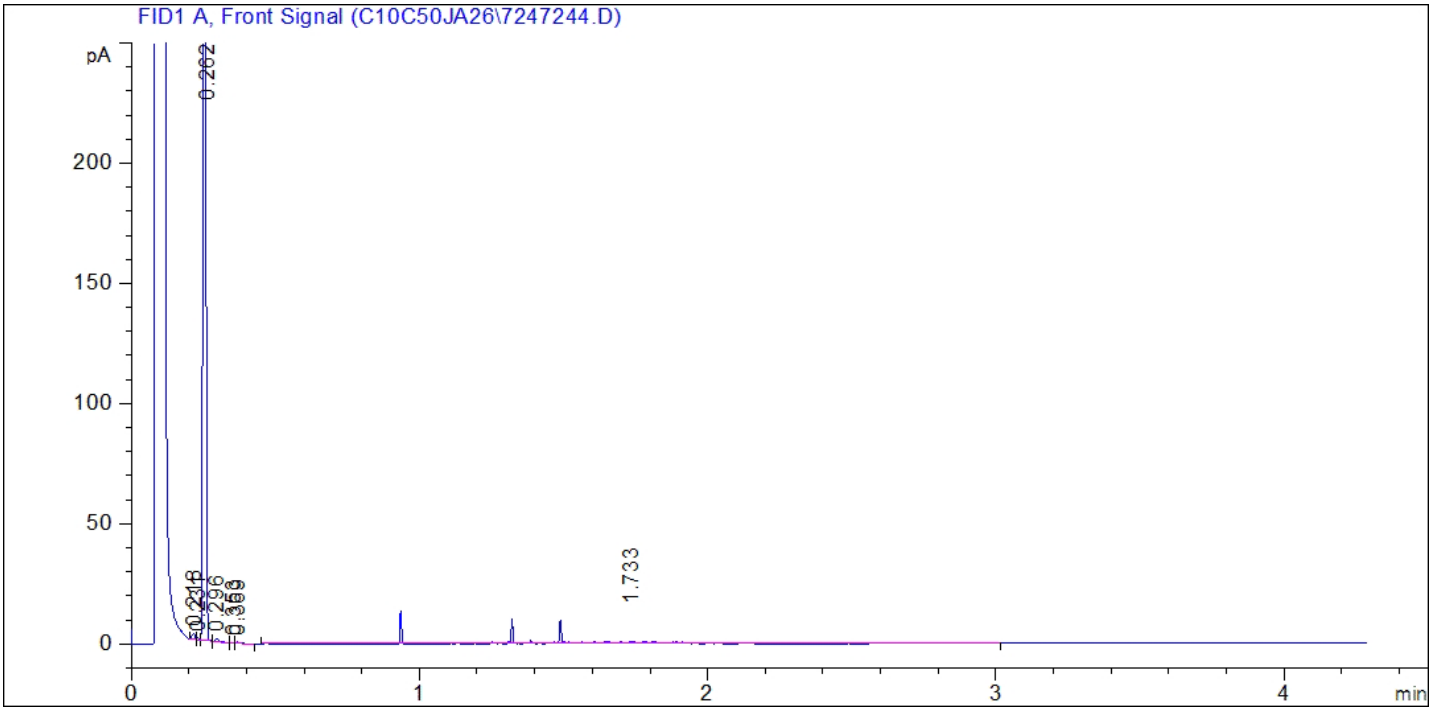


IMAGE004: 7347244, MW-10-16/CF-1/0,00-0,60



Les résultats ne se rapportent qu'aux échantillons soumis pour analyse

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Image du chromatogramme

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC

N° BON DE TRAVAIL: 16A062480

N° DE PROJET: 634451

À L'ATTENTION DE: M. MARC MUNGER

IMAGE005: 7347250, BH-13-16/VR-1/0,00-0,10

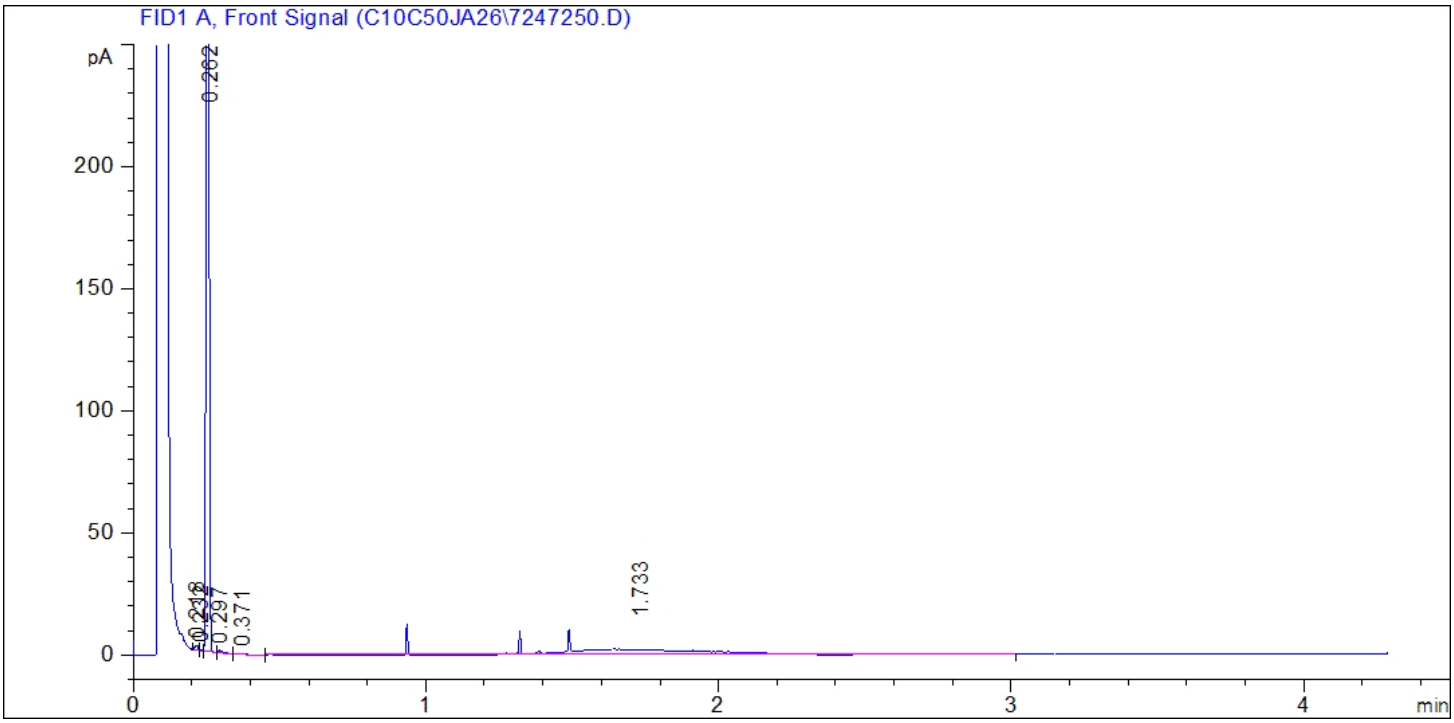
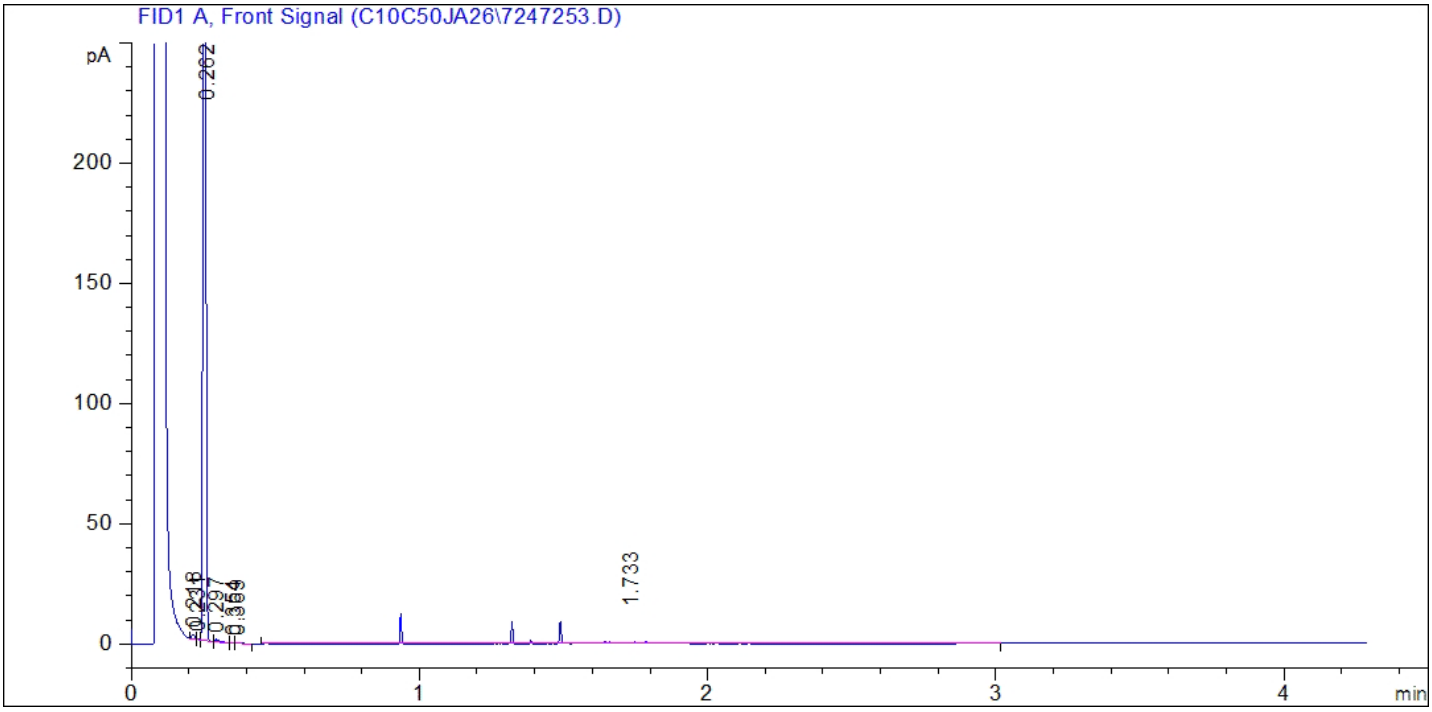


IMAGE006: 7347253, BH-16-16/VR-1/0,00-0,10



Les résultats ne se rapportent qu'aux échantillons soumis pour analyse

Annexe F5 - Stratigraphie simplifiée

Sondage n°[2]	Élévation du sol	Remblai	Terre végétale	Dépôt naturel	Roc (profondeur)	Roc (élévation)	Commentaire
BH-01-16	137,1	--	0,00 à 0,60	0,60 à 10,06	10,06	127,04	Qualité du roc moyenne
BH-02-16	138,39	0,00 à 1,30	--	--	1,30	137,09	--
MW-03A-16	138,66	0,00 à 2,30	--	--	2,30	136,36	--
MW-03B-16	138,66	0,00 à 1,90	--	--	1,90	136,76	--
BH-04-16	139,61	--	0,00 à 1,00	1,00 à 7,30	7,30	132,31	Qualité du roc bonne
BH-05-16	140,10	--	0,00 à 0,40	--	0,40	139,70	Qualité du roc moyenne
BH-06-16	140,78	0,00 à 2,00	--	--	2,00	138,78	--
MW-07-16	140,41	--	0,00 à 0,10	0,10 à 7,45	7,45	132,96	Qualité du roc très mauvaise
BH-08-16	139,63	--	0,00 à 0,10	0,10 à 9,28	9,28	130,35	Qualité du roc excellente
MW-09-16	142,11	0,00 à 3,90	--	--	3,90	138,21	--
MW-10-16 (A-B)	139,41	--	--	0,00 à 7,33	7,33	132,08	Qualité du roc excellente
BH-11-16	141,64	0,00 à 4,50	--	4,50 à >6,30	--	--	Socle rocheux non rencontré
BH-12-16	141,65	0,00 à 5,30	--	5,30 à >5,90	--	--	Socle rocheux non rencontré
BH-13-16	141,73	0,00 à 4,80	--	4,80 à >5,95	--	--	Socle rocheux non rencontré
BH-14-16	141,97	0,00 à 3,20	--	3,20 à 4,20	--	--	Socle rocheux non rencontré
BH-15-16	141,98	0,00 à 4,00	--	--	4,00	137,98	--
BH-16-16	142,16	0,00 à 3,30	--	--	3,30	138,86	--
BH-17-16	142,09	0,00 à 4,50	--	--	5,30	136,79	--
BH-18-16[1]	139,40	--	--	--	--	--	Refus sur un bloc
BH-19-16[1]	139,58	--	--	--	0,85	138,73	Refus sur roc probable
BH-20-16[1]	139,94	--	--	--	--	--	Refus dans le till

Sondage n°[2]	Élévation du sol	Remblai	Terre végétale	Dépôt naturel	Roc (profondeur)	Roc (élévation)	Commentaire
BH-21-16[1]	139,79	--	--	--	--	--	Refus dans le till
BH-22-16[1]	140,3	--	--	--	9,73	130,57	Refus sur roc probable
BH-23-16[1]	139,89	--	--	--	6,81	133,08	Refus sur roc probable
TP-24-16	150,34	--	0,00 à 0,20	--	0,20	150,14	Refus sur roc
TP-25-16	148,78	--	0,00 à 0,10	--	0,10	148,68	Refus sur roc
TP-26-16	146,76	--	0,00 à 0,20	0,20 à 0,40	0,40	146,36	Refus sur roc
TP-27-16	143,79	--	0,00 à 0,60	0,60 à 1,00	1,00 à 1,20	142,79	Refus sur roc, fragmenté de 1,00 à 1,20 m.

Notes 1 : Test de pénétration dynamique
2 : BH : forage;
MW : forage avec installation de puits d'observation de la nappe;
TP : Puits d'exploration.

Appendix F2 – Groundwater Quality

- Piezometric groundwater elevations
- Contamination criteria note of explanation
- Table of analytical results
- Certificates of analysis

Annexe F2.1 Élévations piézométriques des eaux souterraines et résumé de la construction des puits d'observation (tiré de SNC-Lavalin 2016)

Forage n°	Profondeur de la lanterne de sable (m)		Profondeur de l'élément poreux (m)		Profondeur de l'eau p/r au sol (m)	Élévation de l'eau (m)	Type de construction
	De	À	De	À			
MW-03A-16	3,20	12,10	6,10	12,10	8,53	130,130	Élément poreux dans le socle rocheux; En PVC de 51 mm; Crépine.
MW-03B-16	0,60	2,90	0,90	2,60	Sec	sec	Élément poreux dans le remblai; En PVC de 51 mm; Crépine.
MW-07-16	8,00	10,45	9,60	9,90	0,71	139,700	Élément poreux dans le socle rocheux; En PVC de 38 mm; Cellule Cassagrande.
MW-09-16	5,0	14,01	6,50	9,50	Sec	Sec	Élément poreux dans le socle rocheux; En PVC de 51 mm; Crépine.
MW-10-16A	8,33	10,48	10,18	10,48	0,46	138,950	Élément poreux dans le socle rocheux; En PVC de 38 mm; Cellule Cassagrande.
MW-10-16B	0,50	7,33	0,50	6,33	0,61	138,800	Élément poreux dans le dépôt argileux; En PVC de 38 mm; Crépine.

NOTES EXPLICATIVES ACCOMPAGNANT LES TABLEAUX DE RÉSULTATS DES ANALYSES CHIMIQUES DES EAUX

LÉGENDE

ND : Non détecté, résultat inférieur à la limite de détection du laboratoire.

- : Aucune valeur établie par le MDDELCC. L'absence de critère pour un paramètre ne signifie pas qu'il est dans risque pour la santé humaine et l'environnement.

-- : Paramètre non analysé.

CRITÈRES APPLICABLES AUX CAS DE CONTAMINATION DES EAUX

LQM - LIMITE DE QUANTIFICATION : Dans le cas où la limite de quantification (LQM) de la méthode analytique est supérieure à la valeur du critère, cette limite de quantification est tolérée comme seuil à respecter, le critère demeure toutefois l'objectif à atteindre.

EC - Eau de consommation : Critères d'eau de consommation établis par la Politique de protection des sols et de réhabilitation des terrains contaminés du MDDELCC.

RESIE - Eau de surface et égouts : Ces critères constituent les valeurs limites de qualité lors de la résurgence de l'eau souterraine dans l'eau de surface et lors de l'infiltration de l'eau souterraine dans les égouts de la Politique de protection des sols et de réhabilitation des sols contaminés du MDDELCC. La valeur retenue pour chaque paramètre correspond à la plus basse des quatre valeurs suivantes: 1 X CVAA, 100 X CVAC, 100 X CPCO, 100 X CFP, tirées du document « Critères de qualité de l'eau de surface au Québec » (MENV 2001) :

- **CVAA:** Critère de vie aquatique aiguë;
- **CVAC:** Critère de vie aquatique chronique;
- **CPCO:** Critère de prévention de la contamination des organismes aquatiques;
- **CFP:** Critère pour la faune piscivore.

Le terme « égouts » désigne aussi bien les égouts pluviaux, sanitaires ou combinés.

AUTRES CRITÈRES

EAU DE SURFACE **:** Critères de la qualité de l'eau de surface. La valeur retenue pour chaque paramètre correspond à la plus basse des valeurs tirées du document « Critères de qualité de l'eau de surface au Québec » (MENV 2001).

RQEP : Valeur limite applicable selon le règlement sur la qualité de l'eau potable du MDDELCC**.**

SEUIL D'ALERTE **:** Valeur limite correspondant au seuil d'alerte établie pour le projet.

RÉFÉRENCE**:** Politique de protection des sols et de réhabilitation des terrains contaminés 1999, mise à jour et vérifiée sur le site Internet du MDDELCC.

Mise en garde : Si les résultats inscrits dans le tableau diffèrent de ceux inscrits dans les certificats d'analyses du laboratoire, ce sont les résultats inscrits dans les certificats d'analyses du laboratoire qui prévalent.

Paramètre	Unités	LDR	EC	RESIE	BH-07-16	MW-03A-16	MW-03A-16 / DUP	MW-03B-16	MW-07-16	MW-10A-16	MW-10B-16
Date de prélèvement					2016-01-26	2016-05-18	2016-05-18	2016-05-18	2016-05-18	2016-05-18	2016-05-18
HP C10-C50	µg/L	100	-	**3500**	<100	<100	<100	110	<100	<100	<100
HAP											
Acénaphtène	µg/L	0,03 ou 0,1	-	**67**	<0,1	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Anthracène	µg/L	0,03 ou 0,1	-	**11 000 000**	<0,1	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Benzo(a)anthracène	µg/L	0,03 ou 0,1	-	**4,9**	<0,1	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Benzo(a)pyrène	µg/L	0,008 ou 0,01	**0,01**	**4,9**	<0,01	<0,008	<0,008	<0,008	<0,008	<0,008	<0,008
Benzo(b)fluoranthène	µg/L	0,06 ou 0,1	-	**4,9**	<0,1	<0,06	<0,06	<0,06	<0,06	<0,06	<0,06
Benzo(j)fluoranthène	µg/L	0,06 ou 0,1	-	**4,9**	<0,1	<0,06	<0,06	<0,06	<0,06	<0,06	<0,06
Benzo(k)fluoranthène	µg/L	0,06 ou 0,1	-	**4,9**	<0,1	<0,06	<0,06	<0,06	<0,06	<0,06	<0,06
Chrysène	µg/L	0,03 ou 0,1	-	**4,9**	<0,1	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Dibenzo(a,h)anthracène	µg/L	0,03 ou 0,1	-	**4,9**	<0,1	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Fluoranthène	µg/L	0,03 ou 0,1	-	**2,3**	<0,1	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Fluorène	µg/L	0,03 ou 0,1	-	**1 400 000**	<0,1	<0,03	<0,03	<0,03	<0,03	0,08	<0,03
Indéno(1,2,3-cd)pyrène	µg/L	0,03 ou 0,1	-	**4,9**	<0,1	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Naphtalène	µg/L	0,03 ou 0,1	-	**340**	<0,1	<0,03	<0,03	<0,03	0,04	0,1	0,05
Phénanthrène	µg/L	0,03 ou 0,1	-	**30**	<0,1	<0,03	<0,03	<0,03	<0,03	0,22	0,07
Pyrène	µg/L	0,03 ou 0,1	-	**1 100 000**	<0,1	<0,03	<0,03	<0,03	<0,03	<0,03	<0,03
Métaux											
Aluminium dissous	mg/L	0,03 ou 0,01	-	**0,75**	0,131	0,09	0,14	<0,03	<0,03	<0,03	<0,03
Arsenic dissous	mg/L	0,001	**0,025**	**0,34**	<0.001	<0,001	<0,001	0,003	0,002	0,003	0,003
Baryum dissous	mg/L	0,02 ou 0,001	**1**	**5,3**	0,025	0,06	0,06	<0,02	0,04	<0,02	<0,02
Cadmium dissous	mg/L	0,001 ou0,0001	**0,005**	**0,0021**	<0,0001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Calcium dissous	mg/L	0,5 ou 5,0	-	-	22,4	14	14	62	29	63	64
Chrome dissous	mg/L	0,005	**0,05**	-	-	<0,005	<0,005	<0,005	<0,005	<0,005	<0,005
Cobalt dissous	mg/L	0,02 ou 0,0005	-	**0,5**	<0,0005	<0,02	<0,02	<0,02	<0,02	<0,02	<0,02
Cuivre dissous	mg/L	0,003 ou 0,001	**1**	**0,0073**	0,001	<0,003	<0,003	<0,003	<0,003	<0,003	<0,003
Dureté dissoute	mg/L-CaCO3	1	-	-	73,4	56	52	220	94	230	230
Fer dissous	mg/L	0,1 ou 0,02	-	-	0,04	<0,1	<0,1	<0,1	<0,1	<0,1	<0,1
Magnésium dissous	mg/L	0,2 ou 0,05	-	-	4,24	4,9	4,4	16	5,6	17	18
Manganèse dissous	mg/L	0,003 ou 0,001	**0,05**	-	**0,088**	**0,1**	**0,074**	**0,17**	**0,12**	**0,17**	**0,19**
Mercure dissous	mg/L	0,0001	**0,001**	**0,00013**	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001
Molybdène dissous	mg/L	0,01 ou 0,001	**0,07**	**2**	0,007	0,04	0,05	<0,01	<0,01	<0,01	<0,01
Nickel dissous	mg/L	0,01 ou 0,001	**0,02**	**0,26**	0,002	0,01	<0,01	<0,01	<0,01	<0,01	<0,01
Plomb dissous	mg/L	0,001 ou 0,0001	**0,01**	**0,034**	<0,0001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Sélénium dissous	mg/L	0,001	**0,01**	**0,02**	0,001	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
Sodium dissous	mg/L	0,2 ou 5,0	**200**	-	33,8	81	86	16	16	17	18
Titane dissous	mg/L	0,05 ou 0,003	-	-	0,006	<0,05	<0,05	<0,05	<0,05	<0,05	<0,05
Zinc dissous	mg/L	0,005 ou 0,003	**5**	**0,067**	<0,003	0,019	0,011	0,007	0,009	0,009	<0,005
Autres analyses inorganiques											
Azote ammoniacal	mg/L - N	0,02	-	-	0,31	<0,02	<0,02	0,2	<0,02	0,11	0,11
Chlorures	mg/L	0,05 ou 0,5	**250**	**860**	2,2	23	22	5,6	1,2	2,3	2,5
Conductivité (à 25 °C)	mS/cm	0,001 ou 0,002	-	-	0,277	0,47	0,48	0,29	0,23	0,47	0,46
Fluorures	mg/L	0,1 ou 1,0	**1,5**	**4**	<1,0	0,8	1,0	0,2	0,1	0,2	0,2
pH	-	-	-	-	7,67	7,97	8,07	6,97	7,48	7,8	7,85
Phosphore total	mg/L - P	0,01	-	**3**	2,78	1,3	2,2	0,23	1,2	0,11	0,05
Solides dissous totaux	mg/L	10 ou 20	-	-	272	410	350	220	200	310	300
Sulfates	mg/L	0,5	-	-	18,3	97	67	74	14	40	21
Sulfures totaux	mg/L - S-2	0,02	**0,05**	**0,2**	**0,08**	**0,14**	**0,18**	<0,02	**0,07**	**0,06**	0,04
Température (terrain)	°C	-	-	-	nd	5,7	5,7	6,0	7,3	6,4	5,6
Phénols											
2,4-Diméthylphénol	µg/L	0,6 ou 1,0	-	**110**	<1,0	<0,6	<0,6	<0,6	<0,6	<0,6	<0,6
2,4-Dinitrophénol	µg/L	10 ou 1,0	-	**39**	<1,0	<10	<10	<10	<10	<10	<10
2-Méthyl-4,6-dinitrophénol	µg/L	10	-	**6,6**	-	<10	<10	<10	<10	<10	<10
4-Nitrophénol	µg/L	1 ou 1,0	-	**570**	<1,0	<1	<1	<1	<1	<1	<1
Phénol	µg/L	0,6 ou 1,0	-	**490**	2	<0,6	<0,6	<0,6	<0,6	1,7	<0,6
2-Chlorophénol	µg/L	0,5 ou 1,0	-	**100**	<1,0	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5
3-Chlorophénol	µg/L	0,5 ou 1,0	-	**100**	<1,0	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5
4-Chlorophénol	µg/L	0,4 ou 1,0	-	**100**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
2,3-Dichlorophénol	µg/L	0,5 ou 1,0	-	**100**	<1,0	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5
2,4 + 2,5-Dichlorophénol	µg/L	0,3 ou 1,0	**0,3**	**100**	<1,0	<0,3	<0,3	<0,3	<0,3	<0,3	<0,3
2,6-Dichlorophénol	µg/L	0,4 ou 1,0	-	**100**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
3,4-Dichlorophénol	µg/L	0,4 ou 1,0	-	**100**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
3,5-Dichlorophénol	µg/L	0,4 ou 1,0	-	**100**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
Pentachlorophénol	µg/L	0,4 ou 1,0	**30**	**8,7**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
2,3,4,6-Tétrachlorophénol	µg/L	0,4 ou 1,0	**1**	**7**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
2,3,5,6-Tétrachlorophénol	µg/L	0,4 ou 1,0	-	**8,5**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
2,4,5-Trichlorophénol	µg/L	0,4 ou 1,0	-	**46**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
2,4,6-Trichlorophénol	µg/L	0,4 ou 1,0	**2**	**36**	<1,0	<0,4	<0,4	<0,4	<0,4	<0,4	<0,4
o-Crésol	µg/L	1	-	**3800**	2,4	<1	<1	<1	<1	<1	<1
p-Crésol	µg/L	1	-	**620**	2,6	<1	<1	<1	<1	1	<1
HAM											
Benzène	µg/L	0,2	**5**	**590**	nd	-	-	-	-	<0,2	-
Chlorobenzène	µg/L	0,2	**30**	**130**	nd	-	-	-	-	<0,2	-
Dichloro-1,2 benzène	µg/L	0,2	**3**	**70**	nd	-	-	-	-	<0,2	-
Dichloro-1,3 benzène	µg/L	0,1	-	**15 000**	nd	-	-	-	-	<0,1	-
Dichloro-1,4 benzène	µg/L	0,2	**1**	**110**	nd	-	-	-	-	<0,2	-
Ethylbenzène	µg/L	0,1	**2,4**	**420**	nd	-	-	-	-	0,1	-
Styrène	µg/L	0,1	**20**	**190**	nd	-	-	-	-	<0,1	-
Toluène[Note 1]	µg/L	0,1	**24**	**580**	nd	-	-	-	-	**73**[Note 1]	-
Xylènes	µg/L	0,4	**300**	**820**	nd	-	-	-	-	<0,4	-

Note 1 : Les résultats présentés dans ce tableau correspondent aux analyses d'échantillons prélevés le18 mai 2016. Le puits où l'échantillon MW-10A-16 a été prélevés a été sondé de nouveau le 29 juin et les résultats en toluène ont montré une valeur de 12 µg/L, respectant le critère associé à l'eau de consommation (EC). Une campagne d'échantillonnage additionnelle est prévue aux puits MW-03, MW-07 et MW10 le 28 juillet 2016 afin de confirmer les résultats obtenus pour les HAM.

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Certificat d'analyse

N° BON DE TRAVAIL: 16A061773

N° DE PROJET: 634451

NOM DU CLIENT: GROUPE QUALITAS INC.

A L'ATTENTION DE: MME MARTINE CHABOT

PRELEVE PAR:

LIEU DE PRELEVEMENT:

Analyses inorganiques (Eau)

DATE DE RECEPTION: 2016-01-21

DATE DU RAPPORT: 2016-01-27

			IDENTIFICATION DE L'ECHANTILLON:	BH-07-16
			MATRICE:	Eau souterraine
			DATE D'ECHANTILLONNAGE:	2016-01-21
Parametre	**Unites**	**C / N**	**LDR**	**7340420**
Chlorures	mg/L		0.5	2.2
pH	pH		NA	7.67
Solides dissous totaux	mg/L		25	272
Sulfates	mg/L		0.5	18.3

Commentaires: LDR - Limite de detection rapportee; C / N - Criteres Normes

Certifie par:

La procedure des Laboratoires AGAT concernant les signatures et les signataires se conforme strictement aux exigences d'accreditation ISO 17025:2005 comme le requiert, lorsque applicable, CALA, CCN et MDDEFP. Toutes les signatures sur les certificats d'AGAT sont protegees par des mots de passe et les signataires rencontrent les exigences des domaines d'accreditation ainsi que les exigences regionales approuvees par CALA, CCN et MDDEFP.

Cette version remplace et annule toute version, le cas echeant. Ce document ne doit pas etre reproduit, sinon en entier, sans l'autorisation ecrite du laboratoire. Les resultats ne se rapportent qu'aux echantillons soumis pour analyse.

Votre # de commande: Q105389
Votre # du projet: 634451
Adresse du site: NAIC
Votre # Bordereau: E-16-05-18

Attention:Claude Fortin

SNC-Lavalin GEM Québec Inc.
3306, Boulevard St-Francois
Saguenay, QC
CANADA G7X2W9

Date du rapport: 2016/05/31
Rapport: R2145231
Version: 2 - Révisé

CERTIFICAT D'ANALYSE – RÉVISÉ

 # DE DOSSIER MAXXAM: B629520
Reçu: 2016/05/19, 11:13

Matrice: EAU SOUTERRAINE
Nombre d'échantillons reçus: 6

Analyses	Quantité	Date de l' extraction	Date Analysé	Méthode de laboratoire	Référence Primaire
Anions*	6	N/A	2016/05/26	STL SOP-00014	MA300-Ions 1.3 R3 m
Hydrocarbures pétroliers (C10-C50) (1)*	1	2016/05/25	2016/05/26	QUE SOP-00209	MA400–HYD 1.1 R1 m
Hydrocarbures pétroliers (C10-C50) (1)*	5	2016/05/25	2016/05/27	QUE SOP-00209	MA400–HYD 1.1 R1 m
Conductivité (1)*	6	N/A	2016/05/19	QUE SOP-00142	MA.303-TitrAuto 2.1m
Fluorures*	6	N/A	2016/05/26	STL SOP-00038	SM 22 4500-F m
Hydrocarbures aromatiques monocycliques*	1	N/A	2016/05/26	STL SOP-00145	MA400–COV 2.0 R4 m
Métaux dissous par ICP-MS*	1	N/A	2016/05/24	STL SOP-00006	MA200-Mét 1.2 R5 m
Métaux dissous par ICP-MS*	5	N/A	2016/05/25	STL SOP-00006	MA200-Mét 1.2 R5 m
Métaux extractibles totaux par ICP*	6	2016/05/25	2016/05/26	STL SOP-00006	MA200–Mét 1.2 R5 m
Azote ammoniacal*	6	N/A	2016/05/24	STL SOP-00040	MA300–N 2.0 R2 m
Hydrocarbures aromatiques polycycliques (1)*	6	2016/05/25	2016/05/26	QUE SOP-00207	MA403-HPA 4.1 R3 m
pH (1)*	6	N/A	2016/05/19	QUE SOP-00142	MA.303-TitrAuto 2.1m
Composés acides (Phénols)*	6	2016/05/25	2016/05/26	STL SOP-00134	MA400–Phé 1.0 R3 m
Sulfures (exprimés en S2-) (1)*	6	2016/05/27	2016/05/27	QUE SOP-00107	SM 21 4500-S2- D m
Solides totaux dissous*	6	2016/05/25	2016/05/25	STL SOP-00050	MA115–S.D. 1.0 R4 m

Lorsque la méthode de référence comprend un suffixe « m », cela signifie que la méthode d'analyse du laboratoire contient des modifications validées et appliquées afin d'améliorer la performance de la méthode de référence.

Notez: Les données brutes sont utilisées pour le calcul du RPD (% d'écart relatif). L'arrondissement des résultats finaux peut expliquer la variation apparente.

(1) Cette analyse a été effectuée par Maxxam - Québec

* Maxxam détient l'accréditation pour cette analyse selon le programme du MDDELCC.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

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clé de cryptage

Veuillez adresser toute question concernant ce certificat d'analyse à votre chargé(e) de projets
Martine Lepage, M.Sc.A chimiste, Chargée de projets
Courriel: MLepage@maxxam.ca
Téléphone (418)543-3788 Ext:6201

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Maxxam a mis en place des procédures qui protègent contre l'utilisation non autorisée de la signature électronique et emploie les «signataires» requis, conformément à la section 5.10.2 de la norme ISO/CEI 17025:2005(E). Veuillez vous référer à la page des signatures de validation pour obtenir les détails des validations pour chaque division.

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SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105389
Initiales du préleveur: DS

HAP PAR GCMS (EAU SOUTERRAINE)

ID Maxxam		CJ2737	CJ2766	CJ2767	CJ2768	CJ2769	CJ2770		
Date d'échantillonnage		2016/05/18	2016/05/18	2016/05/18	2016/05/18	2016/05/18	2016/05/18		
# Bordereau		E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18		
	Unités	MW-03A-16	MW-03B-16	MW-07-16	MW-10A-16	MW-10B-16	MW-03A-16 / DUP	LDR	Lot CQ
HAP									
Acénaphtène	ug/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	1609482
Anthracène	ug/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	1609482
Benzo(a)anthracène	ug/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	1609482
Benzo(b)fluoranthène	ug/L	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.06	1609482
Benzo(j)fluoranthène	ug/L	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.06	1609482
Benzo(k)fluoranthène	ug/L	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.06	1609482
Benzo(a)pyrène	ug/L	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.008	1609482
Chrysène	ug/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	1609482
Dibenz(a,h)anthracène	ug/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	1609482
Fluoranthène	ug/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	1609482
Fluorène	ug/L	<0.03	<0.03	<0.03	0.08	<0.03	<0.03	0.03	1609482
Indéno(1,2,3-cd)pyrène	ug/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	1609482
Naphtalène	ug/L	<0.03	<0.03	0.04	0.10	0.05	<0.03	0.03	1609482
Phénanthrène	ug/L	<0.03	<0.03	<0.03	0.22	0.07	<0.03	0.03	1609482
Pyrène	ug/L	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	1609482
Récupération des Surrogates (%)									
D10-Anthracène	%	88	93	86	87	89	87	N/A	1609482
D12-Benzo(a)pyrène	%	104	98	100	86	102	97	N/A	1609482
D14-Terphenyl	%	105	107	106	91	105	103	N/A	1609482
D8-Acenaphthylene	%	87	90	83	93	83	84	N/A	1609482
D8-Naphtalène	%	90	95	87	87	88	88	N/A	1609482

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Dossier Maxxam: B629520
Date du rapport: 2016/05/31

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105389
Initiales du préleveur: DS

PHÉNOLS PAR GCMS (EAU SOUTERRAINE)

ID Maxxam		CJ2737	CJ2766	CJ2767	CJ2768	CJ2769	CJ2770		
Date d'échantillonnage		2016/05/18	2016/05/18	2016/05/18	2016/05/18	2016/05/18	2016/05/18		
# Bordereau		E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18		
	Unités	MW-03A-16	MW-03B-16	MW-07-16	MW-10A-16	MW-10B-16	MW-03A-16 / DUP	LDR	Lot CQ
PHÉNOLS									
2,4-Diméthylphénol	ug/L	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	0.6	1609460
2,4-Dinitrophénol	ug/L	<10	<10	<10	<10	<10	<10	10	1609460
2-Méthyl-4,6-dinitrophénol	ug/L	<10	<10	<10	<10	<10	<10	10	1609460
4-Nitrophénol	ug/L	<1	<1	<1	<1	<1	<1	1	1609460
Phénol	ug/L	<0.6	<0.6	<0.6	1.7	<0.6	<0.6	0.6	1609460
2-Chlorophénol	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	1609460
3-Chlorophénol	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	1609460
4-Chlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,3-Dichlorophénol	ug/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	1609460
2,4 + 2,5-Dichlorophénol	ug/L	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.3	1609460
2,6-Dichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
3,4-Dichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
3,5-Dichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
Pentachlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,3,4,6-Tétrachlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,3,5,6-Tétrachlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,4,5-Trichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,4,6-Trichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,3,5-Trichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,3,4-Trichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,3,6-Trichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
2,3,4,5-Tétrachlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
3,4,5-Trichlorophénol	ug/L	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	0.4	1609460
o-Crésol	ug/L	<1	<1	<1	<1	<1	<1	1	1609460
p-Crésol	ug/L	<1	<1	<1	1	<1	<1	1	1609460
Récupération des Surrogates (%)									
D6-Phénol	%	88	91	82	86	87	86	N/A	1609460
Tribromophénol-2,4,6	%	98	98	96	95	96	95	N/A	1609460
Trifluoro-m-crésol	%	93	92	89	90	95	89	N/A	1609460

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HYDROCARBURES PAR GCFID (EAU SOUTERRAINE)

ID Maxxam		CJ2737	CJ2766	CJ2767	CJ2768	CJ2769	CJ2770		
Date d'échantillonnage		2016/05/18	2016/05/18	2016/05/18	2016/05/18	2016/05/18	2016/05/18		
# Bordereau		E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18		
	Unités	MW-03A-16	MW-03B-16	MW-07-16	MW-10A-16	MW-10B-16	MW-03A-16 / DUP	LDR	Lot CQ
HYDROCARBURES PÉTROLIERS									
Hydrocarbures pétroliers (C10-C50)	ug/L	<100	110	<100	<100	<100	<100	100	1609481
Récupération des Surrogates (%)									
1-Chlorooctadécane	%	100	107	107	103	95	89	N/A	1609481

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HAM PAR GC/MS (EAU SOUTERRAINE)

ID Maxxam		CJ2768		
Date d'échantillonnage		2016/05/18		
# Bordereau		E-16-05-18		
	Unités	**MW-10A-16**	**LDR**	**Lot CQ**
VOLATILS				
Benzène	ug/L	<0.2	0.2	1609471
Chlorobenzène	ug/L	<0.2	0.2	1609471
Dichloro-1,2 benzène	ug/L	<0.2	0.2	1609471
Dichloro-1,3 benzène	ug/L	<0.1	0.1	1609471
Dichloro-1,4 benzène	ug/L	<0.2	0.2	1609471
Éthylbenzène	ug/L	0.1	0.1	1609471
Styrène	ug/L	<0.1	0.1	1609471
Toluène	ug/L	73	0.1	1609471
Xylènes (o,m,p)	ug/L	<0.4	0.4	1609471
Récupération des Surrogates (%)				
4-Bromofluorobenzène	%	100	N/A	1609471
D4-1,2-Dichloroéthane	%	99	N/A	1609471
D8-Toluène	%	99	N/A	1609471

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2016/05/31 13:18

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Initiales du préleveur: DS

MÉTAUX DISSOUS (EAU SOUTERRAINE)

ID Maxxam		CJ2737		CJ2766		CJ2767		CJ2768		
Date d'échantillonnage		2016/05/18		2016/05/18		2016/05/18		2016/05/18		
# Bordereau		E-16-05-18		E-16-05-18		E-16-05-18		E-16-05-18		
	Unités	MW-03A-16	Lot CQ	MW-03B-16	Lot CQ	MW-07-16	Lot CQ	MW-10A-16	LDR	Lot CQ
MÉTAUX										
Aluminium (Al)	mg/L	0.09	1609367	<0.03	1608756	<0.03	1609364	<0.03	0.03	1609550
Arsenic (As)	mg/L	<0.001	1609367	0.003	1608756	0.002	1609364	0.003	0.001	1609550
Baryum (Ba)	mg/L	0.06	1609367	<0.02	1608756	0.04	1609364	<0.02	0.02	1609550
Cadmium (Cd)	mg/L	<0.001	1609367	<0.001	1608756	<0.001	1609364	<0.001	0.001	1609550
Calcium (Ca)	mg/L	14	1609367	62	1608756	29	1609364	63	0.5	1609550
Chrome (Cr)	mg/L	<0.005	1609367	<0.005	1608756	<0.005	1609364	<0.005	0.005	1609550
Cobalt (Co)	mg/L	<0.02	1609367	<0.02	1608756	<0.02	1609364	<0.02	0.02	1609550
Cuivre (Cu)	mg/L	<0.003	1609367	<0.003	1608756	<0.003	1609364	<0.003	0.003	1609550
Dureté totale (CaCO3)	mg/L	56	1609367	220	1608756	94	1609364	230	1	1609550
Fer (Fe)	mg/L	<0.1	1609367	<0.1	1608756	<0.1	1609364	<0.1	0.1	1609550
Magnésium (Mg)	mg/L	4.9	1609367	16	1608756	5.6	1609364	17	0.2	1609550
Manganèse (Mn)	mg/L	0.10	1609367	0.17	1608756	0.12	1609364	0.17	0.003	1609550
Mercure (Hg)	mg/L	<0.0001	1609367	<0.0001	1608756	<0.0001	1609364	<0.0001	0.0001	1609550
Molybdène (Mo)	mg/L	0.04	1609367	<0.01	1608756	<0.01	1609364	<0.01	0.01	1609550
Nickel (Ni)	mg/L	0.01	1609367	<0.01	1608756	<0.01	1609364	<0.01	0.01	1609550
Plomb (Pb)	mg/L	<0.001	1609367	<0.001	1608756	<0.001	1609364	<0.001	0.001	1609550
Sélénium (Se)	mg/L	<0.001	1609367	<0.001	1608756	<0.001	1609364	<0.001	0.001	1609550
Sodium (Na)	mg/L	81	1609367	16	1608756	16	1609364	17	0.2	1609550
Titane (Ti)	mg/L	<0.05	1609367	<0.05	1608756	<0.05	1609364	<0.05	0.05	1609550
Zinc (Zn)	mg/L	0.019	1609367	0.007	1608756	0.009	1609364	0.009	0.005	1609550

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Adresse du site: NAIC
Votre # de commande: Q105389
Initiales du préleveur: DS

MÉTAUX DISSOUS (EAU SOUTERRAINE)

ID Maxxam		CJ2769		CJ2770		
Date d'échantillonnage		2016/05/18		2016/05/18		
# Bordereau		E-16-05-18		E-16-05-18		
	Unités	MW-10B-16	Lot CQ	MW-03A-16 / DUP	LDR	Lot CQ
MÉTAUX						
Aluminium (Al)	mg/L	<0.03	1609364	0.14	0.03	1609367
Arsenic (As)	mg/L	0.003	1609364	<0.001	0.001	1609367
Baryum (Ba)	mg/L	<0.02	1609364	0.06	0.02	1609367
Cadmium (Cd)	mg/L	<0.001	1609364	<0.001	0.001	1609367
Calcium (Ca)	mg/L	64	1609364	14	0.5	1609367
Chrome (Cr)	mg/L	<0.005	1609364	<0.005	0.005	1609367
Cobalt (Co)	mg/L	<0.02	1609364	<0.02	0.02	1609367
Cuivre (Cu)	mg/L	<0.003	1609364	<0.003	0.003	1609367
Dureté totale (CaCO3)	mg/L	230	1609364	52	1	1609367
Fer (Fe)	mg/L	<0.1	1609364	<0.1	0.1	1609367
Magnésium (Mg)	mg/L	18	1609364	4.4	0.2	1609367
Manganèse (Mn)	mg/L	0.19	1609364	0.074	0.003	1609367
Mercure (Hg)	mg/L	<0.0001	1609364	<0.0001	0.0001	1609367
Molybdène (Mo)	mg/L	<0.01	1609364	0.05	0.01	1609367
Nickel (Ni)	mg/L	<0.01	1609364	<0.01	0.01	1609367
Plomb (Pb)	mg/L	<0.001	1609364	<0.001	0.001	1609367
Sélénium (Se)	mg/L	<0.001	1609364	<0.001	0.001	1609367
Sodium (Na)	mg/L	18	1609364	86	0.2	1609367
Titane (Ti)	mg/L	<0.05	1609364	<0.05	0.05	1609367
Zinc (Zn)	mg/L	<0.005	1609364	0.011	0.005	1609367

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité

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Dossier Maxxam: B629520
Date du rapport: 2016/05/31

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105389
Initiales du préleveur: DS

MÉTAUX EXTRACTIBLES TOTAUX (EAU SOUTERRAINE)

ID Maxxam		CJ2737	CJ2766	CJ2767	CJ2768	CJ2769	CJ2770		
Date d'échantillonnage		2016/05/18	2016/05/18	2016/05/18	2016/05/18	2016/05/18	2016/05/18		
# Bordereau		E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18	E-16-05-18		
	Unités	MW-03A-16	MW-03B-16	MW-07-16	MW-10A-16	MW-10B-16	MW-03A-16 / DUP	LDR	Lot CQ
MÉTAUX									
Phosphore total	mg/L	1.3	0.23	1.2	0.11	0.05	2.2	0.01	1609480

LDR = Limite de détection rapportée
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2016/05/31 13:18

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PARAMÈTRES CONVENTIONNELS (EAU SOUTERRAINE)

ID Maxxam		CJ2737		CJ2766	CJ2767		CJ2768		CJ2769		
Date d'échantillonnage		2016/05/18		2016/05/18	2016/05/18		2016/05/18		2016/05/18		
# Bordereau		E-16-05-18		E-16-05-18	E-16-05-18		E-16-05-18		E-16-05-18		
	Unités	MW-03A-16	LDR	MW-03B-16	MW-07-16	LDR	MW-10A-16	LDR	MW-10B-16	LDR	Lot CQ
CONVENTIONNELS											
Azote ammoniacal (N-NH3)	mg/L	<0.02	0.02	0.20	<0.02	0.02	0.11	0.02	0.11	0.02	1608585
Conductivité	mS/cm	0.47	0.001	0.29	0.23	0.001	0.47	0.001	0.46	0.001	1607929
Fluorure (F)	mg/L	0.8	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.1	1608368
pH	pH	7.97	N/A	6.97	7.48	N/A	7.80	N/A	7.85	N/A	1607901
Sulfures (exprimés en S2-)	mg/L	0.14	0.02	<0.02	0.07	0.02	0.06	0.02	0.04	0.02	1610721
Chlorures (Cl)	mg/L	23	0.05	5.6	1.2	0.05	2.3	0.05	2.5	0.05	1609513
Sulfates (SO4)	mg/L	97	0.5	74	14	0.5	40	0.5	21	0.5	1609513
Solides dissous totaux	mg/L	410	20	220	200	10	310	20	300	10	1609430

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

ID Maxxam		CJ2770	CJ2770		
Date d'échantillonnage		2016/05/18	2016/05/18		
# Bordereau		E-16-05-18	E-16-05-18		
	Unités	MW-03A-16 / DUP	MW-03A-16 / DUP Dup. de Lab.	LDR	Lot CQ
CONVENTIONNELS					
Azote ammoniacal (N-NH3)	mg/L	<0.02	N/A	0.02	1608585
Conductivité	mS/cm	0.48	0.48	0.001	1607929
Fluorure (F)	mg/L	1.0	N/A	0.1	1608368
pH	pH	8.07	8.10	N/A	1607901
Sulfures (exprimés en S2-)	mg/L	0.18	N/A	0.02	1610721
Chlorures (Cl)	mg/L	22	22	0.05	1609513
Sulfates (SO4)	mg/L	67	67	0.5	1609513
Solides dissous totaux	mg/L	350	N/A	20	1609430

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
Duplicata de laboratoire
N/A = Non Applicable

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Initiales du préleveur: DS

REMARQUES GÉNÉRALES

État des échantillons à l'arrivée: BON

Rapport révisé : Ajout du chrome dans la liste de métaux.

HAP PAR GCMS (EAU SOUTERRAINE)

Veuillez noter que les résultats n'ont été corrigés ni pour la récupération des échantillons de contrôle qualité (blanc fortifié et blanc de méthode), ni pour les surrogates.

Dû à une présence de sédiments, les échantillons « CJ2737, CJ2767 et CJ2770 » furent décantés avant l'analyse.

PHÉNOLS PAR GCMS (EAU SOUTERRAINE)

Veuillez noter que les résultats n'ont été corrigés ni pour la récupération des échantillons de contrôle qualité (blanc fortifié et blanc de méthode), ni pour les surrogates.

Dû à une présence de sédiments, les échantillons « CJ2737, CJ2767, CJ2768 et CJ2770 » furent décantés avant l'analyse.

HYDROCARBURES PAR GCFID (EAU SOUTERRAINE)

Veuillez noter que les résultats n'ont pas été corrigés pour la récupération des échantillons de contrôle de qualité (blanc fortifié et surrogates).
Veuillez noter que les résultats n'ont pas été corrigés pour le blanc de méthode.

Dû à une présence de sédiments, les échantillons « CJ2737 ,CJ2767 et CJ2770 » furent décantés avant l'analyse.

HAM PAR GC/MS (EAU SOUTERRAINE)

Veuillez noter que les résultats n'ont été corrigés ni pour la récupération des échantillons de contrôle qualité (blanc fortifié et blanc de méthode), ni pour les surrogates.

Veuillez noter que les échantillons sont analysés par Headspace GC/MS.

MÉTAUX DISSOUS (EAU SOUTERRAINE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.
Les échantillons CJ2737, CJ2766, CJ2767, CJ2768, CJ2769, CJ2770 ont été filtrés en laboratoire avant l'analyse des métaux.

MÉTAUX EXTRACTIBLES TOTAUX (EAU SOUTERRAINE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.

PARAMÈTRES CONVENTIONNELS (EAU SOUTERRAINE)

Veuillez noter que les résultats n'ont pas été corrigés ni pour la récupération des échantillons de contrôle qualité, ni pour le blanc de méthode.

Les résultats ne se rapportent qu'aux échantillons soumis pour analyse

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Votre # de commande: Q105389
Initiales du préleveur: DS

RAPPORT ASSURANCE QUALITÉ

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
1607901	CB8	MRC	pH	2016/05/19		101	%
1607929	CB8	MRC	Conductivité	2016/05/19		102	%
1607929	CB8	Blanc de méthode	Conductivité	2016/05/19	<0.001		mS/cm
1608368	MR4	Blanc fortifié	Fluorure (F)	2016/05/26		97	%
1608368	MR4	Blanc de méthode	Fluorure (F)	2016/05/26	<0.1		mg/L
1608585	DKH	MRC	Azote ammoniacal (N-NH3)	2016/05/24		92	%
1608585	DKH	Blanc fortifié	Azote ammoniacal (N-NH3)	2016/05/24		100	%
1608585	DKH	Blanc de méthode	Azote ammoniacal (N-NH3)	2016/05/24	<0.02		mg/L
1608756	JS2	Blanc fortifié	Aluminium (Al)	2016/05/24		104	%
			Arsenic (As)	2016/05/24		102	%
			Baryum (Ba)	2016/05/24		98	%
			Cadmium (Cd)	2016/05/24		104	%
			Calcium (Ca)	2016/05/24		102	%
			Chrome (Cr)	2016/05/24		95	%
			Cobalt (Co)	2016/05/24		96	%
			Cuivre (Cu)	2016/05/24		95	%
			Fer (Fe)	2016/05/24		99	%
			Magnésium (Mg)	2016/05/24		100	%
			Manganèse (Mn)	2016/05/24		103	%
			Mercure (Hg)	2016/05/24		102	%
			Molybdène (Mo)	2016/05/24		102	%
			Nickel (Ni)	2016/05/24		98	%
			Plomb (Pb)	2016/05/24		105	%
			Sélénium (Se)	2016/05/24		100	%
			Sodium (Na)	2016/05/24		100	%
			Titane (Ti)	2016/05/24		98	%
			Zinc (Zn)	2016/05/24		100	%
1608756	JS2	Blanc de méthode	Aluminium (Al)	2016/05/24	<0.03		mg/L
			Arsenic (As)	2016/05/24	<0.001		mg/L
			Baryum (Ba)	2016/05/24	<0.02		mg/L
			Cadmium (Cd)	2016/05/24	<0.001		mg/L
			Calcium (Ca)	2016/05/24	<0.5		mg/L
			Chrome (Cr)	2016/05/24	<0.005		mg/L
			Cobalt (Co)	2016/05/24	<0.02		mg/L
			Cuivre (Cu)	2016/05/24	<0.003		mg/L
			Dureté totale (CaCO3)	2016/05/24	<1		mg/L
			Fer (Fe)	2016/05/24	<0.1		mg/L
			Magnésium (Mg)	2016/05/24	<0.2		mg/L
			Manganèse (Mn)	2016/05/24	<0.003		mg/L
			Mercure (Hg)	2016/05/24	<0.0001		mg/L
			Molybdène (Mo)	2016/05/24	<0.01		mg/L
			Nickel (Ni)	2016/05/24	<0.01		mg/L
			Plomb (Pb)	2016/05/24	<0.001		mg/L
			Sélénium (Se)	2016/05/24	<0.001		mg/L
			Sodium (Na)	2016/05/24	<0.2		mg/L
			Titane (Ti)	2016/05/24	<0.05		mg/L
			Zinc (Zn)	2016/05/24	<0.005		mg/L
1609364	MCA	Blanc fortifié	Aluminium (Al)	2016/05/25		101	%
			Arsenic (As)	2016/05/25		105	%
			Baryum (Ba)	2016/05/25		99	%

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SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105389
Initiales du préleveur: DS

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			Cadmium (Cd)	2016/05/25		100	%
			Calcium (Ca)	2016/05/25		97	%
			Chrome (Cr)	2016/05/25		98	%
			Cobalt (Co)	2016/05/25		98	%
			Cuivre (Cu)	2016/05/25		91	%
			Fer (Fe)	2016/05/25		99	%
			Magnésium (Mg)	2016/05/25		100	%
			Manganèse (Mn)	2016/05/25		104	%
			Mercure (Hg)	2016/05/25		98	%
			Molybdène (Mo)	2016/05/25		98	%
			Nickel (Ni)	2016/05/25		99	%
			Plomb (Pb)	2016/05/25		96	%
			Sélénium (Se)	2016/05/25		101	%
			Sodium (Na)	2016/05/25		99	%
			Titane (Ti)	2016/05/25		102	%
			Zinc (Zn)	2016/05/25		98	%
1609364	MCA	Blanc de méthode	Aluminium (Al)	2016/05/25	<0.03		mg/L
			Arsenic (As)	2016/05/25	<0.001		mg/L
			Baryum (Ba)	2016/05/25	<0.02		mg/L
			Cadmium (Cd)	2016/05/25	<0.001		mg/L
			Calcium (Ca)	2016/05/25	<0.5		mg/L
			Chrome (Cr)	2016/05/25	<0.005		mg/L
			Cobalt (Co)	2016/05/25	<0.02		mg/L
			Cuivre (Cu)	2016/05/25	<0.003		mg/L
			Dureté totale (CaCO3)	2016/05/25	<1		mg/L
			Fer (Fe)	2016/05/25	<0.1		mg/L
			Magnésium (Mg)	2016/05/25	<0.2		mg/L
			Manganèse (Mn)	2016/05/25	<0.003		mg/L
			Mercure (Hg)	2016/05/25	<0.0001		mg/L
			Molybdène (Mo)	2016/05/25	<0.01		mg/L
			Nickel (Ni)	2016/05/25	<0.01		mg/L
			Plomb (Pb)	2016/05/25	<0.001		mg/L
			Sélénium (Se)	2016/05/25	<0.001		mg/L
			Sodium (Na)	2016/05/25	<0.2		mg/L
			Titane (Ti)	2016/05/25	<0.05		mg/L
			Zinc (Zn)	2016/05/25	<0.005		mg/L
1609367	MCA	Blanc fortifié	Aluminium (Al)	2016/05/25		103	%
			Arsenic (As)	2016/05/25		103	%
			Baryum (Ba)	2016/05/25		98	%
			Cadmium (Cd)	2016/05/25		100	%
			Calcium (Ca)	2016/05/25		97	%
			Chrome (Cr)	2016/05/25		98	%
			Cobalt (Co)	2016/05/25		98	%
			Cuivre (Cu)	2016/05/25		89	%
			Fer (Fe)	2016/05/25		101	%
			Magnésium (Mg)	2016/05/25		102	%
			Manganèse (Mn)	2016/05/25		114	%
			Mercure (Hg)	2016/05/25		100	%
			Molybdène (Mo)	2016/05/25		98	%
			Nickel (Ni)	2016/05/25		107	%

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RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			Plomb (Pb)	2016/05/25		94	%
			Sélénium (Se)	2016/05/25		100	%
			Sodium (Na)	2016/05/25		98	%
			Titane (Ti)	2016/05/25		100	%
			Zinc (Zn)	2016/05/25		102	%
1609367	MCA	Blanc de méthode	Aluminium (Al)	2016/05/25	<0.03		mg/L
			Arsenic (As)	2016/05/25	<0.001		mg/L
			Baryum (Ba)	2016/05/25	<0.02		mg/L
			Cadmium (Cd)	2016/05/25	<0.001		mg/L
			Calcium (Ca)	2016/05/25	<0.5		mg/L
			Chrome (Cr)	2016/05/25	<0.005		mg/L
			Cobalt (Co)	2016/05/25	<0.02		mg/L
			Cuivre (Cu)	2016/05/25	<0.003		mg/L
			Dureté totale (CaCO3)	2016/05/25	<1		mg/L
			Fer (Fe)	2016/05/25	<0.1		mg/L
			Magnésium (Mg)	2016/05/25	<0.2		mg/L
			Manganèse (Mn)	2016/05/25	<0.003		mg/L
			Mercure (Hg)	2016/05/25	<0.0001		mg/L
			Molybdène (Mo)	2016/05/25	<0.01		mg/L
			Nickel (Ni)	2016/05/25	<0.01		mg/L
			Plomb (Pb)	2016/05/25	<0.001		mg/L
			Sélénium (Se)	2016/05/25	<0.001		mg/L
			Sodium (Na)	2016/05/25	<0.2		mg/L
			Titane (Ti)	2016/05/25	<0.05		mg/L
			Zinc (Zn)	2016/05/25	<0.005		mg/L
1609430	FSI	Blanc fortifié	Solides dissous totaux	2016/05/25		102	%
1609430	FSI	Blanc fortifié DUP	Solides dissous totaux	2016/05/25		101	%
1609430	FSI	Blanc de méthode	Solides dissous totaux	2016/05/25	<10		mg/L
1609460	MA1	Blanc fortifié	D6-Phénol	2016/05/26		98	%
			Tribromophénol-2,4,6	2016/05/26		104	%
			Trifluoro-m-crésol	2016/05/26		101	%
			2,4-Diméthylphénol	2016/05/26		102	%
			4-Nitrophénol	2016/05/26		89	%
			Phénol	2016/05/26		100	%
			2-Chlorophénol	2016/05/26		106	%
			3-Chlorophénol	2016/05/26		107	%
			4-Chlorophénol	2016/05/26		103	%
			2,3-Dichlorophénol	2016/05/26		116	%
			2,4 + 2,5-Dichlorophénol	2016/05/26		110	%
			2,6-Dichlorophénol	2016/05/26		110	%
			3,4-Dichlorophénol	2016/05/26		107	%
			3,5-Dichlorophénol	2016/05/26		108	%
			Pentachlorophénol	2016/05/26		101	%
			2,3,4,6-Tétrachlorophénol	2016/05/26		111	%
			2,3,5,6-Tétrachlorophénol	2016/05/26		110	%
			2,4,5-Trichlorophénol	2016/05/26		111	%
			2,4,6-Trichlorophénol	2016/05/26		107	%
			2,3,5-Trichlorophénol	2016/05/26		107	%
			2,3,4-Trichlorophénol	2016/05/26		110	%
			2,3,6-Trichlorophénol	2016/05/26		116	%

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Votre # de commande: Q105389
Initiales du préleveur: DS

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			2,3,4,5-Tétrachlorophénol	2016/05/26		101	%
			3,4,5-Trichlorophénol	2016/05/26		114	%
			o-Crésol	2016/05/26		107	%
			p-Crésol	2016/05/26		111	%
1609460	MA1	Blanc de méthode	D6-Phénol	2016/05/26		90	%
			Tribromophénol-2,4,6	2016/05/26		105	%
			Trifluoro-m-crésol	2016/05/26		100	%
			2,4-Diméthylphénol	2016/05/26	<0.6		ug/L
			2,4-Dinitrophénol	2016/05/26	<10		ug/L
			2-Méthyl-4,6-dinitrophénol	2016/05/26	<10		ug/L
			4-Nitrophénol	2016/05/26	<1		ug/L
			Phénol	2016/05/26	<0.6		ug/L
			2-Chlorophénol	2016/05/26	<0.5		ug/L
			3-Chlorophénol	2016/05/26	<0.5		ug/L
			4-Chlorophénol	2016/05/26	<0.4		ug/L
			2,3-Dichlorophénol	2016/05/26	<0.5		ug/L
			2,4 + 2,5-Dichlorophénol	2016/05/26	<0.3		ug/L
			2,6-Dichlorophénol	2016/05/26	<0.4		ug/L
			3,4-Dichlorophénol	2016/05/26	<0.4		ug/L
			3,5-Dichlorophénol	2016/05/26	<0.4		ug/L
			Pentachlorophénol	2016/05/26	<0.4		ug/L
			2,3,4,6-Tétrachlorophénol	2016/05/26	<0.4		ug/L
			2,3,5,6-Tétrachlorophénol	2016/05/26	<0.4		ug/L
			2,4,5-Trichlorophénol	2016/05/26	<0.4		ug/L
			2,4,6-Trichlorophénol	2016/05/26	<0.4		ug/L
			2,3,5-Trichlorophénol	2016/05/26	<0.4		ug/L
			2,3,4-Trichlorophénol	2016/05/26	<0.4		ug/L
			2,3,6-Trichlorophénol	2016/05/26	<0.4		ug/L
			2,3,4,5-Tétrachlorophénol	2016/05/26	<0.4		ug/L
			3,4,5-Trichlorophénol	2016/05/26	<0.4		ug/L
			o-Crésol	2016/05/26	<1		ug/L
			p-Crésol	2016/05/26	<1		ug/L
1609471	TS2	Blanc fortifié	4-Bromofluorobenzène	2016/05/25		100	%
			D4-1,2-Dichloroéthane	2016/05/25		84	%
			D8-Toluène	2016/05/25		99	%
			Benzène	2016/05/25		104	%
			Chlorobenzène	2016/05/25		100	%
			Dichloro-1,2 benzène	2016/05/25		104	%
			Dichloro-1,3 benzène	2016/05/25		97	%
			Dichloro-1,4 benzène	2016/05/25		100	%
			Éthylbenzène	2016/05/25		93	%
			Styrène	2016/05/25		93	%
			Toluène	2016/05/25		97	%
			Xylènes (o,m,p)	2016/05/25		98	%
1609471	TS2	Blanc de méthode	4-Bromofluorobenzène	2016/05/25		100	%
			D4-1,2-Dichloroéthane	2016/05/25		82	%
			D8-Toluène	2016/05/25		100	%
			Benzène	2016/05/25	<0.2		ug/L
			Chlorobenzène	2016/05/25	<0.2		ug/L
			Dichloro-1,2 benzène	2016/05/25	<0.2		ug/L

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Dossier Maxxam: B629520
Date du rapport: 2016/05/31

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105389
Initiales du préleveur: DS

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			Dichloro-1,3 benzène	2016/05/25	<0.1		ug/L
			Dichloro-1,4 benzène	2016/05/25	<0.2		ug/L
			Éthylbenzène	2016/05/25	<0.1		ug/L
			Styrène	2016/05/25	<0.1		ug/L
			Toluène	2016/05/25	<0.1		ug/L
			Xylènes (o,m,p)	2016/05/25	<0.4		ug/L
1609480	MCA	Blanc fortifié	Phosphore total	2016/05/26		97	%
1609480	MCA	Blanc de méthode	Phosphore total	2016/05/26	0.01, LDR=0.01		mg/L
1609481	VBO	Blanc fortifié	1-Chlorooctadécane	2016/05/26		99	%
			Hydrocarbures pétroliers (C10-C50)	2016/05/26		91	%
1609481	VBO	Blanc de méthode	1-Chlorooctadécane	2016/05/26		109	%
			Hydrocarbures pétroliers (C10-C50)	2016/05/26	<100		ug/L
1609482	MEP	Blanc fortifié	D10-Anthracène	2016/05/26		77	%
			D12-Benzo(a)pyrène	2016/05/26		95	%
			D14-Terphenyl	2016/05/26		99	%
			D8-Acenaphthylene	2016/05/26		75	%
			D8-Naphtalène	2016/05/26		79	%
			Acénaphtène	2016/05/26		84	%
			Anthracène	2016/05/26		78	%
			Benzo(a)anthracène	2016/05/26		87	%
			Benzo(b)fluoranthène	2016/05/26		92	%
			Benzo(j)fluoranthène	2016/05/26		91	%
			Benzo(k)fluoranthène	2016/05/26		98	%
			Benzo(a)pyrène	2016/05/26		90	%
			Chrysène	2016/05/26		88	%
			Dibenz(a,h)anthracène	2016/05/26		91	%
			Fluoranthène	2016/05/26		82	%
			Fluorène	2016/05/26		84	%
			Indéno(1,2,3-cd)pyrène	2016/05/26		83	%
			Naphtalène	2016/05/26		76	%
			Phénanthrène	2016/05/26		73	%
			Pyrène	2016/05/26		84	%
1609482	MEP	Blanc de méthode	D10-Anthracène	2016/05/26		90	%
			D12-Benzo(a)pyrène	2016/05/26		105	%
			D14-Terphenyl	2016/05/26		107	%
			D8-Acenaphthylene	2016/05/26		85	%
			D8-Naphtalène	2016/05/26		91	%
			Acénaphtène	2016/05/26	<0.03		ug/L
			Anthracène	2016/05/26	<0.03		ug/L
			Benzo(a)anthracène	2016/05/26	<0.03		ug/L
			Benzo(b)fluoranthène	2016/05/26	<0.06		ug/L
			Benzo(j)fluoranthène	2016/05/26	<0.06		ug/L
			Benzo(k)fluoranthène	2016/05/26	<0.06		ug/L
			Benzo(a)pyrène	2016/05/26	<0.008		ug/L
			Chrysène	2016/05/26	<0.03		ug/L
			Dibenz(a,h)anthracène	2016/05/26	<0.03		ug/L
			Fluoranthène	2016/05/26	<0.03		ug/L
			Fluorène	2016/05/26	<0.03		ug/L
			Indéno(1,2,3-cd)pyrène	2016/05/26	<0.03		ug/L

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Dossier Maxxam: B629520
Date du rapport: 2016/05/31

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105389
Initiales du préleveur: DS

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			Naphtalène	2016/05/26	<0.03		ug/L
			Phénanthrène	2016/05/26	<0.03		ug/L
			Pyrène	2016/05/26	<0.03		ug/L
1609513	JL1	Blanc fortifié	Chlorures (Cl)	2016/05/26		96	%
			Sulfates (SO4)	2016/05/26		92	%
1609513	JL1	Blanc de méthode	Chlorures (Cl)	2016/05/26	<0.05		mg/L
			Sulfates (SO4)	2016/05/26	<0.5		mg/L
1609550	JS2	Blanc fortifié	Aluminium (Al)	2016/05/25		105	%
			Arsenic (As)	2016/05/25		104	%
			Baryum (Ba)	2016/05/25		101	%
			Cadmium (Cd)	2016/05/25		101	%
			Calcium (Ca)	2016/05/25		101	%
			Chrome (Cr)	2016/05/25		98	%
			Cobalt (Co)	2016/05/25		96	%
			Cuivre (Cu)	2016/05/25		92	%
			Fer (Fe)	2016/05/25		102	%
			Magnésium (Mg)	2016/05/25		104	%
			Manganèse (Mn)	2016/05/25		106	%
			Mercure (Hg)	2016/05/25		98	%
			Molybdène (Mo)	2016/05/25		102	%
			Nickel (Ni)	2016/05/25		100	%
			Plomb (Pb)	2016/05/25		98	%
			Sélénium (Se)	2016/05/25		101	%
			Sodium (Na)	2016/05/25		101	%
			Titane (Ti)	2016/05/25		102	%
			Zinc (Zn)	2016/05/25		99	%
1609550	JS2	Blanc de méthode	Aluminium (Al)	2016/05/25	<0.03		mg/L
			Arsenic (As)	2016/05/25	<0.001		mg/L
			Baryum (Ba)	2016/05/25	<0.02		mg/L
			Cadmium (Cd)	2016/05/25	<0.001		mg/L
			Calcium (Ca)	2016/05/25	<0.5		mg/L
			Chrome (Cr)	2016/05/25	<0.005		mg/L
			Cobalt (Co)	2016/05/25	<0.02		mg/L
			Cuivre (Cu)	2016/05/25	<0.003		mg/L
			Dureté totale (CaCO3)	2016/05/25	<1		mg/L
			Fer (Fe)	2016/05/25	<0.1		mg/L
			Magnésium (Mg)	2016/05/25	<0.2		mg/L
			Manganèse (Mn)	2016/05/25	<0.003		mg/L
			Mercure (Hg)	2016/05/25	<0.0001		mg/L
			Molybdène (Mo)	2016/05/25	<0.01		mg/L
			Nickel (Ni)	2016/05/25	<0.01		mg/L
			Plomb (Pb)	2016/05/25	<0.001		mg/L
			Sélénium (Se)	2016/05/25	<0.001		mg/L
			Sodium (Na)	2016/05/25	<0.2		mg/L
			Titane (Ti)	2016/05/25	<0.05		mg/L
			Zinc (Zn)	2016/05/25	<0.005		mg/L
1610721	DP3	MRC	Sulfures (exprimés en S2-)	2016/05/27		89	%

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Dossier Maxxam: B629520
Date du rapport: 2016/05/31

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105389
Initiales du préleveur: DS

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
1610721	DP3	Blanc de méthode	Sulfures (exprimés en S2-)	2016/05/27	<0.02		mg/L

LDR = Limite de détection rapportée

MRC: Un échantillon de concentration connue préparé dans des conditions rigoureuses par un organisme externe. Utilisé pour vérifier la justesse de la méthode.

Blanc fortifié: Un blanc, d'une matrice exempte de contaminants, auquel a été ajouté une quantité connue d'analyte provenant généralement d'une deuxième source. Utilisé pour évaluer la précision de la méthode.

Blanc de méthode: Une partie aliquote de matrice pure soumise au même processus analytique que les échantillons, du prétraitement au dosage. Sert à évaluer toutes contaminations du laboratoire.

Surrogate: Composé se comportant de façon similaire aux composés analysés et ajouté à l'échantillon avant l'analyse. Sert à évaluer la qualité de l'extraction.

Réc = Récupération

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Dossier Maxxam: B629520
Date du rapport: 2016/05/31

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
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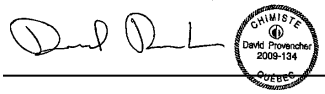
Initiales du préleveur: DS

PAGE DES SIGNATURES DE VALIDATION

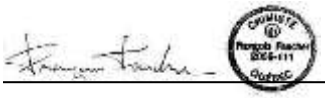
Les résultats analytiques ainsi que les données de contrôle-qualité contenus dans ce rapport furent vérifiés et validés par les personnes suivantes:

Caroline Bougie, B.Sc. Chimiste

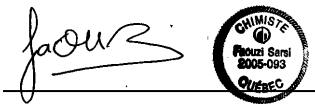
Dochka Koleva Hristova, B.Sc., Chimiste



David Provencher, B.Sc., Chimiste, Québec



Francois Faucher, B.Sc., Chimiste



Faouzi Sarsi, B. Sc. Chimiste

Kathie Quevillon, B.Sc., Chimiste

Marilyn Blanc, B.Sc., Chimiste

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Dossier Maxxam: B629520
Date du rapport: 2016/05/31

SNC-Lavalin GEM Québec Inc.
Votre # du projet: 634451
Adresse du site: NAIC
Votre # de commande: Q105389
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PAGE DES SIGNATURES DE VALIDATION (SUITE)

Les résultats analytiques ainsi que les données de contrôle-qualité contenus dans ce rapport furent vérifiés et validés par les personnes suivantes:

Veronic Beausejour, B.Sc., Chimiste, Superviseur

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AGAT Laboratoires

350, rue Franquet
Quebec, Quebec
CANADA G1P 4P3
TEL (418)266-5511
FAX (418)653-2335
http://www.agatlabs.com

Certificat d'analyse

N° BON DE TRAVAIL: 16A062958
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
A L'ATTENTION DE: MME MARTINE CHABOT
PRELEVE PAR:
LIEU DE PRELEVEMENT:

HAP + Separation Benzo (b,j,k) fluoranthene (Eau)

DATE DE RECEPTION: 2016-01-26
DATE DU RAPPORT: 2016-02-03

	IDENTIFICATION DE L'ECHANTILLON:			BH-07-16
	MATRICE:			eau souterraine
	DATE D'ECHANTILLONNAGE:			2016-01-26
Parametre	Unites	C / N	LDR	7350542
Acenaphtene	µg/L		0.1	<0.1
Anthracene	µg/L		0.1	<0.1
Benzo (a) anthracene	µg/L		0.1	<0.1
Benzo (a) pyrene	µg/L		0.01	<0.01
Benzo (b) fluoranthene	µg/L		0.1	<0.1
Benzo (j) fluoranthene	µg/L		0.1	<0.1
Benzo (k) fluoranthene	µg/L		0.1	<0.1
Chrysene	µg/L		0.1	<0.1
Dibenzo (a,h) anthracene	µg/L		0.1	<0.1
Fluoranthene	µg/L		0.1	<0.1
Fluorene	µg/L		0.1	<0.1
Indeno (1,2,3-cd) pyrene	µg/L		0.1	<0.1
Naphtalene	µg/L		0.1	<0.1
Phenanthrene	µg/L		0.1	<0.1
Pyrene	µg/L		0.1	<0.1
Etalon de recouvrement	Unites		Limites	
Rec. Acenaphtene-d10	%		40-140	84
Rec. Benzo(a)anthracene-d12	%		40-140	108
Rec. Pyrene-d10	%		40-140	99

Commentaires: LDR - Limite de detection rapportee; C / N - Criteres Normes

Certifie par: Véronique Paré

La procedure des Laboratoires AGAT concernant les signatures et les signataires se conforme strictement aux exigences d'accreditation ISO 17025:2005 comme le requiert, lorsque applicable, CALA, CCN et MDDEFP. Toutes les signatures sur les certificats d'AGAT sont protegees par des mots de passe et les signataires rencontrent les exigences des domaines d'accreditation ainsi que les exigences regionales approuvees par CALA, CCN et MDDEFP.

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062958
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
A L'ATTENTION DE: MME MARTINE CHABOT

PRELEVE PAR:
LIEU DE PRELEVEMENT:

Hydrocarbures petroliers C10-C50 - IPP (Eau)

DATE DE RECEPTION: 2016-01-26
DATE DU RAPPORT: 2016-02-03

			IDENTIFICATION DE L'ECHANTILLON:	BH-07-16
			MATRICE:	eau souterraine
			DATE D'ECHANTILLONNAGE:	2016-01-26
Parametre	Unites	C / N	LDR	7350542
Hydrocarbures petroliers C10 a C50	µg/L		100	<100
IPP	NA		NA	NA

Commentaires: LDR - Limite de detection rapportee; C / N - Criteres Normes

Certifie par: Véronique Paré

La procedure des Laboratoires AGAT concernant les signatures et les signataires se conforme strictement aux exigences d'accreditation ISO 17025:2005 comme le requiert, lorsque applicable, CALA, CCN et MDDEFP. Toutes les signatures sur les certificats d'AGAT sont protegees par des mots de passe et les signataires rencontrent les exigences des domaines d'accreditation ainsi que les exigences regionales approuvees par CALA, CCN et MDDEFP.

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062958
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
A L'ATTENTION DE: MME MARTINE CHABOT
PRELEVE PAR:
LIEU DE PRELEVEMENT:

Phenols (eau)

DATE DE RECEPTION: 2016-01-26
DATE DU RAPPORT: 2016-02-03

	IDENTIFICATION DE L'ECHANTILLON:			BH-07-16
	MATRICE:			eau souterraine
	DATE D'ECHANTILLONNAGE:			2016-01-26
Parametre	Unites	C / N	LDR	7350542
ortho-Cresol	µg/L		1.0	2.4
para-Cresol	µg/L		1.0	2.6
m-Cresol	µg/L		1.0	1.3
2,4-dimethylphenol	µg/L		1.0	<1.0
4-nitrophenol	µg/L		1.0	<1.0
Phenol	µg/L		1.0	2.0
2-chlorophenol	µg/L		1.0	<1.0
3-chlorophenol	µg/L		1.0	<1.0
4-chlorophenol	µg/L		1.0	<1.0
2,3-dichlorophenol	µg/L		1.0	<1.0
2,4 + 2,5-dichlorophenol	µg/L		1.0	<1.0
2,6-dichlorophenol	µg/L		1.0	<1.0
3,4-dichlorophenol	µg/L		1.0	<1.0
3,5-dichlorophenol	µg/L		1.0	<1.0
Pentachlorophenol	µg/L		1.0	<1.0
2,3,4,6-tetrachlorophenol	µg/L		1.0	<1.0
2,3,5,6-tetrachlorophenol	µg/L		1.0	<1.0
2,4,5-trichlorophenol	µg/L		1.0	<1.0
2,4,6-trichlorophenol	µg/L		1.0	<1.0
Sommation des composes phenoliques chlores	µg/L		1.0	<1.0
Etalon de recouvrement	Unites	Limites		
Phenol-D5	%	40-140		89
2-Fluorophenol	%	40-140		82
2,6-dibromophenol	%	40-140		74
2,4,6-tribromophenol	%	40-140		72

Certifie par: Véronique Paré

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AGAT Laboratoires

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FAX (418)653-2335
http://www.agatlabs.com

Certificat d'analyse

N° BON DE TRAVAIL: 16A062958
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
A L'ATTENTION DE: MME MARTINE CHABOT

PRELEVE PAR:
LIEU DE PRELEVEMENT:

Phenols (eau)

DATE DE RECEPTION: 2016-01-26
DATE DU RAPPORT: 2016-02-03

Commentaires: LDR - Limite de detection rapportee; C / N - Criteres Normes

7350542 Le blanc est contamine en phenol, il a ete soustrait des echantillons.

L'analyse est realisee au laboratoire AGAT de Montreal.

Certifie par: Véronique Paré

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062958
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
A L'ATTENTION DE: MME MARTINE CHABOT

PRELEVE PAR:
LIEU DE PRELEVEMENT:

Analyses Inorganiques

DATE DE RECEPTION: 2016-01-26
DATE DU RAPPORT: 2016-02-03

			IDENTIFICATION DE L'ECHANTILLON:	BH-07-16
			MATRICE:	eau souterraine
			DATE D'ECHANTILLONNAGE:	2016-01-26
Parametre	Unites	C / N	LDR	7350542
Azote ammoniacal	mg/L - N		0.05	0.31
Conductivite (a 25 degre Celcius)	µmhos/cm		2	277
Fluorures	mg/L		1.0	<1.0
Phosphore total	mg/L - P		0.02	2.78
Sulfures totaux	mg/L S-2		0.02	0.08

Commentaires: LDR - Limite de detection rapportee; C / N - Criteres Normes
7350542 L'analyse des sulfures totaux est realisee au laboratoire AGAT de Montreal.

Certifie par:

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Certificat d'analyse

N° BON DE TRAVAIL: 16A062958
N° DE PROJET: 634451

NOM DU CLIENT: SNC-LAVALIN GEM QUEBEC INC
A L'ATTENTION DE: MME MARTINE CHABOT
PRELEVE PAR:
LIEU DE PRELEVEMENT:

Balayage - Metaux dissous + durete

DATE DE RECEPTION: 2016-01-26
DATE DU RAPPORT: 2016-02-03

	IDENTIFICATION DE L'ECHANTILLON:			BH-07-16
	MATRICE:			eau souterraine
	DATE D'ECHANTILLONNAGE:			2016-01-26
Parametre	Unites	C / N	LDR	7350542
Aluminium dissous	µg/L		10	131
Arsenic dissous	µg/L		1	1
Baryum dissous	µg/L		1	25
Cadmium dissous	µg/L		0.1	<0.1
Calcium dissous	µg/L		5000	22400
Cobalt dissous	µg/L		0.5	<0.5
Cuivre dissous	µg/L		1.0	1.0
Fer dissous	µg/L		20	40
Magnesium dissous	µg/L		50	4240
Manganese dissous	µg/L		1	88
Mercure dissous	µg/L		0.1	<0.1
Molybdene dissous	µg/L		1	7
Nickel dissous	µg/L		1	2
Plomb dissous	µg/L		0.1	<0.1
Selenium dissous	µg/L		1	1
Sodium dissous	µg/L		5000	33800
Titane dissous	µg/L		2	6
Zinc dissous	µg/L		3	<3
Durete dissoute	µg/L - CaCO3		1000	73400

Commentaires: LDR - Limite de detection rapportee; C / N - Criteres Normes

7350542 La durete dissoute a ete evaluee en fonction des teneurs en calcium dissous et magnesium dissous dans l'eau.

Certifie par:

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Appendix F3 – Calculation of the DRASTIC Vulnerability Index

A.8 ÉVALUATION DE LA VULNÉRABILITÉ DE LA FORMATION HYDROGÉOLOGIQUE

INTRODUCTION DE LA MÉTHODE DRASTIC

L'évaluation de la vulnérabilité de l'aquifère a été déterminée à partir de la méthode DRASTIC (USEPA, 1987). Cette méthode évalue la vulnérabilité des eaux souterraines par un système d'indices pondérés. Elle repose sur trois hypothèses fondamentales :

- La source de contamination potentielle est localisée en surface du sol ;
- Les contaminants sont entraînés depuis la surface du sol jusqu'à l'aquifère par l'infiltration efficace, soit verticalement ;
- Le type de contaminant n'intervient pas dans la définition de la vulnérabilité, c'est-à-dire que le contaminant est considéré comme possédant la même mobilité que l'eau.

L'évaluation de la vulnérabilité s'effectue en deux étapes. La première consiste à déterminer les unités hydrostratigraphiques à partir des caractéristiques qui influencent l'écoulement des eaux souterraines depuis la surface du sol jusqu'à la formation aquifère et jusqu'à l'intérieur de l'aquifère. Par la suite, l'indice DRASTIC de chaque unité est calculé par la somme pondérée des cotes attribuées à chacune des caractéristiques évaluées.

Le calcul de l'indice DRASTIC a été effectué pour le terrain où la future usine sera implantée, sans considérer la portion qui ne sera pas développée.

DÉTERMINATION DES UNITÉS HYDROSTRATIGRAPHIQUES

La description des unités hydrostratigraphiques est donnée à section 3.2.2 du présent rapport réalisée par SNC-Lavalin inc.

D'après cette description, l'unité hydrostratigraphiques présente dans la zone d'étude, est :

- La formation de roc constitué de gneiss et de paragneiss gris foncé ainsi que de granite rose (granite de La Baie) avec des fractures sub-verticales, horizontales et sub-horizontales.

Selon le secteur, le roc est soit affleurant ou recouvert d'un dépôt argileux variant de 0.6 à 10 m d'épaisseur.

A.8 CALCUL DE L'INDICE DRASTIC

L'indice DRASTIC est calculé à partir de sept (7) paramètres physiques qui interviennent dans le processus de transport et d'atténuation des contaminants :

› Profondeur de l'eau (**D**epth of water). Source d'information utilisée : Section *3.2.2. sur les Conditions hydrogéologiques de l'eau souterraine* ;

› Recharge annuelle (net **R**echarge). Sources d'informations utilisées : Sections du rapport 2.3.3.2 (topographie), 3.2.1 (stratigraphie des sols), 3.2.2 (conditions hydrogéologiques de l'eau souterraine) et les archives du site Internet de Météomédia pour la base de Bagotville ;

› Milieu aquifère (**A**quifer media). Sources d'informations utilisées : les résultats des forages réalisés sur le site ;

› Type de sol (**S**oil media). Sources d'informations utilisées : les résultats des forages réalisés sur le site ;

› Pente du terrain (**T**opography). Source d'information utilisée : Image LIDAR acquise lors des travaux de construction de la plateforme et l'arpentage réalisé dans le présent mandat ;

› Zone vadose (**I**mpact vadose zone). Sources d'informations utilisées : les résultats des forages réalisés sur le site;

› Conductivité hydraulique (hydraulic **C**onductivity of the aquifer). Source d'information utilisée : Section *3.2.2. sur les Conditions hydrogéologiques de l'eau souterraine*;

Une cote est attribuée à chacun des paramètres. L'indice DRASTIC propre à chaque unité hydrogéologique est obtenu par la somme pondérée des différentes cotes. Les facteurs de pondération utilisés sont ceux définis par la méthode et traduisent l'importance de chacun des paramètres dans les processus de transport et d'atténuation des contaminants. De façon générale, l'indice final DRASTIC varie entre 23 et 226. La classification de l'indice DRASTIC utilisée est celle adaptée par Fréchette – 1987. Les résultats sont récapitulés au tableau A.2.1.

L'indice DRASTIC a été calculé pour la formation rocheuse sous deux scénarios soient affleurant ou recouvert d'un dépôt argileux.

L'indice DRASTIC est estimé de 108 pour le roc recouvert d'un dépôt argileux et de 156 pour roc affleurant. Ces résultats qualifient la vulnérabilité de l'aquifère rocheux de moyen selon le cas.

Le calcul de l'indice DRASTIC est basé sur les données disponibles, soit en l'occurrence les informations obtenues dans la bibliographie ou sur des terrains voisins, limitant ainsi la précision de l'évaluation de la vulnérabilité. Néanmoins, le calcul effectué permet d'obtenir un résultat

représentatif de l'évaluation de la vulnérabilité qui tient compte du contexte climatique, physique, géologique et hydrogéologique du secteur.

L'indice de vulnérabilité des aquifères est estimé en mode absolu et ne tient pas compte notamment des futurs aménagements qui sont prévus sur le site et qui minimiseront les impacts potentiels. En effet, les impacts potentiels sur les aquifères, incluant celui de surface qui est le plus vulnérable, seront amoindris par la diminution de la recharge, dû au fait que plusieurs surfaces de l'usine seront imperméabilisées par l'installation de structures, dalles de béton, asphalte, etc. De plus, tous les moyens seront mis en place pour protéger les endroits les plus susceptibles de subir un déversement de produit avec l'installation de bassins de rétention ou autres structures de confinement.

Tableau A.2.1 Calcul de l'indice de vulnérabilité DRASTIC pour l'aquifère rocheux

Paramètres	Description	Recouvert d'argile			Description	Affleurant ou recouvert d'un sol mince		
		Cote	Poids	Total		Cote	Poids	Total
Profondeur de l'eau	Selon profondeur du roc qui varie de 2.0 à 10.0 m	9	5	45	0.6 m	10	5	50
Recharge annuelle	entre 10 et 18 cm / année	6	4	24	entre 10 et 18 cm / année	6	4	24
Unité hydrostratigraphique	Métamorphique ou ignée (granite ou gneiss)	3	3	9	Métamorphique ou ignée (granite ou gneiss)	3	3	9
Sol	Argile silteuse	1	2	2	Sol mince sur roc	10	2	20
Pente	0 à 2 %	10	1	10	0 à 2 %	10	1	10
Zone non saturée	Silt et argile	3	5	15	Métamorphique ou ignée (granite ou gneiss)	8	5	40
Conductivité hydraulique	Granite ou gneiss fracturé (<4 m/j ou 5^{E}-3 cm/sec)	1	3	3	Granite ou gneiss fracturé (<4 m/j ou 5^{E}-3 cm/sec)	1	3	3
Total -- Indice DRASTIC				**108**				**156**

Appendix G

Biological Species (French only)

Tableau 1 Mammifères susceptibles de fréquenter la zone d'étude1

Nom français	Nom la tin	Statut particulier[2]	Prés ence confirmée [3]
Grande Faune			
Cerf de Virginie	*Odocoileus virginianus*		
Orignal	*Alces americanus*		X
Ours noir	*Ursus americanus*		X
Petite Faune			
Castor	*Castor canadensis*		X
Coyote	*Canis latrans*		
Lièvre d'Amérique	*Lepus americanus*		X
Loup gris	*Canis lupus*		
Loutre de rivière	*Lontra canadensis*		
Lynx du Canada	*Lynx canadensis*		
Marmotte commune	*Marmota monax*		
Martre d'Amérique	*Martes americana*		
Mouffette rayée	*Mephitis mephitis*		
Pékan	*Martes pennanti*		
Porc-épic d'Amérique	*Erethizon dorsatum*		
Raton laveur	*Procyon lotor*		
Renard roux	*Vulpes vulpes*		
Tamia rayé	*Tamias striatus*		
Vison d'Amérique	*Neovison vison*		
Micromammifères			
Belette pygmée	*Mustela nivalis*	X	
Campagnol à dos roux de Gapper	*Myodes gapperi*		
Campagnol des champs	*Microtus pennsylvanicus*		X
Campagnol des rochers	*Microtus chrotorrhinus*	X	
Campagnol-lemming de Cooper	*Synaptomys cooperi*	X	
Condylure à nez étoilé	*Condylura cristata*		
Écureuil roux	*Tamiasciurus hudsonicus*		X
Grand polatouche	*Glaucomys sabrinus*		
Grande musaraigne	*Blarina brevicauda*		X
Hermine	*Mustela erminea*		
Musaraigne cendrée	*Sorex cinereus*		X
Musaraigne fuligineuse	*Sorex fumeus*		
Musaraigne palustre	*Sorex palustris*		
Musaraigne pygmée	*Sorex hoyi*		
Phénacomys	*Phenacomys intermedius*		
Rat musqué	*Ondatra zibethicus*		
Rat surmulot	*Rattus norvegicus*		
Souris commune	*Mus musculus*		
Souris sauteuse des bois	*Napoeozapus insignis*		
Souris sauteuse des champs	*Zapus hudsonius*		X
Souris sylvestre	*Peromyscus maniculatus*		X
Chauves-souris			
Chauve-souris argentée	*Lasionycteris noctivagans*	X	
Chauve-souris cendrée	*Lasiurus cinereus*	X	
Chauve-souris nordique	*Myotis septentrionalis*	X	
Chauve-souris rousse	*Lasiurus borealis*	X	
Grande chauve-souris brune	*Eptesicus fuscus*	X	
Petite chauve-souris brune	*Myotis lucifugus*	X	
Pipistrelle de l'Est	*Perimyotis subflavus*	X	

1. Selon Desrosiers et coll. (2002), MFFP (2016), Prescott et Richard (2013), Jutras et coll. (2012).
2. Selon la Loi sur les espèces menacées ou vulnérables (LEMV, provincial) ou la *Loi sur les espèces en péril* (LEP,fédéral)
3. GENIVAR (2013), GroupeHemisphères (2012), CDPNQ (2016b).

Tableau 2 Espèces d'oiseaux nicheurs dans la zone d'étude ou à proximité1

Nom français[2]	Nom latin	Catégorie de nidification
Canard chipeau	*Anas strepera*	POSS
Canard noir	*Anas rubripes*	CONF
Canard colvert	*Anas platyrhynchos*	CONF
Canard souchet	*Anas clypeata*	CONF
Fuligule à collier	*Aythya collaris*	POSS
Garrot à oeil d'or	*Bucephala clangula*	CONF
Grand Harle	*Mergus merganser*	CONF
Gélinotte huppée	*Bonasa umbellus*	CONF
Plongeon huard	*Gavia immer*	POSS
Urubu à tête rouge	*Cathartes aura*	POSS
Busard Saint-Martin	*Circus cyaneus*	POSS
Petite Buse	*Buteo platypterus*	POSS
Faucon émerillon	*Falco columbarius*	POSS
Faucon pèlerin	*Falco peregrinus anatum*	CONF
Pluvier kildir	*Charadrius vociferus*	CONF
Chevalier grivelé	*Actitis macularius*	POSS
Bécasse d'Amérique	*Scolopax minor*	POSS
Tourterelle triste	*Zenaida macroura*	CONF
Coulicou à bec noir	*Coccyzus erythropthalmus*	POSS
Grand-duc d'Amérique	*Bubo virginianus*	POSS
Petite Nyctale	*Aegolius acadicus*	POSS
Colibri à gorge rubis	*Archilochus colubris*	PROB
Pic maculé	*Sphyrapicus varius*	POSS
Pic mineur	*Picoides pubescens*	CONF
Pic chevelu	*Picoides villosus*	PROB
Pic flamboyant	*Colaptes auratus*	POSS
Grand Pic	*Dryocopus pileatus*	POSS
Pioui de l'Est	*Contopus virens*	POSS
Moucherolle à ventre	*Empidonax flaviventris*	PROB
Moucherolle des	*Empidonax alnorum*	POSS
Moucherolle tchébec	*Empidonax minimus*	PROB
Viréo à tête bleue	*Vireo solitarius*	PROB
Viréo aux yeux rouges	*Vireo olivaceus*	PROB
Geai bleu	*Cyanocitta cristata*	CONF
Corneille d'Amérique	*Corvus brachyrhynchos*	CONF
Grand Corbeau	*Corvus corax*	CONF
Hirondelle bicolore	*Tachycineta bicolor*	POSS
Hirondelle rustique	*Hirundo rustica*	CONF
Mésange à tête noire	*Poecile atricapillus*	CONF
Mésange à tête brune	*Poecile hudsonica*	PROB
Sittelle à poitrine	*Sitta canadensis*	CONF
Grimpereau brun	*Certhia americana*	POSS
Troglodyte des forêts	*Troglodytes troglodytes*	PROB
Roitelet à couronne	*Regulus satrapa*	POSS
Roitelet à couronne	*Regulus calendula*	PROB
Grive fauve	*Catharus fuscescens*	PROB
Grive à dos olive	*Catharus ustu*	CONF
Grive solitaire	*Catharus gutt*	PROB
Merle d'Amérique	*Turdus migrat*	CONF
Étourneau sansonnet	*Sturnus vulga*	CONF
Jaseur d'Amérique	*Bombycilla ce*	POSS
Paruline obscure	*Vermivora per*	CONF
Paruline à joues	*Vermivora ruf*	PROB
Paruline à collier	*Parula americ*	POSS
Paruline jaune	*Dendroica pet*	POSS
Paruline à flancs	*Dendroica pe*	PROB
Paruline à tête	*Dendroica ma*	PROB
Paruline tigrée	*Dendroica tigr*	CONF
Paruline bleue	*Dendroica cae*	PROB
Paruline à croupion	*Dendroica cor*	CONF
Paruline à gorge noire	*Dendroica vir*	CONF
Paruline à gorge	*Dendroica fus*	CONF
Paruline à poitrine	*Dendroica cas*	PROB
Paruline noir et blanc	*Mniotilta vari*	CONF
Paruline flamboyante	*Setophaga rut*	PROB
Paruline couronnée	*Seiurus auroc*	PROB
Paruline des	*Seiurus noveb*	POSS
Paruline triste	*Oporornis phil*	CONF
Paruline masquée	*Geothlypis tri*	PROB
Paruline du Canada	*Wilsonia cana*	POSS
Bruant familier	*Spizella passe*	CONF
Bruant des prés	*Passerculus s*	PROB
Bruant chanteur	*Melospiza me*	PROB
Bruant de Lincoln	*Melospiza linc*	POSS
Bruant des marais	*Melospiza ge*	POSS
Bruant à gorge	*Zonotrichia al*	PROB
Junco ardoisé	*Junco hyemali*	CONF
Cardinal à poitrine	*Pheucticus lu*	POSS
Passerin indigo	*Passerina cya*	PROB
Carouge à épaulettes	*Agelaius phoe*	PROB
Quiscale bronzé	*Quiscalus quis*	PROB
Roselin pourpré	*Carpodacus p*	PROB
Bec-croisé des sapins	*Loxia curviros*	POSS
Bec-croisé bifascié	*Loxia leucopt*	POSS
Tarin des pins	*Carduelis pinu*	PROB
Chardonneret jaune	*Carduelis trist*	POSS
Gros-bec errant	*Coccothraust*	PROB
Moineau domestique	*Passer domes*	POSS

Note 1 : Parcelle 19CP66, Atlas des oiseaux nicheurs du Québec méridional (2012)
Note 2 : Espèces ordonnées par classification taxonomique
En GRAS : espèce à statut particulier (voir section 4.3.3.2)

Tableau 3 Espèces de poissons observées dans le la rivière Saguenay

Ordre	Famille	Espèce	
		Nom français	Nom latin
Acipenseriformes	Acipenseridae	**Esturgeon noir**	*Acipenser oxyrinchus*
Anguilliformes	Anguillidae	**Anguille d'Amérique**	*Anguilla rostrata*
Clupeiformes	Clupeidae	**Alose savoureuse**	*Alosa sapidissima*
		Gaspareau	*Alosa pseudoharengus*
		Hareng atlantique	*Clupea harengus*
Cypriniformes	Catostomidae	Meunier noir	*Catostomus commersoni*
Cypriniformes	Catostomidae	Meunier rouge	*Catostomus catostomus*
	Cyprinidae	Méné ventre rouge	*Phoxinus eos*
		Mulet de lac	*Couesius plumbeus*
		Naseaux des rapides	*Rhinichthys cataractae*
		Tête-de-boule	*Pimephales promelas*
Cyprinodontiformes	Cyprinodontidae	Fondule barré	*Fundulus diaphanus*
Dalatiformes	Dalatiidae	Requin du groenland	*Somniosus microcephalus*
Gadiformes	Gadidae	Goberge	*Pollachius virens*
		Morue franche	*Gadus morhua*
		Ogac	*Gadus ogac*
		Poulamon atlantique	*Microgadus tomcod*
		Saïda franc	*Boreogadus saida*
		Saïda imberbe	*Arctogadus glacialis*
	Lotidae	Motelle à quatre barbillons	*Enchelyopus cimbrius*
	Phycidae	Merluche blanche	*Urophycis tenuis*
Gasterosteiformes	Gasterosteidae	Épinoche à trois épines	*Gasterosteus aculeatus*
		Épinoche à neuf épines	*Pungitius pungitius*
		Épinoche tacheté	*Gasterosteus wheatlandi*

Ordre	Famille	Espèce	
		Nom commun	Nom latin
Perciformes	Zoarcidae	Lycode à tête longue	*Lycenchelys verrillii*
		Lycode du Labrador	*Lycodes lavalaei*
		Lycode pâle	*Lycodes pallidus*
		Lycode polaire	*Lycodes polaris*
		Unernak caméléon	*Gymnelus viridis*
Pleuronectiformes	Pleuronectidae	Flétan atlantique	*Hippoglossus hippoglossus*
		Flétan du Groenland	*Reinhardtius hippoglossoides*
		Limande à queue jaune	*Limanda ferruginea*
		Plie canadienne	*Hippoglossoides platessoides*
		Plie lisse	*Liopsetta putnami*
		Plie rouge	*Pseudopleuronectes americanus*
Rajiformes	Rajidae	**Raie épineuse**	*Amblyraja radiata*
Salmoniformes	Esocidae	Grand Brochet	*Esox lucius*
	Osmeridae	Éperlan arc-en-ciel	*Osmerus mordax*
	Salmonidae	Grand Corégone	*Coregonus clupeaformis*
		Omble d efontaine	*Salvelinus fontinalis*
		Saumon atlantique	*Salmo salar*
		Cisco de lac	*Coregonus artedi*
Scorpaeniformes	Agonidae	Agone atlantique	*Leptagonus decagonus*
		Poisson-alligator atlantique	*Aspidophoroides monopterygius*
	Cottidae	Chaboisseau à épines courtes	*Myoxocephalus scorpius*
		Faux-trigle armé	*Triglops murrayi*
		Hameçon atlantique	*Artediellus atlanticus*
		Tricorne arctique	*Gymnocanthus tric*

Ordre	Famille	Espèce	
		No m français	Nom latin
Osmeriformes	Osmeridae	Capelan	*Mallotus villosus*
Perciformes	Ammodytidae	Lançon d'Amérique	*Ammodytes americanus*
	Anarhichadidae	**Loup à tête large**	*Anarhichas denticulatus*
		Loup tacheté	*Anarhichas minor*
	Moronidae	**Bar rayé**	*Morone saxatilis*
	Percidae	Doré jaune	*Sander vitreus*
		Perchaude	*Perca flavescens*
	Pholidae	Sigouine de roche	*Pholis gunnellus*
	Zoarcidae	Lycode arctique	*Lycodes reticulatus*
		Lycode à carreaux	*Lycodes vahlii*

Ordre	Famille	Espèce	
		Nom commun	Nom latin
			uspis
	Cyclopteridae	Grosse poule de mer	*Cyclopterus lumpus*
	Hemitripteridae	Hémitriptère atlantique	*Hemitripterus americanus*
	Liparidae	Limace atlantique	*Liparis atlanticus*
		Limace des laminaires	*Liparis tunicatus*
		Limace marbrée	*Liparis gibbus*
		Petite limace de mer	*Careproctus reinhardtii*
	Psychrolutidae	Cotte polaire	*Cottunculus microps*
	Sebastidae	Sébaste acadien	*Sebastes fasciatus*
		Sébaste atlantique	*Sebastes mentella*
		Sébaste orangé	*Sebastes norvegicus*

Sources : Agence Parcs Canada, Parc marin Saguenay-Saint-Laurent (2016) EN GRAS Espèce possédant un statut particulier

Tableau 4 Amphibiens et des reptiles susceptibles de fréquenter la zone d'étude1

Nom français	Nom latin	Statut particulier[2]	Mention confirmée dans la zone d'étude[3]
Amphibiens			
Salamandre cendrée	*Plethodon cinereus*		
Salamandre à deux lignes	*Eurycea bislineata*		
Salamandre à points bleus	*Ambystoma laterale*		
Salamandre maculée	*Ambystoma maculatum*		
Triton vert	*Notophthalmus viridescens*		
Crapaud d'Amérique	*Anaxyrus americanus*		X
Grenouille des bois	*Lithobates sylvaticus*		X
Grenouille du Nord	*Lithobates septentrionalis*		
Grenouille des marais	*Lithobates palustris*	X	
Grenouille léopard	*Lithobates pipiens*		
Grenouille verte	*Lithobates clamitans*		
Ouaouaron	*Lithobates catesbeianus*		
Rainette crucifère	*Pseudacris crucifer*		
Reptiles			
Couleuvre rayée	*Thamnophis sirtalis*		
Couleuvre à collier	*Diadophis punctatus edwardsii*	X	
Couleuvre à ventre rouge	*Storeria occipitomaculata*		
Tortue serpentine	*Chelydra serpentina*	X	

1. Selon l'AARQ (2016a, b), Desroches et Rodrigue (2004) et GENIVAR (2013).
2. *Loi sur les espèces menacées ou vulnérables* (LEMV, provincial) ou Loi sur les espèces en péril (LEP, fédéral).
3. GroupeHemisphères (2012), Envill (2011).

Appendix H

Noise

H1 – Noise Measurements (French only)

H2 – Administrative Codification of Regulation VS-R-2007-51 relative to Noise in the City of Saguenay (French Only)

H3 – Handling of Noise Complaints and Requirements of Companies that Generate it (MDDELCC) (French only)

H4 – Guidelines on Noise Levels from the Industrial Construction Site (MDDELCC) (French only)

H5 – Noise Impact Intensity (French only)

H6 – Map H1 Predicted Noise Levels during Facility Operation

Appendix H1 – Noise Measurements

Annexe H1 - Relevés sonores

Extraits de : Port de Saguenay, Étude des répercussions sonores reliées à l'implantation d'une gare de triage dans le secteur de la Baie, Yockell Associés, Avril 2013

TABLEAU A1.1 : Condition météorologique les 12 et 13 décembre 2012 à Bagotville

Date	Heure	Température	Humidité	Vent	
				Direction	Vitesse
12-déc-12	11:00 AM	-12.0 ° C	79%	Calme	Calme
	12:00 PM	-11.0 ° C	73%	Calme	Calme
	1:00 PM	-10.0 ° C	56%	NNE	3.7 km/h
	2:00 PM	-10.0 ° C	79%	Est	9.3 km/h
	3:00 PM	-10.0 ° C	79%	SSE	3.7 km/h
	4:00 PM	-9.0 ° C	73%	Calme	Calme
	5:00 PM	-9.0 ° C	73%	Nord	5.6 km/h
	6:00 PM	-9.0 ° C	73%	NNO	3.7 km/h
	7:00 PM	-9.0 ° C	68%	Calme	Calme
	8:00 PM	-9.0 ° C	79%	Calme	Calme
	9:00 PM	-9.0 ° C	86%	Calme	Calme
	10:00 PM	-9.0 ° C	86%	Calme	Calme
	11:00 PM	-9.0 ° C	93%	Sud	3.7 km/h
13-déc-12	12:00 AM	-9.0 ° C	93%	Calme	Calme
	1:00 AM	-9.0 ° C	82%	Calme	Calme
	2:00 AM	-10.0 ° C	86%	Calme	Calme
	3:00 AM	-12.0 ° C	85%	Ouest	7.4 km/h
	4:00 AM	-9.0 ° C	79%	Ouest	7.4 km/h
	5:00 AM	-10.0 ° C	86%	NO	5.6 km/h
	6:00 AM	-10.0 ° C	86%	ONO	11.1 km/h
	7:00 AM	-10.0 ° C	81%	Ouest	11.1 km/h
	8:00 AM	-11.0 ° C	85%	Ouest	7.4 km/h
	9:00 AM	-10.0 ° C	86%	Ouest	7.4 km/h
	10:00 AM	-9.0 ° C	86%	Calme	Calme
	11:00 AM	-8.0 ° C	79%	Est	9.3 km/h
	12:00 PM	-8.0 ° C	79%	Est	13.0 km/h
	1:00 PM	-7 ° C	67%	Est	9.3 km/h

* Source : http://french.wunderground.com - Bagotville les 12 et 13 décembre 2012

TABLEAU A2.1 : INDICES STATISTIQUES DE LA MESURE RELEVÉE AU 4893 CHEMIN SAINT-MARTIN (P1)

Heure des relevés	Bruit de pointe $L_{1\%}$	$L_{10\%}$	Bruit moyen $L_{50\%}$	$L_{90\%}$	Bruit de fond $L_{95\%}$	$L_{99\%}$	Bruit Ambiant L_{eq}
12 h 30 à 13 h 00	56,5	38,7	23,0	21,9	21,5	21,1	45,0
13 h 00 à 14 h 00	33,8	27,1	23,5	22,2	22,0	21,2	26,4
14 h 00 à 15 h 00	43,5	36,4	26,2	23,2	22,9	22,2	32,8
15 h 00 à 16 h 00	48,3	42,2	35,3	29,1	28,1	26,6	39,1
16 h 00 à 17 h 00	44,9	36,9	25,6	23,1	22,7	22,1	33,1
17 h 00 à 18 h 00	49,8	32,9	26,6	24,5	24,0	23,2	38,4
18 h 00 à 19 h 00	50,6	34,3	25,0	23,6	23,3	23,0	38,3
19 h 00 à 20 h 00	66,6	30,2	25,5	23,9	23,5	23,1	57,2
20 h 00 à 21 h 00	48,3	32,0	25,9	23,7	23,3	23,0	36,2
21 h 00 à 22 h 00	63,3	36,9	24,5	22,9	22,4	22,1	50,5
22 h 00 à 23 h 00	72,4	51,5	24,5	22,6	22,3	22,0	59,5
23 h 00 à 24 h 00	35,3	26,4	23,0	21,8	21,4	21,2	26,5
00 h 00 à 1 h 00	63,6	27,9	22,6	21,6	21,3	21,3	53,7
1 h 00 à 2 h 00	28,6	22,9	21,8	21,1	21,1	21,0	22,3
2 h 00 à 3 h 00	24,6	23,0	21,8	21,2	21,1	21,0	22,1
3 h 00 à 4 h 00	23,0	22,1	21,6	21,1	21,0	21,0	21,6
4 h 00 à 5 h 00	26,4	23,5	22,0	21,2	21,1	21,0	23,0
5 h 00 à 6 h 00	31,9	28,5	25,2	23,4	23,1	22,3	26,4
6 h 00 à 7 h 00	54,6	53,4	25,3	23,0	22,5	22,1	47,9
7 h 00 à 8 h 00	54,9	50,2	24,2	23,1	22,7	22,1	44,0
8 h 00 à 9 h 00	50,5	44,0	26,4	24,4	24,1	23,4	38,9
9 h 00 à 10 h 00	52,7	48,5	26,7	24,1	23,6	23,1	42,8
10 h 00 à 11 h 00	52,6	47,3	24,9	23,1	22,8	22,1	41,6
11 h 00 à 12 h 00	60,5	37,4	25,7	23,5	23,2	23,0	45,2
12 h 00 à 12 h 30	58,6	50,2	33,5	27,3	26,1	25,1	53,2
$LA_{eq, 24h}$	54,4	38,5	26,6	21,8	21,5	21,3	49,4

Note : Tous les niveaux sont en dB(A)

Jour

Nuit

TABLEAU A2.2 : INDICES STATISTIQUES DE LA MESURE RELEVÉE AU 4583 CHEMIN SAINT-MARTIN (P2)

Heure des relevés	Bruit de pointe $L_{1\%}$	$L_{10\%}$	Bruit moyen $L_{50\%}$	$L_{90\%}$	Bruit de fond $L_{95\%}$	$L_{99\%}$	Bruit Ambiant L_{eq}
11 h 00 à 12 h 00	38,7	32,7	30,8	30	29,6	29,1	31,9
12 h 00 à 13 h 00	36,9	32,7	30,8	30	29,5	29,1	31,9
13 h 00 à 14 h 00	53,5	34,9	31,9	30,4	30,2	29,8	38,5
14 h 00 à 15 h 00	39,2	34,8	32,5	31,2	31	30,2	33,7
15 h 00 à 16 h 00	35	32,4	30,7	29,7	29,3	29,1	31,2
16 h 00 à 17 h 00	37,1	32,4	30,7	29,6	29,3	29,1	32,1
17 h 00 à 18 h 00	52,7	33,7	29,9	29,1	29	28,4	38,9
18 h 00 à 19 h 00	66,4	35	30,8	29,3	29,1	28,6	55,5
19 h 00 à 20 h 00	42,1	31	29,3	28,3	28,1	28	32,1
20 h 00 à 21 h 00	31,9	29,4	28,5	28	27,7	27,6	28,7
21 h 00 à 22 h 00	35,8	29,8	28,4	27,6	27,6	27,6	29,1
22 h 00 à 23 h 00	30,5	29	28,3	27,6	27,6	27,6	28,4
23 h 00 à 24 h 00	41,2	28,9	28,1	27,5	27,5	27,5	33,2
00 h 00 à 1 h 00	30,8	28,9	28	27,5	27,5	27,5	28,3
1 h 00 à 2 h 00	31,9	29,8	28,6	28	27,6	27,6	28,9
2 h 00 à 3 h 00	30,2	28,9	28,4	27,6	27,6	27,6	28,3
3 h 00 à 4 h 00	29,9	28,9	28	27,5	27,5	27,5	28,2
4 h 00 à 5 h 00	32,5	29,8	28,5	27,6	27,6	27,6	28,8
5 h 00 à 6 h 00	32	29,5	28,4	27,6	27,6	27,6	28,6
6 h 00 à 7 h 00	33,8	29,7	28	27,6	27,6	27,6	28,7
7 h 00 à 8 h 00	34,7	29,7	28,4	27,6	27,6	27,6	28,9
8 h 00 à 9 h 00	47,7	37,8	29,1	28,2	28,1	28	36,1
9 h 00 à 10 h 00	38,5	33,3	30,7	29,4	29,2	29	37
10 h 00 à 11 h 00	61	41,7	31,7	30,2	29,9	29,2	46,7
$LA_{eq,\ 24h}$	49,1	32,8	29,3	27,9	27,8	27,7	43,6

Note : Tous les niveaux sont en dB(A)

Jour

Nuit

Figure A2.1 : Évolution temporelle du bruit pendant la période de 24 heures entre 12 h 30, le 12 décembre 2012 et 12 h 30, le 13 décembre 2012 au 4893 chemin St-Martin à La Baie (P1)

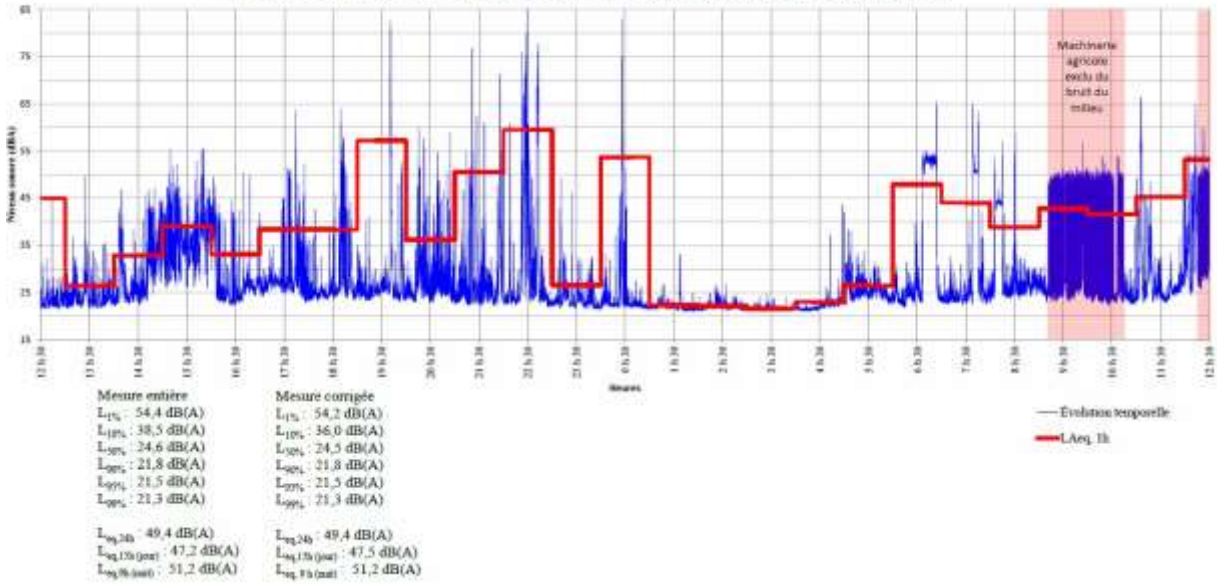
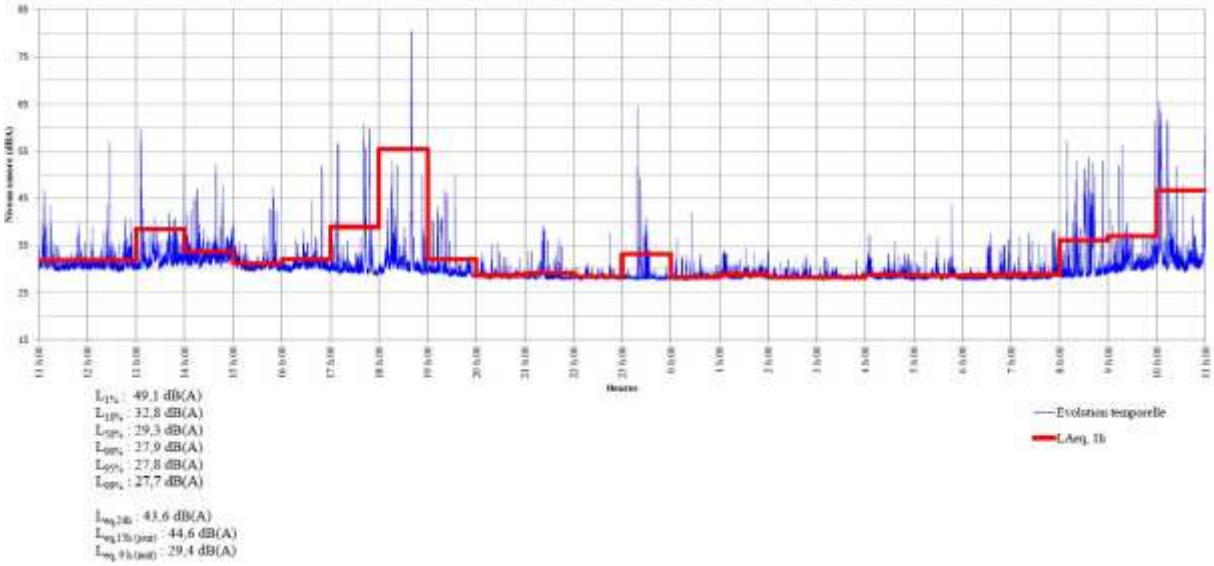


Figure A2.2 : Évolution temporelle du bruit pendant la période de 24 heures entre 11 h 00, le 12 décembre 2012 et 11 h 00, le 13 décembre 2012 au 4583 chemin St-Martin à La Baie (P2)



Extraits de : Administration portuaire de saguenay, Suivi acoustique des travaux dans le cadre de l'implatation d'une desserte ferroviaire au terminal maritime de Grande-Anse – État initial avant travaux, Yockell Associés, Mai 2013

Chemin Saint-Martin
pt 4
x = 279088.1
y = 5362726.6
Client:
Administration Portuaire de Saguenay
Projet:
Desserte ferroviaire Saguenay
Titre:
Localisation des points de mesures - 4583, chemin Saint-Martin
Plan no: 4
Date: Mai 2013
Préparé par: Claude Yockell, M. Arch, acousticien
Dessiné par: Richard Jolivet, tech.
Yockell Associés inc.

TABLEAU A3.1 : INDICES STATISTIQUES DE LA MESURE RELEVÉE AU 4413 ROUTE DE L'ANSE-À-BENJAMIN

Heure des relevés	Bruit de pointe $L_{1\%}$	$L_{10\%}$	Bruit moyen $L_{50\%}$	$L_{90\%}$	Bruit de fond $L_{95\%}$	$L_{99\%}$	Bruit Ambiant L_{eq}
20 h 00 à 21 h 00	64,2	42,3	25,8	23,8	23,4	23,1	50,8
21 h 00 à 22 h 00	55,6	31,9	26,3	24,5	24,2	23,7	44,1
22 h 00 à 23 h 00	53,9	38,4	31,4	27,9	27,3	26,3	44,6
23 h 00 à 24 h 00	57,3	47,4	37,9	33,1	32,1	30,6	45,8
00 h 00 à 01 h 00	57,7	47,2	36,1	29,7	28,5	27,0	45,7
01 h 00 à 02 h 00	53,1	40,8	31,7	28,3	27,6	26,9	44,0
2 h 00 à 3 h 00	46,3	34,5	27,7	25,4	25,0	24,2	35,1
3 h 00 à 4 h 00	50,0	36,1	25,9	24,2	24,0	23,3	41,1
4 h 00 à 5 h 00	51,3	38,2	30,0	26,5	25,9	25,1	45,0
5 h 00 à 6 h 00	57,4	35,4	28,9	26,8	26,3	25,5	49,0
6 h 00 à 7 h 00	67,0	45,6	34,1	29,0	28,3	27,2	52,1
7 h 00 à 8 h 00	67,9	51,0	37,2	32,6	31,9	30,7	60,3
8 h 00 à 9 h 00	64,6	51,4	39,6	33,9	32,8	31,2	51,3
9 h 00 à 10 h 00	62,4	51,3	41,2	34,5	33,0	31,1	50,4
10 h 00 à 11 h 00	63,8	51,9	41,8	34,9	33,0	30,3	50,8
11 h 00 à 12 h 00	65,1	52,9	43,0	36,0	34,1	31,1	52,1
12 h 00 à 13 h 00	76,8	59,1	46,1	38,7	36,6	32,6	69,7
13 h 00 à 14 h 00	67,7	58,5	49,0	41,7	40,2	37,9	56,1
14 h 00 à 15 h 00	70,7	59,6	47,4	38,9	37,1	34,6	58,0
15 h 00 à 16 h 00	72,3	62,7	49,6	38,4	36,9	34,7	60,2
16 h 00 à 17 h 00	76,1	66,6	54,2	43,9	41,2	37,8	65,2
17 h 00 à 18 h 00	70,6	59,8	46,8	37,3	35,4	32,6	62,8
18 h 00 à 19 h 00	65,9	53,3	42,0	33,8	32,3	30,6	52,5
19 h 00 à 20 h 00	63,8	51,6	39,5	32,3	31,0	29,4	51,9
$LA_{eq, 24h}$	68,2	53,9	38,0	26,7	25,3	24,0	59,7

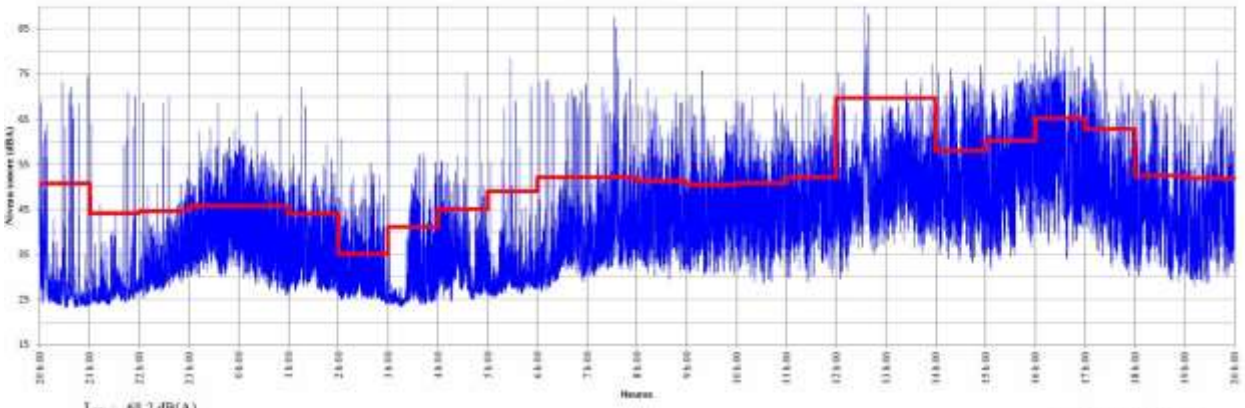
Note : Tous les niveaux sont en dB(A)

TABLEAU A4.1 : INDICES STATISTIQUES DE LA MESURE RELEVÉE AU 4583 CHEMIN SAINT-MARTIN

Heure des relevés	Bruit de pointe $L_{1\%}$	$L_{10\%}$	Bruit moyen $L_{50\%}$	$L_{90\%}$	Bruit de fond $L_{95\%}$	$L_{99\%}$	Bruit Ambiant L_{eq}
20 h 00 à 21 h 00	38,6	33,9	31,7	30,5	30,2	30,0	32,6
21 h 00 à 22 h 00	33,6	32,4	31,3	30,3	30,1	30,0	31,4
22 h 00 à 23 h 00	35,1	33,5	32,3	31,3	31,1	31,0	32,5
23 h 00 à 24 h 00	37,0	35,0	33,7	32,5	32,3	32,0	33,9
00 h 00 à 1 h 00	34,5	33,0	31,7	31,0	30,7	30,1	31,9
1 h 00 à 2 h 00	34,4	33,0	31,9	31,0	30,5	30,1	32,1
2 h 00 à 3 h 00	33,4	32,3	31,2	30,2	30,1	29,6	31,3
3 h 00 à 4 h 00	33,2	31,9	30,9	30,1	30,0	29,5	31,1
4 h 00 à 5 h 00	34,1	32,6	31,5	30,4	30,2	30,0	31,6
5 h 00 à 6 h 00	38,1	33,0	31,5	30,3	30,1	29,6	33,4
6 h 00 à 7 h 00	42,5	33,3	30,8	30,1	30,1	30,0	33,0
7 h 00 à 8 h 00	39,7	33,9	31,5	30,4	30,2	30,0	33,9
8 h 00 à 9 h 00	38,6	34,5	31,8	30,6	30,3	30,0	33,3
9 h 00 à 10 h 00	46,8	36,8	31,8	30,3	30,1	29,4	36,2
10 h 00 à 11 h 00	41,9	35,8	31,4	30,1	30,0	29,2	33,6
11 h 00 à 12 h 00	41,6	36,2	32,1	30,6	30,3	30,0	33,9
12 h 00 à 13 h 00	67,0	45,1	35,7	31,5	31,2	30,7	53,3
13 h 00 à 14 h 00	50,8	45,6	40,4	37,5	37,1	36,1	42,6
14 h 00 à 15 h 00	50,9	44,2	39,1	36,3	35,9	35,0	41,7
15 h 00 à 16 h 00	58,7	50,8	43,3	37,7	36,6	35,3	48,3
16 h 00 à 17 h 00	65,6	52,6	45,7	39,7	38,6	37,2	53,2
17 h 00 à 18 h 00	58,6	52,1	44,9	39,6	38,2	36,5	48,9
18 h 00 à 19 h 00	55,4	48,9	40,8	34,1	33,0	31,6	45,4
19 h 00 à 20 h 00	48,3	41,6	34,8	30,6	30,1	29,2	38,4
$LA_{eq, 24h}$	53,9	44,0	32,4	30,8	30,5	30,1	44,8

Note : Tous les niveaux sont en dB(A)

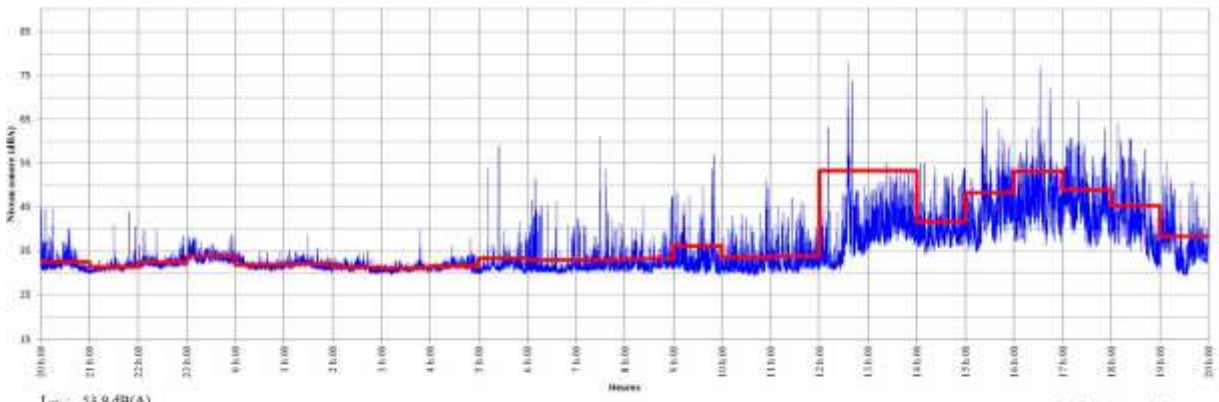
Figure A3.1 : Évolution temporelle du bruit perçu au 4413, route de l'Anse-à-Benjamin, pendant la période de 24 heures du 22 au 23 avril 2013



$L_{1\%}$: 68,2 dB(A)
$L_{10\%}$: 53,9 dB(A)
$L_{50\%}$: 38,0 dB(A)
$L_{90\%}$: 26,7 dB(A)
$L_{95\%}$: 25,3 dB(A)
$L_{99\%}$: 24,0 dB(A)

$L_{eq,24h}$: 59,7 dB(A)
$L_{eq,7\,h\,à\,19\,h}$: 61,9dB(A)
$L_{eq,19\,h\,à\,22\,h}$: 50,0 dB(A)
$L_{eq,22\,h\,à\,7\,h}$: 46,7 dB(A)

Figure A4.1 : Évolution temporelle du bruit perçu au 4583, chemin Saint-Martin, pendant la période de 24 heures du 22 au 23 avril 2013



$L_{1\%}$: 53,9 dB(A)
$L_{10\%}$: 44,0 dB(A)
$L_{50\%}$: 32,4 dB(A)
$L_{90\%}$: 30,8 dB(A)
$L_{95\%}$: 30,5 dB(A)
$L_{99\%}$: 30,1 dB(A)

$L_{eq,24h}$: 44,8 dB(A)
$L_{eq,7\,h\,à\,19\,h}$: 47,3 dB(A)
$L_{eq,19\,h\,à\,22\,h}$: 35,3 dB(A)
$L_{eq,22\,h\,à\,7\,h}$: 32,4 dB(A)

Appendix H2 – dministrative Codification of Regulation VS-R-2007-51 relative to Noise in the City of Saguenay

CODIFICATION ADMINISTRATIVE DU RÈGLEMENT VS-R-2007-51 RELATIF AU BRUIT SUR LE TERRITOIRE DE LA VILLE DE SAGUENAY

AVERTISSEMENT

Le présent document constitue une codification administrative du règlement VS-R-2007-51 adopté par le conseil municipal de la Ville de Saguenay.

Cette codification intègre les modifications apportées au règlement VS-R-2007-51.

Cette codification doit être considérée comme un document de travail facilitant la consultation du règlement VS-R-2007-51 en y intégrant les modifications qui lui ont été apportées.

S'il y a divergence entre la présente codification administrative et le contenu du règlement VS-R-2007-51 ou de ses règlements modificateurs, le texte original adopté et en vigueur est celui qui prévaut.

Liste des règlements pris en considération aux fins de cette codification administrative :

Numéro du règlement	Adoption	Entrée en vigueur
VS-R-2007-51	3 décembre 2007	9 décembre 2007
VS-R-2016-8	1er février 2016	5 février 2016

CANADA
PROVINCE DE QUÉBEC
DISTRICT DE CHICOUTIMI
VILLE DE SAGUENAY

RÈGLEMENT NUMÉRO VS-R-2007-51 RELATIF AU BRUIT SUR LE TERRITOIRE DE LA VILLE DE SAGUENAY

Règlement numéro VS-R-2007-51 passé et adopté à la séance ordinaire du conseil municipal de la Ville de Saguenay tenue dans la salle des délibérations, le 3 décembre 2007.

PRÉAMBULE

ATTENDU que les membres du conseil municipal estiment opportun de réglementer le bruit à l'intérieur des limites de la Ville de Saguenay;

ATTENDU les pouvoirs octroyés aux municipalités, aux termes de l'article 59 de la Loi sur les compétences municipales (L.Q., 2005, c. C-6), en matière de nuisance;

ATTENDU que le conseil peut, en vertu de l'article précité, dicter les moyens à prendre pour supprimer telle nuisance;

ATTENDU qu'un avis de présentation du présent règlement a été régulièrement donné, savoir à la séance ordinaire du 5 novembre 2007 ;

À CES CAUSES, il est décrété ce qui suit :

ARTICLE 1.- Le préambule du présent règlement en fait partie intégrante comme s'il était ici au long récité.

_____

VS-R-2007-51, a.1;

ARTICLE 2.- DÉFINITIONS

Dans le présent règlement, à moins que le contexte n'indique un sens différent, les expressions et termes suivants désignent :

2.1 Bruit

Son ou assemblage de sons, harmonieux ou pas, perceptible par l'ouïe.

2.2 Bruit ambiant

Ensemble des bruits habituels de provenances diverses y compris les bruits d'origine extérieure à caractère plus ou moins régulier et repérable dans un temps déterminé en dehors de tout bruit perturbateur.

2.3 Bruit fluctuant

Bruit qui n'est pas stable.

2.4 Bruit perturbateur

Tout bruit repérable distinctement du bruit d'ambiance selon les termes du présent règlement et qui cause un préjudice aux voisins.

2.5 Bruit stable

Bruit provenant d'un appareil en fonctionnement dont le niveau sonore mesuré est le même peu importe la période de temps utilisé.

2.6 Corps de police

Corps de police de la Ville de Saguenay.

2.7 Décibel

Unité utilisée pour exprimer, sous forme logarithmique, le rapport existant entre une quantité mesurée et une valeur de référence et dont l'application au bruit est établie conformément aux normes édictées par le bureau central de la Commission électrotechnique internationale exprimée en dB(A).

2.8 Ville

La Ville de Saguenay.

_____

VS-R-2007-51, a.2;

ARTICLE 3.- PROHIBITION

L'émission d'un bruit considéré comme nuisance aux termes du présent règlement est prohibée et punissable selon ce que prévu à l'article 7 du présent règlement.

_____

VS-R-2007-51, a.3;

ARTICLE 4.- NUISANCE

Le fait, pour toute personne, d'occasionner, de tolérer ou de permettre la production de tout bruit perturbateur, de quelque façon que ce soit, susceptible de troubler la paix ou la tranquillité ou le confort ou le repos ou le bien-être d'un ou de plusieurs citoyens, constitue une nuisance et est prohibé.

Le présent article est non limitatif et constitue une offense à caractère général distinct des cas particuliers énumérés aux articles suivants.

VS-R-2007-51, a.4; VS-R-2016-8, a.1;

ARTICLE 5.- BRUITS CONSIDÉRÉS COMME NUISANCES

Sans limiter la portée de l'article 4, sont considérées comme des infractions les situations qui suivent :

5.1 Haut-parleur ou autre appareil amplificateur ou reproducteur de sons

Nonobstant toute disposition contraire, aucun haut-parleur, microphone, amplificateur ou appareil transmetteur, relié à une radio, phonographe ou autre instrument ou appareil producteur ou reproducteur de sons ne doit être installé dans, sur ou près des murs, portes ou fenêtres d'un édifice ou de partie d'un édifice où se trouve ledit appareil ou instrument, de façon à ce que les sons reproduits ou transmis soient projetés à l'extérieur dudit édifice, vers une rue, ruelle, place publique ou autre ou audible à l'intérieur d'une bâtisse ou maison d'habitation de manière à nuire à la tranquillité ou au bien-être.

Les dispositions du présent règlement ne s'appliquent pas lorsqu'une réunion publique ou activité spéciale a été expressément autorisée par la Ville ou le conseil d'arrondissement.

5.2 Machines à moteur

Il est défendu de se servir, entre 22 h et 7 h, d'une machine ou instrument muni ou non d'un moteur électrique ou à carburant, de façon à ce que le bruit en soit entendu aux limites du terrain.

Le présent article ne s'applique pas :

- aux stationnements publics;
- aux travaux à caractère public;
- au déneigement des stationnements publics ou privés ouverts à la circulation du public;
- au déneigement des stationnements privés mais uniquement lorsqu'il y a une accumulation au sol de plus de 5 cm;
- à l'utilisation normale des appareils ménagers.

5.3 Travaux de construction

Sauf en cas de force majeure, il est interdit à toute personne de faire ou de laisser faire, entre 22 h 00 et 7 h 00, en tout endroit de la Ville située à moins de deux cents mètres (200 m) d'une maison d'habitation, des bruits à l'occasion de l'exécution de travaux de construction, de reconstruction, d'excavation, de modification ou de réparation d'un bâtiment ou d'une structure ou des bruits provenant d'un véhicule automobile ou de tout autre appareil ou machine.

5.4 Véhicule moteur stationnaire

Il est défendu de faire fonctionner le moteur d'un véhicule stationnaire ou en mouvement à une vitesse susceptible de causer un bruit de nature à nuire à la paix et à la tranquillité.

5.5 Sirène

L'usage d'une sirène est défendu sauf pour les véhicules de police, de pompier et les ambulances.

5.6 Bruit stable

Sans toutefois restreindre la portée des articles précédents, tout bruit émanant d'une pompe à chaleur, équipement de chauffage, de climatisation ou de ventilation, système de filtration ou de pompage de piscine est considéré comme une nuisance lorsque le bruit mesuré à un mètre (1 m) de la limite du terrain où est situé l'appareil perturbateur du côté du voisin perturbé est de plus de 50 dB(A);

Dans le cas où il n'y a pas plus d'un appareil perturbateur, s'il est constaté qu'une fois l'appareil perturbateur fermé le niveau sonore mesuré à l'extérieur est inférieur de moins de 5 dB(A), le bruit mesuré précédemment n'est pas considéré comme une nuisance.

Les précédentes dispositions s'appliquent pour un niveau de bruit mesuré pendant un minimum de quinze (15) secondes et il ne doit y avoir aucun autre bruit perturbateur durant la prise de mesure. Au moins deux mesures de quinze secondes doivent être prises et si la différence entre les deux est inférieure ou égale à 3 dB(A), c'est la moyenne de ces deux mesures qui constitue le niveau sonore. Si l'écart entre les deux mesures est supérieur à 3 dB(A), une troisième mesure de quinze (15) secondes doit être prise et le niveau sonore mesuré est constitué par la moyenne des trois mesures.

Les précédentes dispositions ne s'appliquent pas pour les activités agricoles.

5.7 Usage d'un appareil sonore dans un but de publicité, promotion ou sollicitation

Nul ne peut faire ou permettre que soit fait, dans les limites de la Ville, aucun bruit susceptible d'être entendu dans une place ou endroit public, ou audible à l'intérieur d'une bâtisse ou maison d'habitation, au moyen de la voix ou de tout autre instrument musical ou non, dans le but d'annoncer ou de vendre des marchandises ou d'attirer l'attention du public en général, pour quelque motif que ce soit.

Toutefois, les dispositions du présent article sont sans application dans le cas où la réunion publique ou événement mentionné ci-dessus est expressément autorisé par la Ville ou le conseil d'arrondissement.

VS-R-2007-51, a.5; VS-R-2016-8, a.2;

ARTICLE 6.- FONCTIONNAIRE DÉSIGNÉ

6.1 Responsabilité du Service de police

Il incombe au Service de police de faire observer les articles 3, 4, 5.1, 5.2, 5.3, 5.4, 5.5 et 5.7 du présent règlement et le directeur est autorisé à prendre toutes les mesures nécessaires pour en assurer la stricte observance.

6.2 Responsabilité de la Division permis et programmes

L'article 5.6 est sous la responsabilité de la Division permis et programmes dans l'exercice des pouvoirs qui lui sont conférés. Le fonctionnaire désigné est autorisé à

visiter ou faire visiter et à examiner ou faire examiner toute propriété, bâtiment ou édifice ou tout endroit ou place publique pour constater si les dispositions des sections des articles plus haut mentionnés du présent règlement sont observées et à délivrer tout constat d'infraction.

VS-R-2007-51, a.6;

ARTICLE 7.- PEINE

7.1 Quiconque contrevient à une disposition du présent règlement commet une infraction et est passible :

a) S'il s'agit d'une personne physique : d'une amende minimale de 100$ mais n'excédant pas 300$ et les frais; ou
b) S'il s'agit d'une personne morale : d'une amende minimale de 300$ mais n'excédant pas 1 000$ et les frais;

À défaut du paiement de ladite amende et des frais, s'il y a lieu, dans les délais accordés par le tribunal, il y aura exécution selon la Loi.

7.2 Si l'infraction dure plus d'un jour, l'infraction commise à chacune des journées constitue une infraction distincte et les pénalités édictées pour chacune des infractions peuvent être imposées pour chaque jour que dure l'infraction conformément au présent article.

7.3 Dans le cas d'une infraction subséquente dans les douze (12) mois commise à l'encontre du présent règlement, le délinquant est passible :

a) S'il s'agit d'une personne physique : d'une amende de pas moins de 200$ mais n'excédant pas 1 000$ et les frais; ou
b) S'il s'agit d'une personne morale : d'une amende de pas moins de 500$ mais n'excédant pas 2 000$ et les frais;

À défaut du paiement de ladite amende et des frais, s'il y a lieu, dans les délais accordés par le tribunal, il y aura exécution selon la Loi.

VS-R-2007-51, a.7;

ARTICLE 8.- ABROGATION DE RÈGLEMENTS

Le présent règlement abroge à toutes fins que de droit les articles 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 et 30 du règlement numéro M459-99 de l'ex-municipalité de Shipshaw; le chapitre 11 du règlement 1127-01 de l'ex-Ville de La Baie, les articles 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 et 30 du règlement numéro 2000-03 de l'ex-municipalité de Lac-Kénogami; les articles 20, 21, 22, 23, 24, 25, 27 et 28 du règlement 405-2000 de l'ex-municipalité de Canton Tremblay et les règlements numéros 857 de l'ex-ville de Jonquière, 93-090 et 94-066 de l'ex-ville de Chicoutimi, 94-217 et les chapitres 7 et 11 du règlement 91-160 de l'ex-ville de Laterrière ainsi que tous les règlements les amendant et toutes autres dispositions inconciliables avec le présent règlement.

VS-R-2007-51, a.8;

ARTICLE 9.- ENTRÉE EN VIGUEUR

Le présent règlement entrera en vigueur après que les formalités prescrites auront été dûment remplies selon la Loi.

VS-R-2007-51, a.9;

PASSÉ ET ADOPTÉ, tel que ci-dessus mentionné, en séance présidée par le maire.

Appendix H3 – Handling of Noise Complaints and Requirements of Companies that Generate it (MDDELCC)

Traitement des plaintes sur le bruit et exigences aux entreprises qui le generent

References legales : LRQ (c. Q-2), articles 20 et 22

JUIN 2006

Introduction

1. Objet de la note d'instructions

Cette note d'instructions sur le bruit a pour objet de preciser la fa9on dont le ministre du Developpement durable, de !'Environnement et des Pares entend assumer les fonctions et !es pouvoirs que lui confere la Loi sur la qualite de l' environnement, notamment ceux mentionnes a !'article 94, a l'egard des sources fixes. Elle fixe les methodes et les criteres qui permettent de juger de l'acceptabilite des emissions sonores, de s'assurer du respect du deuxieme alinea de !'article 20 de la Loi et de baliser les interventions et les actions du ministere notamment en vue de la delivrance de documents officiels .

2. Champ d'application

La presente note vise toute source fixe telle que definie au paragraphe suivant. Elle ne s'applique pas aux sources deja visees par reglement, soit les carrieres, les sablieres et les usines de beton bitumineux, ainsi qu'aux activites agricoles telles que definies dans la note d' instruction O1-13 intitulee «Activites agricoles liees a l'agriculture ainsi que le conditionnement et la transformation de produits agricoles».

On entend par «source fixe» une industrie, une manufacture, une centrale generatrice d'energie, une ligne a haute tension, un poste de transformation electrique, un lieu d' enfouissement, un champ de tir et toute entreprise qui exploite un procede.

Une source fixe est delimitee dans l'espace par le perimetre du terrain qu'elle occupe et peut etre constituee d'un ou plusieurs unites ou elements (equipement de manutention, de fabrication ou d ' epu ration, machinerie, ventilateur, vehicule moteur, etc.) dont la somme des bruits particuliers constitue la contribution totale imputable a la source. Le bruit de la circulation de vehicules ou d'equipements mobiles sur le terrain d'une source fixe lui est imputable. Ce bruit fait cependant partie du bruit routier des que la circulation se fait en dehors des limites de la source fixe.

3. Modalite d'application des criteres

Les criteres d'acceptabilite accordent a une source fixe le niveau de bruit le plus eleve entre le niveau de bruit residue! (tel que defini dans la methode de reference au glossaire de la partie 2) et le niveau maximal permis selon le zonage et la periode de la journee, tel que mentionne au tableau de la paiiie 1. Cependant, a partir du moment ou le niveau maximum est atteint, Jes ajouts d'activites ou !'augmentation de production de la source fixe ne doivent amener aucune augmentation supplementaire du niveau sonore .
Puisque Jes criteres d'acceptabilite constituent Jes limites maximums permises, il est toujours souhaitable et recommande, dans une perspective de developpement durable, que l' exploitant ou l' initiateur en plus de respecter ces criteres prenne toute mesure «faisable et raisonnable » et favorise des pratiques d'exploitation de fa<;;on a ce que sa contribution sonore soit le mains perceptible possible en zones sensibles.

Les criteres preconises visent la protection des etres humains. De fa9on generale, on assume qu' ils devraient assurer une protection suffisante des autres especes animales. Toutefois, le ministre pourra etablir des limites plus restrictives s' il s'averait que Jes criteres de cette note ne protegent pas adequatement certaines especes fauniques ou leurs habitats.

Finalement, Jes criteres d'acceptabilite et la methodologie de mesure ne sont pas adaptes a tous Jes types de bruit ou a toute la variete de sources de bruit. En consequence, il pourrait etre justifie de preconiser en ce1iain cas I'utilisation de criteres ou de methodes differents ou complementaires.

4. Exigences relatives a la delivrance de document officiel

Lorsqu'il le juge a propos, le MDDEP exige une etude previsionnelle ou une etude des impacts sonores. Pour obtenir un ce1iificat d'autorisation, une telle etude devra demontrer le respect des criteres. De plus, l'initiateur (ou l'exploitant) devra s'engager a appo1ier Jes correctifs requis advenant que Jes impacts sonores reels depassent Jes previsions. A cet effet, Jes criteres etablis et/ou la lettre d'engagement (partie 3) peuvent etre utilises. Lors de la delivrance du certificat d'autorisation, ces criteres deviendront des normes pour I'entreprise.

Dans le cas ou ii n'y aurait pas de collaboration de la part de l' ex ploitan t et que Jes criteres ne seraient pas respectes, une enquete pour poursuite en vertu de l'article 20 (et 22 s' il ya lieu) de la Loi sur la qualite de l' envi ronnement (LRQ, chap. Q-2), peut etre demandee.

5. Responsabilites et pouvoirs des municipalites

Les municipalites ont des responsabilites en ce qui concerne Jes regles de zonage et les plans de developpement desquels depend principalement la determination des criteres applicables. De plus, la Loi sur Jes cites et villes (aiiicle 410) et le Code municipal du Quebec (atiicles 490 et 628) accordent aux municipalites des pouvoirs generaux de reglementer afin de limiter certaines nuisances , dont le bruit.

Avant)'emission de tout document officiel, en plus de s' assurer du respect des presents criteres, le MDDEP doit obtenir la confirmation, le cas echeant, que l'exploitant d'une source fixe respecte toute reglementation municipale qui vise Jes nuisances sonores. Malgre

!'existence d' une reglementation municipale, le MDDEP doit tout de meme s' assurer que les criteres de la presente note sont respectes , a mains que la reglementation municipale assure une protection equivalente ou superieure a ces criteres ou qu'une reglementation municipale ait ete approuvee par le ministre.

Partie 1 - Niveau sonore maximum des sources fixes

Le niveau acoustique d'evaluation (LAr,Ih) d'une source fixe sera inferieur, en tout temps, pour tout intervalle de reference d'une heure continue et en tout point de reception du bruit, au plus eleve des niveaux sonores suivants :

1. le niveau de bruit residue! (tel que defini dans la methode de reference au glossaire de la partie 2), ou

2. le niveau maximal permis selon le zonage et la periode de la journee, tel que mentionne au tableau suivant :

Zonage	*Nuit (dB.A)*	*Jour(dBA)*
I	40	45
II	45	50
III	50	55
IV	70	70

CATEGORIES DE ZONAGE

Zones sensibles

I : Territoire destine a des habitations unifamiliales isolees ou jumelees, a des ecoles, h6pitaux ou autres etablissements de services d'enseignement, de sante ou de convalescence. Terrain d'une habitation existante en zone agricole.

II : Territoire destine a des habitations en unites de logements multiples, des pares de maisons mobiles, des institutions ou des campings.

III : Territoire destine a des usages commerciaux ou a des pares recreatifs. Toufefois, le niveau de bruit prevu pour la nuit ne s'applique que dans les limites de propriete des etablissements utilises a des fins residentielles. Dans les autres cas, le niveau maximal de bruit prevu le jour s'applique egalement la nuit.

Zones non sensibles

IV : Territoire zone pour fins industrielles ou agricoles. Toutefois, sur le terrain d'une habitation existante en zone industrielle et etablie conformement aux reglements municipaux en vigueur au moment de sa construction, les criteres sont de 50 dBA la nuit et 55 dBA le jour.

La categorie de zonage est etablie en vertu des usages permis par le reglement de zonage municipal. Lorsqu'un territoire ou une partie de territoire n'est pas zone tel que prevu, a l'interieur d'une municipalite, ce sont les usages reels qui determinent la categorie de zonage.

Le jour s'etend de 7 h a 19 h, tandis que la nuit s'etend de 19 h a 7 h.

Ces criteres ne s'appliquent pas a une source de bruit en mouvement sur un chemin public.

Partie 2 - Methode de reference pour la mesure du bruit et pour la determination du niveau acoustique d'evaluation

Glossaire

Bruit a c aractere tonal: bruit caracterise par une composante a frequence unique ou des composantes a bandes etroites qui emergent de fa9on audible du bruit ambiant;

Bruit ambiant : bruit total existant dans une situation donnee a un instant donne, habituellement compose de bruits emis par plusieurs sources , proches ou eloignees;

Bruit initial : bruit ambiant avant toute modification d'une situation existante;

Bruit d' impact : bruit de courte duree dont on perc;;oit une augmentation brusque du niveau sonore sur un comt laps de temps (un bruit d ' impact peut etre produit notamment par des chocs mecaniques ou pneumatiques, des collisions, des percussions , des secousses, des detonations, des explosions);

Bruit particulier : composante du bruit ambiant qui peut etre identifie specifiquement et qui est generalement associe a une source specifique;

Bruit residue! : bruit qui perdure a un endroit do nnee, dans une situation donnee, quand les bruits pmt iculi ers de la source visee sont supprimes du bruit ambiant;

Evaluation : toute methode servant a mesurer ou prevoir la valeur d'un niveau acoustique et des termes correctifs ainsi que les effets nuisibles correspondants;

Intervalle de long terme : intervalle de temps specifie au cours duquel !es bruits d'une serie d' intervalles de reference sont moyennes ou evalues;

Intervalle de reference : intervalle de temps auquel !'evaluation du bruit est rapportee ;

Niveau acoustique d ' evaluation : tout niveau acoustique mesure ou prevu auquel un terme correctif est ajoute;

Point d ' ev aluat ion : endroit precis d'ot1 est effectuee une evaluation;

Source: toute activite ou tout etat de chose ayant pour effet !'emission de bruit dans l'environnement (un ou plusieurs bruits particuliers peuvent etre emis par une source);

Terme correctif : toute grandeur qui est ajoutee a un niveau acoustique mesure ou prevu afin de tenir compte de certaines caracteristiques acoustiques;

Symboles

FFT: algorithme de calcul de la transformee de Fourier rapide (Fast Fourier Transform);

LAeq,r : niveau de pression acoustique continu equivalent pondere A pour un intervalle de reference *T;*

Lceq, r: niveau de pression acoustique continu equivalent pondere C pour un intervalle de reference *T;*

Lceq, *r*- LAeq,T: indicateur utilise pour evaluer le contenu spectral en basse frequence;

LAr, r : niveau acoustique d'evaluation pondere A pour un intervalle de reference d'une duree *T;*

LAFN, *r* : niveau de pression acoustique avec ponderation frequentielle A et ponderation temporelle F, depasse pendant *N* % de la duree *T;*

LAFrms : moyenne des valeurs individuelles des « Taktmaximal» mesurees pour chaque intervalle de 5 second es pendant la duree *T* ou il y a des bruits d' impact, conformement a la norme allemande TA Larm et VDI 2058 (Note : les valeurs individuelles des «Ta ktmaximal » sont en fait les LAF max atteints a chaque intervalle successif de 5 secondes pendant la duree totale de mesure, soit *1);*

LAF max : niveau de pression acoustique maximal avec ponderation frequentielle A et ponderation temporelle F;

LLeq,T (l/Jact): niveau de pression acoustique continu lineaire equivalent mesure par bande de tiers d'octave pour un intervalle de reference *T.*

1. Niveau acoustique d'evaluation

1.1 Definition et description

Le niveau acoustique d'evaluation est le niveau depression acoustique equivalent pondere A, mesure ou prevu, auquel on ajoute des termes correctifs. Le niveau acoustique d'evaluation est determine a pmtir de la formule suivante:

$$l..Ar,_T = Lleq,_{T+} \boldsymbol{Kr}+\mathbf{Kr}+\boldsymbol{Ks} \text{ , } \text{Oll}$$

LAr,Test le niveau acoustique d'evaluation pondere A pour un intervalle de reference d'une duree *T.* (Voir detail a !'annexe I);

LAeq,T est le niveau depression acoustique continu equivalent pondere A pour un intervalle de reference *T.* (Voir detail a!'annexe II);

K_1 est un terme correctif pour les bruits d' impact. (Voir detail a!'annexe III);

KT est un terme correctif pour le bruit a caractere tonal. (Voir detail a l' annexe IV);

Ks est un terme correctif pour certaines situations speciales, tels !es bruits perturbateurs ou !es bruits de basse frequence (Voir detail a !'annexe V);

Remarque : Lorsque aucun terme correctif **n'** est applicable $LAr_{,T} = L\,Aeq_{,T}$

1.2 Duree des intervalles de reference

La duree d'un intervalle de reference *T* est etablie conformement aux criteres ou aux normes en vigueur . Lorsque la duree *T* n'est pas specifiee ou qu'il est requis de la modifier pour des motifs exceptionnels, celle-ci doit alors etre fixee dans le respect des regles de !'mi en tenant compte a la fois des habitudes de vie des collectivites riveraines et des caracteristiques des sources sonores.

1.3 Autres parametres, indices ou appreciations subjectives

En plus des divers parametres requis pour evaluer le niveau acoustique d' evaluation tel que decrit a la section 1.1 (incluant !es annexes auxquels cette section refere), d'autres parametres, indices ou appreciations subjectives peuvent s'averer utiles voire essentiels a !'interpretation, a la validation et a !'evaluation des mesures de bruit. C'est notamment le cas pour !es indices statistiques $LAFN_{,T,}$ [1] ainsi que !es notes terrains et !es commentaires concomitants a des mesures.

2. Selection des points d'evaluation du bruit

[1] Par exemple, le $L_{AF9S.\,Jh}$ est le niveau depression acoustique avec ponderation frequentielle A et ponderation temporelle F, depasse pendant 95% de I h.

Une reconnaissance prealable des lieux doit permettre d'evaluer !es espaces pouvant etre affectes par !es bruits particuliers de la source et d'identifier !es types d'occupation du sol. Pour chaque zone (ou chaque espace) touchee, c'est normalement le point sensible le plus expose au bruit de la source qui doit etre retenu comme point d'evaluation. II peut aussi etre requis d'evaluer le bruit au point sensible qui subit ou est susceptible de subir le plus important impact sonore si ce point est different du precedent' ou au point sensible d'ou sont formulees des plaintes. Lorsque plusieurs points sensibles sont exposes approximativement au meme niveau de bruit en provenance de la source, l'un ou l'autre peut etre retenu comme point d'evaluation representatif d'un ensemble. On entend par point sensible une habitation, une institution, un terrain de camping, un lieu recreatif ou un terrain destine a l'un de ces usages par reglement municipal. Le nombre et la selection des points d'evaluation doivent permettre une evaluation adequate du climat sonore.

Note: La presente section traite davantage de la selection des points d'evaluation dans le but d'evaluer !es impacts sonores de sources existantes ou projetees. Pour d'autres fins, tels la recherche, le developpement ou des mesures en zones industrielles (non sensibles), la selection des points d'evaluation serafaite enfonction des objectifs vises et des diverses contraintes presentes.

3. Appareil de mesure

3.1 Caracteristiques techniques des appareils de mesures

L'appareillage de mesurage doit etre con9u pour determiner le niveau de pression acoustique continu equivalent pondere A (LAeq.*T)* en pleine conformite avec la definition et !'equation mentionnees a I'annexe II. Lorsque un ou plusieurs termes correctifs doivent etre evalues afin de determiner le niveau acoustique d'evaluation, l'appareillage doit:

- pour la correction K_1, etre con9u pour determiner soit le LAFTms, soit chacun des LAF max correspondant a chacun des impacts pendant I' intervalle de reference;
- pour la correction *KT*, doit etre con9u pour determiner le $LLeq_{T(I/3oct)}$ (et si necessaire une analyse en bande plus fine ou en FFT avec la fenetre Hanning) ;
- pour la correction *Ks* relative au contenu en basse frequence, etre con9u pour determiner le Lceq. *T.*

Pour !'analyse statistique, etre con9u pour determiner !es indices statistiques *LAFN, T.*

L'appareillage de mesure doit etre conforme aux specifications de la Publication CEI 651 pour les sonometres de preference de classe 1, mais au moins de classe 2. Pour fins d'interpretation des resultats, on assume que les mesures prises avec un sonometre de classe 1 comportent une marge d'erreur de ± 1 dB, alors que les mesures prises avec un sonometre de classe 2 compo1ient une marge d'erreur de ± 1,5 dB. Les sonometres integrateurs doivent etre conformes a la Publication CEI 804. On peut utiliser un autre

[2] Un point d'evaluation situe initialement en zone tranquille peut effectivement subir une plus grande degradation du climat sonore qu'un autre point davantage expose au bruit de la source fixe mais initialement situe en zone bruyante.

appareillage de mesurage (exemple un sonometre de classe 0) a condition qu'il soit de performance equivalente ou superieure en ce qui concerne les ponderations temporelles et frequentielles et leurs tolerances.

3.2 Etalonnage

Un sonometre doit etre etalonne avant chaque serie de mesures avec une source etalon . A la fin de chaque serie, l'etalonnage doit etre verifie et la correction doit etre notee. Si cette correction est superieure a 0,5 dB, les releves sonores sont invalides.

La precision du sonometre et de la source etalon doit etre verifiee une fois par annee par un laboratoire possedant les accreditations necessaires.

4. Releves sonores

4.1 Emplacement et localisation du microphone

Pour fin d'application des criteres ou des normes de bruit, le microphone doit etre positionne a I'exterieur a une hauteur comprise entre 1,2 et 1,5 metre au-dessus du sol, a plus de trois metres de murs ou autres obstacles analogues susceptibles de reflechir !es ondes acoustiques et a plus de 3 metres d'une voie de circulation.

II peut exister des situations ou ii est oppo1tun, necessaire ou justifie d'evaluer le climat sonore a un recepteur dont la localisation necessite un positionnement du microphone different des consignes du precedent paragraphe. Le cas echeant, ii est permis de positionner le microphone en fonction de la localisation reelle d 'un tel recepteur en respectant !es regles suivantes :

- on tend a maintenir la hauteur du microphone entre 1,2 et 1,5 metre au-dessus de chaque niveau d'etage considere;
- afin de minimiser I'influence des reflexions, !es mesurages sont effectues dans la mesure du possible a trois metres ou plus de toute structure reflechissante, ou a 0,5 metre en avant d'une fenetre ouverte;
- si !'on est contraint de faire des mesurages entre 1 et 2 metres de la fa<;ade d'un batiment, on soustraira 3 dBA a la valeur mesuree pour estimer le niveau depression acoustique incidente (cette regle n'est toutefois pas applicable en presence d'un bruit a caractere tonal).

Le microphone doit etre place du cote de la source par rapport a tout batiment ou au terrain affecte et protege par une boule anti-vent ou !'equivalent. En zone sensible, ainsi qu'a toute habitation existante sans egard au zonage, toute evaluation du niveau de bruit realisee pour la periode de 7 h a 22 h, soit la periode de jour a laquelle on ajoute !es trois premieres heures de la periode de nuit, doit etre faite preferablement a au moins 3 metres d' un batiment et etre situe sur n'importe quel point du terrain pour lesquels les residents ou !es beneficiaires peuvent demontrer qu ' il en font raisonnablement usage. Par ailleurs, toute evaluation du niveau de bruit realisee pour la periode de 22 h a 7 h (periode de sommeil) doit preferablement etre realisee entre 3 et 6 metres de toute chambre a coucher ou do1toir.

Dans le cas d'un terrain ou d'un lot non bati, pour des mesures realisees entre 7 h et 22 h, le microphone est localise en tout point ou un usage regulier des eventuels occupants est raisonnablement previsible. Pour la periode de 22 h a 7 h, lorsque I'on vise la protection du sommeil, le microphone doit etre localise le plus pres possible de !'emplacement prevu des chambres ou des dortoirs. Si cet emplacement ne peut etre determine, le microphone est localise a l ' e ndroit juge le plus approprie au contexte.

4.2 Conditions meteorologiques

Pour fin d'application des criteres ou des normes, une mesure de bruit est jugee recevable si pendant cette mesure :

- la vitesse du vent n'a pas excede 20 Km/h[3];
- le taux d'humidite n'a pas excede 90 %;
- la chaussee etait seche et qu'il n'y avait pas de precipitation;
- la temperature ambiante est demeuree a l'interieur des limites de tolerance specifiees par le fabriquan_t de l' equipement de mesure.

Note : II peut etre requis dans certains cas de determiner le niveau acoustique d'evaluation pour des conditions meteorologiques favorables a la propagation (principalement par vents porteurs ou !ors d'inversions therm iques) . Dans un tel cas, on peut le faire soit en prenant des mesures concomitamment a des conditions meteorologiques favorables a la propagation, soit en prenant des mesures a plus long terme[4]. On procedera de la meme far;on s' ii est requis en vertu des criteres ou des normes applicables de determiner le niveau acoustique d' evaluation sur un intervalle long terme.

4.3 Nombre, duree et programmation des releves sonores

Les choix quant au nombre, a la duree et a la programmation de l' ho raire des releves sonores doivent etre faits en considerant I ' ensemble des contraintes logistiques et des caracteristiques des sources sonores ambiantes. Ces choix doivent etre tels qu'ils nous assurent de l'atteinte des objectifs vises en termes de precision et de representativite des donnees recueillies. L'annexe VI discute a titre informatif de !' elabo ration de strategies de mesures.

4.4 Mesure du bruit ambiant

Le bruit ambiant est mesure de far;on a representer en tout point d'evaluation !'ensemble des bruits emis par toutes !es sources proches et eloignees. On privilegie !es mesurages qui couvrent completement !es intervalles de reference. Cependant, des mesures prises sur des periodes plus courtes peuvent etre extrapolees s'il est clairement demontre qu'elles sont representatives du climat sonore prevalant pendant toute la periode de reference, ou si elles permettent de l'estimer avec une precision suffisante. Les responsables des releves doivent le cas echeant expliquer tout calcul et justifier toute hypothese, extrapolation ou estimation supportant cette demonstration ou cette estimation.

[3] Pour des cas speciaux, telle une eolienne, un protocole de mesure peut accepter des vitesses plus grandes .

[4] Dans le cas des mesurages a plus long terme, Ia duree programmee doit alors etre suffisamment tongue pour esperer couvrir !es conditions de propagation favorables.

Lorsque la valeur mesuree du bruit ambiant est utilisee pour calculer la contribution sonore d'une source specifique (conformement a la section 4.6), il est preferable que !es conditions d'exploitation de cette source soient connues, representatives de la realite et notees. Par ailleurs, si les conditions d ' exploitation de la source ne sont pas connues, ii pourra etre necessaire de faire des mesures sur un plus long terme jusqu'a ce qu'une tendance nette puisse etre etablie.

Le bruit ambiant lorsqu'il est mesure avant toute modification d'une situation existante (par exemple avant !' introduction d'une nouvelle source) constitue le bruit initial. Ce bruit initial pourra etre subsequemment compare au bruit ambiant mesure apres l' introduction d'une nouvelle source pour evaluer son impact, son acceptabilite ou sa conformite.

4.5 Mesure du bruit residue!

Le bruit residuel est mesure en tout point d'evaluation en supprimant du bruit ambiant tous les bruits particuliers de la source visee [5]. Comme pour la mesure du bruit ambiant, on privilegie Jes mesurages qui couvrent completement Jes intervalles de reference. Cependant, des mesures prises sur des periodes plus comies peuvent etre extrapolees s'il est clairement demontre qu'elles sont representatives du climat sonore prevalant pendant toute la periode de reference, ou si elles permettent de l' estimer avec une precision suffisante. Le rappmi d'analyse devra le cas echeant expliquer tout calcul et justifier toute hypothese, extrapolation ou estimation supportant cette demonstration ou cette estimation.

Dans le cas ou ii existe des difficultes pratiques (telle !' exploitation en continu) a !'interruption des bruits particuliers d'une source, !'evaluation du niveau de bruit residue! peut etre faite avec des methodes alternatives adaptees a la situation. L' une de ces methodes consistent a mesurer le bruit ambiant en un point de substitution situe preferablement dans le meme quartier (ou un environnement similaire) et expose au meme bruit ambiant, sans toutefois etre influence par la source visee.

Lorsque le niveau de bruit residue! sert a determiner la valeur d'un critere, on utilise le LAeq, T sans terme correctif *(Ki, Kr* ou Ks).

4.6 Calcul de la contribution d'une source

La contribution de la source visee peut etre isolee ou estimee en soustrayant du «bruit ambiant» le «bruit residue!» avec !' equation suivante:

$$L_{Aeq,T}(\text{source visee}) = -10 \times \log [10^{-LAeq,T(bruitambiant)/10} - 10^{-LOLAeq,T(bruitresiduei)/10}]$$

Lorsque la source visee augmente le bruit residue! de plus de 10 dB, le bruit ambiant peut etre utilise pour evaluer directement la contribution de la source.

[5] Lorsque la source visee n'est qu'a l'etat de projet, le «bruit residue l» correspond au «bruit initial».

En ce qui concerne !es termes correctifs, ceux-ci sont evalues pendant la mesure du bruit ambiant en tout point d'evaluation. On s'assure lors de la mesure du bruit residue! que tout terme correctif est reellement imputable a la source visee.

N.B.: II est important de s'assurer en utilisant !'equation precedente que la contribution des diverses sources au «bruit residue!» demeurent relativement inchangees en importance et en duree lors de !'evaluation du «bruit ambiant». On s'assure ainsi que le calcul estime avec une precision acceptable la contribution sonore de la source.

5. Prevision du niveau acoustique d'evaluation

Dans ce1tains cas, notamment lorsqu'une source n'est qu'a l'etat de projet, le niveau acoustique d'evaluation pourra etre base sur des previsions. Les etudes previsionnelles doivent etre annexees a toute demande de document officiel faite au ministere et inclure Jes informations suivantes[6] :

5.1 I' identification, la description, la localisation et I'utilisation des equipements de production, d'epuration, de manutention ou de transport [7] ainsi que de toute autre composante de la source visee susceptible de generer des bruits particuliers;

5.2 les previsions de la contribution sonore de la source fixe et de tous les bruits particuliers qui Jui sont associes (ceci inclut la description du modele de propagation sonore utilise ou des calculs previsionnels effectues, ainsi que tous les parametres, !es donnees ou les hypotheses servant de base aux previsions);

5.3 la determination des termes correctifs applicables et le calcul des niveaux acoustiques d'evaluation pour chaque point d'evaluation;

Auquel s'ajoute pour tout projet de plus grande envergure:

5.4 !'evaluation de !'impact des activites de la source fixe sur !'augmentation du trafic routier et !'augmentation du bruit routier. (L'evaluation doit notamment traiter de !'impact de toute augmentation du bruit routier sur les perturbations du sommeil.

[6] Des informations supplementaires peuvent toutefois etre exigees pour Jes projets soumis a Ia procedure d'evaluation des impacts.

[7] En ce qui concerne Jes equipements de transport et de manutention, Jes donnees relatives a la circulation et Ia frequence des deplacements doivent etre mentionnees.

Annexe I

Explications complementaires sur le niveau acoustique d'evaluation

Le niveau acoustique d'evaluation (LAr,T) est un indice de !'exposition au bruit qui contient d'une pat1, la description physique du bruit LAeq,T , mais aussi des termes correctifs pour des appreciations subjectives du type de bruit. Par exemple, pour le bruit d'une source fixe, LAr,T introduit de termes correctifs (penalisations) de 5 dB(A) pour Jes sons purs (bruit a caractere tonal), des corrections variables pour les bruits impulsifs (bruits d'impact).

Si a l'interieur d'une intervalle de reference de duree T, on retrouve des intervalles de durees variables $T_1, T_2 \ldots T_n$ *(dont la somme totalise T) comportant des caracteristiques acoustiques distinctives, il peut etre a/ors preferable d'evaluer separement !es niveaux acoustiques d'evaluation* (LAr,n) *pour chacun de ces intervalles. Par la suite, le niveau total d'evaluation pour le segment Test calcule avec !'equation suivante :*

$$LAc,r = 10\log[\text{ja}\,t\,1\backslash IOLA,xo]$$

Lorsqu'une evaluation est basee sur une ou plusieurs mesures et que ces mesures sont de plus courte duree que l'intervalle de reference *T,* des ajustements doivent etre effectues, afin que I'evaluation soit representative de la periode sous des conditions normales d'exploitation.

Lorsqu'on evalue le niveau acoustique d'evaluation (LAr,T) pour une source specifique, !es valeurs du LAeq,T et des termes correctifs K_1, KT et Ks doivent isoler la contribution sonore attribuable a cette source specifique. Le meme principe prevaut pour la determination du niveau acoustique d'evaluation (LAr,T) pour un regroupement de sources sonores.

Si plus d'un terme correctif est applicable a une source sonore, seul le plus eleve est retenu pour evaluer le niveau acoustique d'eva luat ion.

Annexe II

Explications complementaires concernant LAeq, $_T$

LAeq, *Test* le niveau de pression acoustique continu equivalent pondere A pour un intervalle de temps *T* qui commence à t_1 et termine à t_2

L'equation est la suivante:

$$L_{Aeq,T} = 10 \log \left[\frac{1}{T} \int_{t_1}^{t_2} 10^{0,1 L_{pA}(t)} dt \right]$$

LpAi est le niveau de pression acoustique pondere A pendant l'intervalle de temps *T;*

Note : Le niveau sonore equivalent LAeq,T *represente la moyenne energetique d'un son au cours de la mesure. Les bruits dans l'environnement son! rarement stables; le plus souvent ils sont variables en intensite. Pour cette raison, il est necessaire de determiner le niveau sonore moyen d'un bruit. Pour un bruit fluctuant, le niveau* LAeq, *T est calcule de maniere à ce qu'il possede le meme contenu energetique qu'un son continu de meme valeur.*

Lorsque le LAr,T *evalue specifiquement la contribution sonore d'une source fixe en un point d'evaluation, le* LAeq,T *doit etre representatif de la contribution sonore imputable à cette source.*

Annexe III

Explications complementaires concernant la correction *Ki* pour les bruits d'impact

Deux methodes sont acceptees pour determiner la correction *Ki.*

Methode 1

Le terme correctif peut etre obtenu directement en soustrayant deux parametres mesures par l'appareil. L'equation de correction est la suivante:

$$K1 = LAFTm5 - LAeq,T \quad OU$$

Le LAFTms est mesure directement par Jes appareils qui integrent cet indice , conformement aux normes allemandes TA Larm et VDI 2058.

Cette correction n ' est applicable que s'il ya des bruits d'impact (voir definition) et que la difference est plus grande que 2 dB.

Methode 2

Si l'indice LAFTms n'est pas disponible avec un appareil de mesure , la correction *Ki* peut etre evaluee avec !'equation suivante :

$$Kl = 10 \log\{ [(\frac{5}{T(sec)} \times m) \times 10 L)\{0] + [(T(sec) - (\frac{5}{T(sec)} \times m)) \times 10 LAeq, 1/i)]\} - LAeq, T$$

OU

Li (niveau equivalent du bruit d ' impact) est le calcul de la moyenne logarithmique des niveaux maximum (LAF max) sur la reponse rapide "fast" imputables aux bruits d'impact qui se produisent durant la periode de reference et qui sont pen;us au point d' evaluation . La valeur de Lise calcule avec !'equation suivante:

$$L; = 10 \log 10 \left[\sum_{n=1}^{m} 10^{dBn} \right] \quad OU$$

dBn = niveau maximum (LAF Max) sur la reponse rapide "fast" correspondant au nieme bruit d'impact durant la periode de reference;

m = nombre d'impacts admissibles pendant la periode de reference. Le nombre d'impact admissible est egal au nombre d' impact reel si en aucun moment la cadence des impacts est plus grande que 1 impact par 5 secondes. Cependant, lorsque pour une partie ou la totalite

de la periode de reference, la cadence des impacts est plus grande que 1 impact par 5 secondes, le nombre d'impacts admissibles ne peut depasser 1 impact par 5 secondes pour la pmiie ou la totalite de la periode de reference.

Malgre ce qui precede, aucune correction n'est ajoutee lorsque *Ki* est egal ou inferieur a 2 dB.

AnnexeIV

Explications complementaires concernant la correction *Kt* pour le bruit a caractere tonal

Un terme correctif *Kt* de 5 dB est applicable lorsqu'un bruit a caractere tonal est clairement audible et que la bande de tiers d'octave qui le comprend depasse les bandes adjacentes d'une valeur egale ou superieure a celles inscrites au tableau 4. Si plus d'une composante tonale repondent a ces criteres, un seul terme correctif demeure applicable. Les bandes de tiers d'octave mesurees et analysees vont de 16 a 20 000 Hz.

Tableau 4 Criteres pour l'application d'une correction au bruit a caractere tonal

Frequence emergente en Hz	141 Hz et moins	141 a 440 Hz	440 Hz et plus
Bande passante de tiers d'octave	125 Hz et moins	160 a 400 Hz	500 Hz et plus
Depassement des bandes adjacentes (dB lineaire)	15 dB et plus	8 dB et plus	5 dB et plus

Si une frequence emergente (en Hz) du bruit a caractere tonal s'approche de la limite de deux bandes de tiers d'octave adjacentes, les criteres du tableau 4 deviennent techniquement nuls. Aussi, avant de conclure qu'un terme correctif n'est pas applicable, il conviendra lors de !'analyse d'un bruit a caractere tonal, d'identifier la valeur de la frequence emergente. Si cette frequence s'approche de la limite de deux bandes de tiers d'octave, !'analyse en bandes plus fines (1/12 d'octave, 1/24 d'octave, FFT avec la fenetre Hannning) peut alors s'averer utile, voire necessaire[8], pour evaluer la pertinence d'appliquer un terme correctif. L'analyse en bandes fines peut aussi s'averer utile pour une meilleure comprehension de certaines problematiques singulieres.

Malgre ce qui precede , aucune correction n'est appliquee si le niveau sonore pondere A de la bande de tiers d'octave qui contient une frequence proeminente est inferieur de 15 dB ou plus au niveau sonore en dB_A de tout le spectre.

[8] Cette analyse peut etre evitee si !'existence d'une frequence importune n'est aucunement mise en doute.

Annexe V

Informations complementaires concernant les termes correctifs pour certaines situations speciales, *Ks*

Un terme correctif peut etre applique face a certaines situations speciales notamment:

- 5 dBA pour tout bruit de basse frequence, c'est a dire un bruit dont !es caracteristiques frequentielles font que le Lceq,r - LAeq,r *2* 20 dB; toutefois cette con-ection est applicable exceptionnellement si la mesure est accompagnee d' une demonstration que le bruit de basse frequence est la cause de nuisance accrue a l'interieur de batiment a vocation residentielle ou !'equivalent;

- 5 dBA pour tout bruit perturbateur comportant des elements verbaux, musicaux ou porteurs d'information (signaux sonores).

  Note : Lorsque !es elements verbaux, musicaux au porteurs d'information constituent l'essentiel du bruit perturbateur, I'application de la penalite ne pose pas de probleme. Si *tel n'est pas !es cas, il faut que ces elements contribuent significativement au bruit de la source pour que la penalite s 'applique.* S*'ii est possible de mesurer isolement la contribution d'elements verbaux, musicaux au porteurs d'information en provenance d'une source sonore, cette contribution sonore ne devrait pas etre de plus de 2 dB inferieur* a *la contribution sonore totale de la source pour justifier !'application d'une penalite.*

Annexe VI (inforrnatif)

Nombre, duree et programmation des releves sonores

l n'existe pas de regle simple et rapide pour determiner le nombre, la duree et la programmation de l ' horaire des releves sonores, pas plus qu' il n' existe de recette pour lister !es parametres qui seront mesures ou encore preciser la nature des remarques et des observations qu' il convient de noter concomitamment aux mesures. To utefois, !es trois etapes suivantes peuvent etre considerees comme des prealables a la determination de ces parametres :

- definition des objectifs poursuivis;
- connaissance des specificites acoustiques du milieu concerne;
- identification de toute autre contrainte.

a) Definition des objectifs poursuivis par !es mesures

La premiere etape consiste a definir ou preciser !es objectifs poursuivis par !es mesures . Ces objectifs peuvent varier enormement allant du simple besoin de connaltre le niveau de bruit ponctuel d' un equipementjusqu'a !'evaluation detaillee de !'impact sonore d'une source complexe et fluctuante dans un milieu ambiant lui-meme acoustiquement chaotique. Dans le premier cas, quelques releves de courte duree des niveaux sonores moyens suffiront, alors que dans l'autre cas des mesures sur plusieurs jours incluant I'enregistrement de plusieurs parametres pourront s' averer necessaires . D' autres considerations, telles la possibilite d'intenter des recours juridiques [9] ou d'utiliser !es releves pour la planification ulterieure de mesures correctives, peuvent aussi largement influencer la complexite, la precision et la nature des releves sonores.

b) Connaissance du milieu

La deuxieme etape consiste a decrire !es caracteristiques essentielles des principales sources de bruit dont est compose l'environnement sonore (en tout point ou des mesures sont prevues). Cette caracterisation peut notamment inclure !es elements suivants :

- identification et determination des caracteristiques des sources de bruit existantes;
- acquisition de connaissances et d'informations sur !es procedes et !es equipements de production, !es habitudes et pratiques d'exploitation relatives a la source fixe;
- appreciations subjectives et temoignages des expe1is, des inspecteurs, des plaignants ou de l'exploitant;
- analyse des informations, des donnees ou des releves sonores disponibles au dossier le cas echeant;
- detection de possibles penalisations (impacts , frequence importune, autres).

[9] Toutefois , lorsque des mesurages sont effectues a des fins d' enquetes ou pour des poursuites penales, les mesurages couvriront preferablement tout l'intervalle de reference mentionne dans les criteres ou les normes, avec une surve illance simultanee des conditions d' exploitation et des conditions ambiantes.

Les elements precedents seront evidemment documentes avec un niveau de details et de minutie correspondant a l' envergure des objectifs poursuivis.

c) Identification de toute autre contrainte

Tout autre facteur ou contrainte pouvant influencer de fa9on significative la strategie doit etre identifie, evalue et considere . Ces contraintes peuvent etre de nature diverse selon les circonstances. Citons !es contraintes associees aux limites techniques de l'appareillage, les contraintes logistiques, !es contraintes meteorologiques, les contraintes d 'exploitation et !es contraintes sociales et humaines .

Contraintes liees a l'appareillage: Le niveau de sophistication technique de l'appareillage de mesure a notre disposition peut influencer largement la strategie de mesure a privilegier. Lorsqu' un sonometre est limite dans ses performances, ii peut etre necessaire de proceder a des releves supplementaires pour obtenir toutes !es donnees necessaires a !'evaluation du climat sonore. II peut meme s'averer impossible d'evaluer certaines corrections prevues dans la presente methode . A l' oppose, lorsqu 'un sonometre est tres performant, ceci rend possible !'usage de strategie plus elaboree ou innovatrice[10] .

Contraintes logistigues : Ces contraintes concernent le transpo1i et la manutention du materiel ainsi que la disponibilite des moyens et accessoires necessaires aux mesures en un point d'evaluation. Pour des mesures de tongue duree par exemple, ii faut qu'il soit possible d'installer l'equipement a l' interieur, d' avoir des prises electri ques , et un orifice permettant de passer la connexion reliant le sonometre au microphone exterieur.

Contraintes meteorologigues : II faut evidemment tenir compte des previsions meteorologiques puisque !es mesures prises sous des conditions non conformes sont invalidees. De plus, dans certains cas specifiques, on cherchera a faire des mesures dans des conditions meteorologiques precises (vent portant, inversion thermique, etc).

Contraintes sociales, culturelles, humaines : Ces contraintes concernent la perception, !' imp lication, la collaboration ainsi que !es habitudes de vie des collectivites.

Programmation des mesures

Une fois !es etapes precedentes realis ees, ii revient a l'analyste du dossier de mettre au point la strategie. Ce processus releve davantage de !' art que de la technique. Le tableau 1 de la page suivante propose quelques exemples de strategie qui sont fonction a la fois des objectifs a atteindre et de la nature des mesures. Toutefois, ces exemples ne doivent pas etre per9us comme des references absolues.

[10] Avec un sonometre tres performant, une strategie possible et souple consiste a mes urer en continue pendant plusieurs jours en enregistrant plusieurs parametres. L'analyse de ces parametres avec un logiciel approprie, permet de dresser un p01trait fo11 documente du climat sonore et de la contribution des sources visees par l'e tude .

Tableau 1 Exemple de strategie de mesure du bruit[11]

Objectif de l'evaluation	Nature de la mesure a effectuer		
	Bruit ambiant	**Source stable (continue) [12]**	**Source aleatoire (fluctuante)**
Evaluation somma1·re[13]	- 5 a 10 minutes si le bruit est relativement stable (ou tres foible, c'est-a-dire inferieur a 45dB le jour et 40 dB la nuit) - 20 a 60 minutes si le bruit est relativement chaotique +Prise de notes terrains	- 4 a 5 echantillons $L_{Aeq,30\ sec}$, si l'ecai1 des resultats < 3dB - 8 a 10 echantillons $L_{Aeq,30\ sec}$,, si I'ecatt entres Jes resultats 2':3et <5 dB) Indices statistiques et si justifie, analyse 1/3 oct.	20 a 60 minutes d'echantillonnage programme le plus judicieusement possible +Prise de notes terrains +Parametres d'evaluation du $L_{Ar,T}$ Sl des termes correctifs sont applicables
Evaluation de la conformite	Couvrir l'intervalle de reference en continue [14] +Prise de notes terrains	- 4 a 5 echantillons $L_{Aeq,30\ sec}$, si I' ecart des resultats < 3 dB - 8 a 10 echantillons $L_{Aeq,\ 30\ sec}$, si I'ecatt entre Jes resultats 2':3 et <5 dB) Indices statistiques et si justifie, analyse I /3 oct.	Au moins 60 minutes en continue +Prise de notes terrains (Jes conditions du bruit ambiant doivent etre similaires a celles prevalant !ors de son evaluation) +le cas echeant, Jes parametres d'evaluation du $L_{Ar.T}$
Evaluation detaillee...	Profil complet sur 12 heures de jour, 3 heures de soiree et Jes 9 heures de nuit. (avec Jes $L_{Aeq,\ Ih}$, evaluation des $L_{Ar,r}$ et Jes notes terrains (jour de la semaine ou, si requis, jour de fin de semaine)	Memes echantillons que ceux mentionnes ci haut, mais avec en plus une mesure continue de 20 a 60 minutes avec indices statistiques par bande de 1/3 octave et toutes les notes terrains	Profil complet pour chaque heure de production au cours d'une journee. +le cas echeant, Jes parametres d'evaluation du $L_{Ar,T}$ +notes terrains
. . . et de lon g terme	Duree suffisante pour couvrir Jes diverses conditions de bruit ambiant et de meteo	Duree suffisante pour couvrir !es diverses conditions de meteo	Duree suffisante pour couvrir Jes diverses conditions d'exploitation OU de meteo

[11] Ces exemples sont fournis a titre indicatif seulement, chaque situation etant jugee selon ses specificites.
[12] Un echantillon n'e st valable que si la source fixe etait clairement emergente pendant le releve.
[13] L'evaluation sommaire peut poursuivre differents buts notamment documenter une problematique , identifier une empreinte acoustique, de determiner le niveau sonore prevalant a un moment precis ou pour planifier des mesures plus detai!Jees.
[14] Cette mesure est faite sans exploitation de la source fixe. Elle sera souvent effectuee au moment de la journee *oi1* le bruit ambiant est au plus faible.

Partie 3 - Engagement / bruit

1. Limitation du bruit emis

Dans le cadre de la demande de certificat d'autorisation (ou d'autorisation) deposee au ministere du Developpement durable, de !'Environnement et des Pares concernant ***(inscrire le type de projet):***

(Norn de la compagnie)

s'engage a ce que le niveau acoustique d'evaluation imputable a ses activites exercees au
(adresse ou numero de lot - municipalite)

soit inferieur, en tout temps , pour tout intervalle d'une heure continue et en tout point d'evaluation du bruit, au plus eleve des niveaux sonores suivants :

- le niveau de bruit residue! (bruit qui perdure a un endroit donne, dans une situation donnee, lors de l'arret complet des operations de l'entreprise), ou
- le niveau maximal permis selon le zonage et la periode de la journee, tel que mentionne au tableau suivant :

IZonage	I *Nuit (dB..)*	I *Jour(dB..)*
I	0	45
III	6	SO
III	1150	1515
IV	70	1170

Categories de zonage

Zones sensibles

I : Territoire destine a des habitations unifamiliales isolees ou jumelees, a des ecoles, h6pitaux ou autres etablissements de services d'enseignement, de sante ou de convalescence. Terrain d'une habitation existante en zone agricole.

II : Territoire destine a des habitations en unites de logements multiples, des pares de maisons mobiles, des institutions ou des campings.

Ill : Territoire destine a des usages commerciaux ou a des pares recrea tifs. Toutefois, le niveau de bruit prevu pour la nuit ne s'applique que dans les limites de propriete des etablissements utilises a des fins residentielles. Dans les autres cas, le niveau maximal de bruit prevu le jour s'applique egalement la nuit.

Zones non sensibles

IV: Territoire zone pour fins industrielles ou agricoles. Toutefois, sur le terrain d'une habitation existante en zone industrielle et etablie conformement aux reglements municipaux en vigueur au moment de sa construction, les criteres sont de 50 dBA la nuit et 55 dBAle jour.

La categorie de zonage est etablie en vertu des usages permis par le reglement de zonage municipal. Lorsqu'un territoire ou une partie de territoire n'est pas zone tel que prevu, a l'interieur d'une municipalite, ce sont les usages reels qui determinent la categorie de zonage.

Le jour s'etend de 7 h a 19 h, tandis que la nuit s'etend de 19 h a 7 h.

Ces criteres ne s'appliquent pas a une source de bruit en mouvement sur un chemin public.

2. Methode de mesure du bruit

Aux fins d'application du present engagement, le bruit est mesure suivant la «Methode de reference pour la mesure du bruit et pour la determination du niveau acoustique d'evaluation »

J'atteste que j'ai pris connaissance des conditions de cet engagement et j'accepte de respecter tous et chacun des criteres qui s'app/iquent au present projet.

Signature: _____

Nom:

Date:

Norn de la compagnie *:*

Appendix H4 – Guidelines on Noise Levels from the Industrial Construction Site (MDDELCC)

Développement durable, Environnement et Lutte contre les changements climatiques
Québec

Lignes directrices relativement aux niveaux sonores provenant d'un chantier de construction industriel

1. Pour le jour

Pour la période du jour comprise entre 7 h et 19 h, le MDDELCC a pour politique que toutes les mesures raisonnables et faisables doivent être prises par le maître d'œuvre pour que le niveau acoustique d'évaluation ($L_{Ar,12h}$)[1] provenant du chantier de construction soit égal ou inférieur au plus élevée des niveaux sonores suivants, soit 55 dB ou le niveau de bruit initial s'il est supérieur à 55 dB. Cette limite s'applique en tout point de réception dont l'occupation est résidentielle ou l'équivalent (hôpital, institution, école).

On convient cependant qu'il existe des situations où les contraintes sont telles que le maître d'œuvre ne peut exécuter les travaux tout en respectant ces limites. Le cas échéant, le maître d'œuvre est requis de:

a) prévoir le plus en avance possible ces situations, les identifier et les circonscrire;
b) préciser la nature des travaux et les sources de bruit mises en cause;
c) justifier les méthodes de construction utilisées par rapport aux alternatives possibles;
d) démontrer que toutes les mesures raisonnables et faisables sont prises pour réduire au minimum l'ampleur et la durée des dépassements;
e) estimer l'ampleur et la durée des dépassements prévus;
f) planifier des mesures de suivi afin d'évaluer l'impact réel de ces situations et de prendre les mesures correctrices nécessaires.

2. Pour la soirée et la nuit

Pour les périodes de soirée (19 h à 22 h) et de nuit (22 h à 7 h), tout niveau acoustique d'évaluation sur une heure ($L_{Ar,1h}$) provenant d'un chantier de construction doit être égal ou inférieur au plus élevé des niveaux sonores suivants, soit 45 dB ou le niveau de bruit initial s'il est supérieur à 45 dB. Cette limite s'applique en tout point de réception dont l'occupation est résidentielle ou l'équivalent (hôpital, institution, école).

La nuit (22 h à 7 h), afin de protéger le sommeil, aucune dérogation à ces limites ne peut être jugée acceptable (sauf en cas d'urgence ou de nécessité absolue). Pour les trois heures en soirée toutefois (19 h à 22 h), lorsque la situation[2] le justifie, le niveau acoustique d'évaluation $L_{Ar,3\ h}$ peut atteindre 55 dB peu importe le niveau initial à la condition de justifier ces dépassements conformément aux exigences « a » à « f » telles qu'elles sont décrites à la section 1.

---

[1] Le niveau acoustique d'évaluation $L_{Ar,T}$ (où T est la durée de l'intervalle de référence) est un indice de l'exposition au bruit qui contient niveau de pression acoustique continu équivalent $L_{Aeq,T}$, auquel on ajoute le cas échéant un ou plusieurs termes correctifs pour des appréciations subjectives du type de bruit. Pour plus de détail concernant l'application des termes correctifs, consulter la Note d'instructions 98-01 sur le bruit.

[2] C'est-à-dire lorsque les contraintes sont telles que le maître d'œuvre ne peut exécuter les travaux tout en respectant les limites mentionnées au paragraphe précédent pour la soirée et la nuit.

Appendix H5 – Noise Impact Intensity

Annexe H5 - Intensité de l'impact sonore

L'intensité de l'impact social et environnemental exprime l'importance relative des conséquences attribuables à l'altération d'une composante. Pour la majorité des composantes environnementales, elle dépend à la fois de la valeur de la composante environnementale considérée et de l'ampleur de la perturbation (degré de perturbation) qu'elle subit. Par contre, pour le bruit, l'approche pour déterminer l'intensité et l'importance est exposée ci-après.

La détermination de l'intensité et de l'importance de l'impact sonore a été basée principalement sur la norme ISO 1996-1.

« *Pour être utile, toute méthode de description, de mesurage et d'évaluation du bruit de l'environnement doit être liée, de quelque manière que ce soit, à ce qui est connu de la réaction humaine par rapport au bruit* » (SCHULTZ T.J., 1978).

Plusieurs recherches ont établi des relations dose-effet à long terme associées au bruit (niveau de bruit vs réaction des individus). Une des premières relations proposées est celle de Schultz en 1978, basée sur des bruits reliés aux transports (voir figure H1). D'autres relations ont aussi été proposées par la suite (FINEGOLD S.F. et All, 1994 et MIEDA H.M.E. et VOS H., 1998); en moyenne, « *elles coïncident virtuellement avec la courbe de Schultz* ».

« *Par mesure de simplicité et en raison de sa signification historique, la courbe de Schultz est considérée comme la courbe à utiliser pour définir le pourcentage de la population fortement gênée par le bruit dû à la circulation routière comme une fonction du niveau acoustique jour/nuit (L_{Adn}, en dB)* ». Cette courbe implique une perturbation de longue durée des individus d'une population.

« *Cette relation dose-effet peut être utilisée pour évaluer la réponse de la collectivité à la gêne causée par d'autres sources si les termes correctifs suggérés ont été appliqués* ».

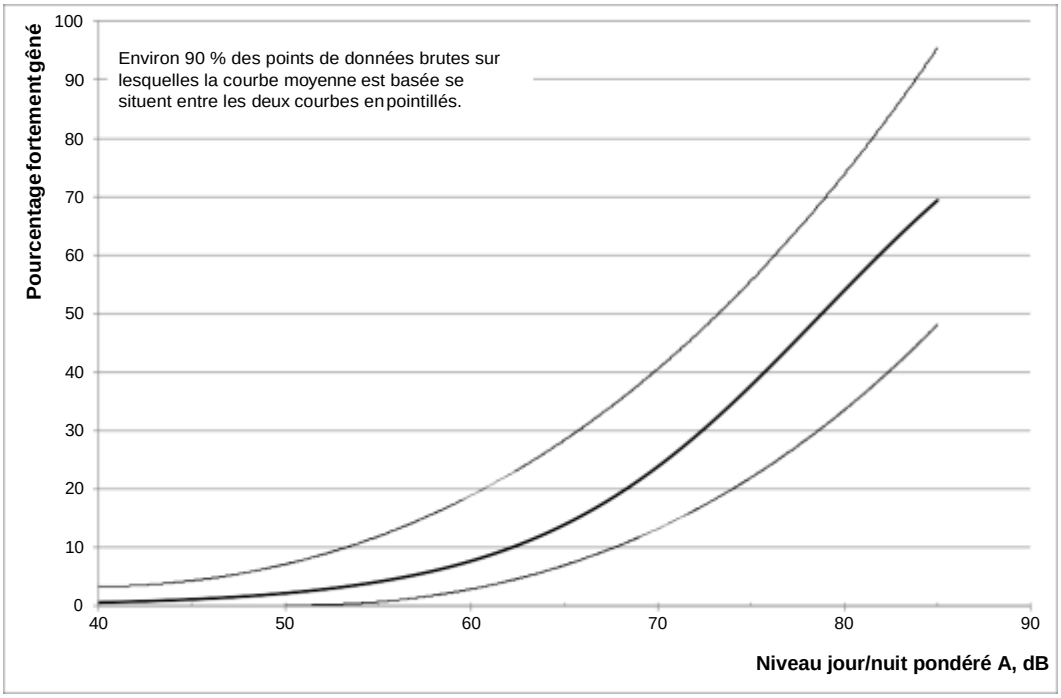
En tenant compte de ce qui précède, il est possible de déterminer le pourcentage de la population fortement gênée par le bruit avec la courbe de Schultz, à partir des résultats de mesures et de prévisions de bruit du projet, auxquels ont été appliqués un ou plusieurs termes correctifs.

Pour évaluer l'importance de l'impact du projet sur le climat sonore, en des termes qualitatifs (i.e. faible, moyenne, forte ou très forte), la méthodologie du département des Transports des États-Unis (HARRIS et al., 1995) a été utilisée. Certains critères, sur lesquels se sont appuyés cette méthode, se retrouvent par ailleurs dans des publications internationales (WHO, 1999) et nationales (SCHL, 1981 et Comité consultatif fédéral – provincial de l'hygiène du milieu et du travail, 1989). Essentiellement, lorsque l'étendue de la perturbation est ponctuelle et que la durée est longue, l'importance est déterminée par l'ampleur du changement dans le pourcentage de la population fortement perturbée par le bruit apporté par le projet (approche relative), ainsi que par des niveaux sonores cibles (approche absolue). Cette approche est également proposée par (Santé Canada, 2010).

Si la détermination de l'importance de l'impact se fait pour une situation dont l'étendue et la durée diffèrent des caractéristiques indiquées précédemment, la grille de détermination de

l'impact est alors utilisée pour ajuster l'importance de l'impact selon les caractéristiques de la perturbation.

Figure H1 Relation dos e-effet de Sh ultz

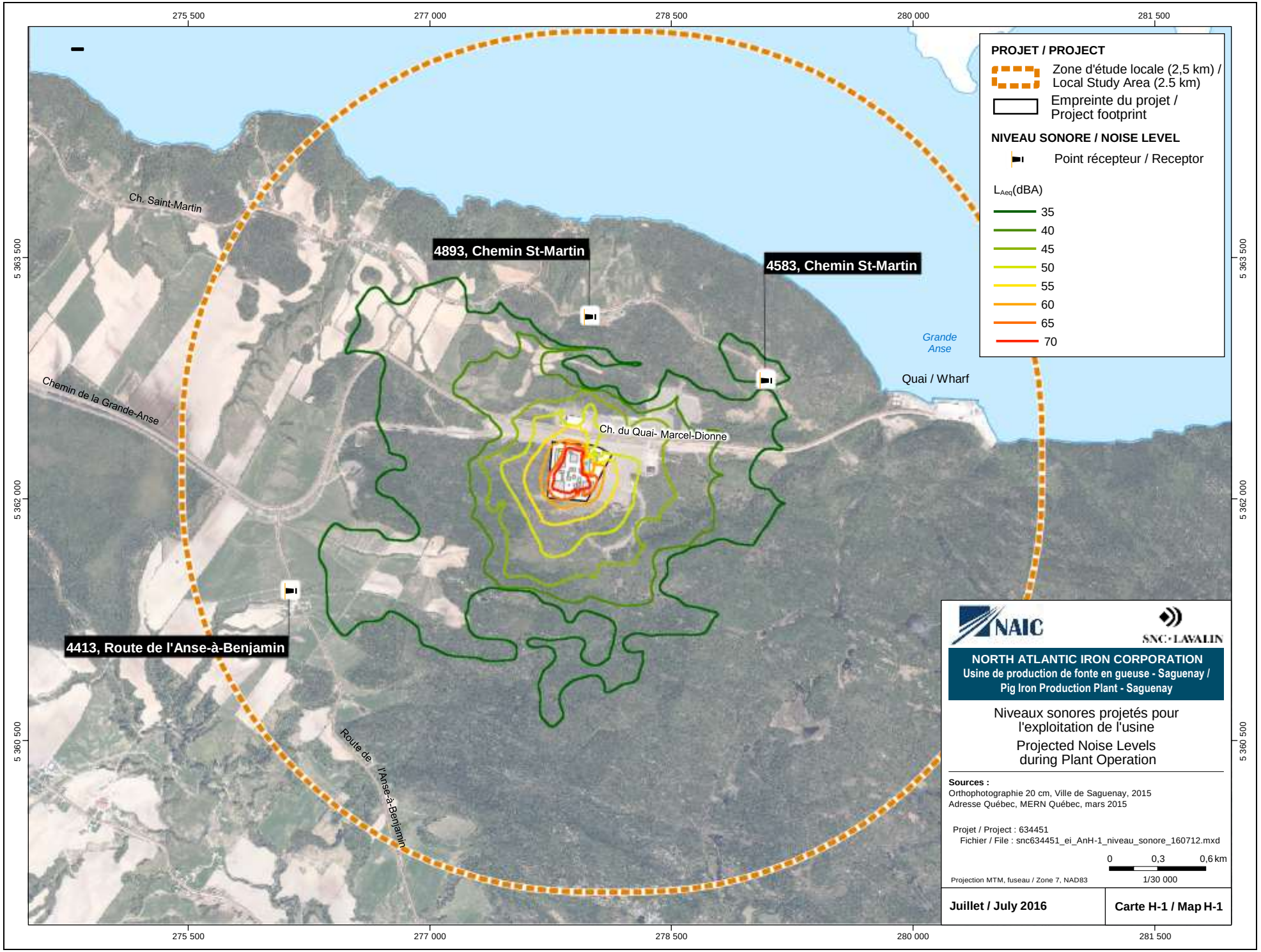


Importance d e l'im p act environnemental – Climat s onore

Qualification de l'importance de l'impact environnemental [(a)]	Changement dans le % de la population fortement gênée par le bruit causé par le projet (climat projeté vs climat initial)		Niveaux sonores cibles, climat sonore projeté
Faible	2,0 % et moins	ou	L_{Adn} ≤ 55 dB
Moyen	2,1 à 6,2 %	et	L_{Adn} > 55 dB
Fort	6,3 à 13,9 %	et	L_{Adn} > 55 dB
très fort	14 % et plus	ou	L_{Adn} ≥ 75 dB

(a) Pour une perturbation ponctuelle de longue durée

Appendix H6 – Map H1 Predicted Noise Levels during Facility Operation



T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnH-1_niveau_sonore_160712.mxd

Appendix J

Consultations

J1 – Stakeholders Met (preliminary consultations)

J2 – Description of Targeted Stakeholders

J3 – Communication Tools Used during Preliminary Consultations

Appendix J1 – Stakeholders Met (preliminary consultations)

Appendix J1 – Meetings and Exchanges Carried Out during Consultations (Exploration Phase)

Category	Organization	Person Consulted	Position	Date (2016)	Place	Type of Meeting	Participants (promotor and consultants)
Administration/elected member	City of Saguenay	Jean Tremblay	Mayor of the City of Saguenay	25 Jan.	City of Saguenay (Mayor's Office)	Exploratory Consultation	**SNC-Lavalin** Lina Lachapelle Pablo Dewez
		Jean-François Boivin	Director General of the City of Saguenay				
Socio-economic Organization	Promotion Saguenay Inc.	Claude Bouchard	Directeur Affaires Corporatives				
Socio-economic Organization	Saguenay Port Authority (Property owner)	Carl Laberge	Director General				
Socio-economic Organization	Saguenay Port Authority	Carl Laberge	Director General	25 Jan.	Saguenay Port Authority	Exploratory Consultation	**SNC-Lavalin** Lina Lachapelle Pablo Dewez
Socio-economic Organization	La Baie local employment center	André Gariépy	Director	26 Jan.	La Baie local employment center	Exploratory Consultation	**SNC-Lavalin** Lina Lachapelle Pablo Dewez
		Patricia Durand	Company advisor				
Citizens	Household 2	Resident of *Chemin* Saint-Martin	Land owner	26 Jan.	Residence	Exploratory Consultation	**SNC-Lavalin** Lina Lachapelle Pablo Dewez
Citizens	Household 4	Resident of *Chemin* Saint-Martin	Land owner	26 Jan.	Residence	Exploratory Consultation	**SNC-Lavalin** Lina Lachapelle Pablo Dewez

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Category	Organization	Person Consulted	Position	Date (2016)	Place	Type of Meeting	Participants (promotor and consultants)
Environmental Organization	Verts Boisés du Fjord	Julien PetitClerc	President	27 Jan.	Verts Boisés du Fjord	Exploratory Consultation	**SNC-Lavalin** Pablo Dewez
		Jean Désy	Vice-president				
		Marcel Villeneuve	Administrator				
		Roger Potvin	Administrative Assistant				
Citizens	Household 7	Resident of Route de l'Anse à Benjamin	Land owner	27 Jan.	Residence (household 7)	Exploratory Consultation	**SNC-Lavalin** Pablo Dewez
Citizens	Household 9	Resident of Route de l'Anse à Benjamin	Land owner				
Citizens	Household 1	Resident *Chemin* Saint-Martin	Land owner	27 Jan.	Auberge des 21 (La Baie)	Exploratory Consultation	**SNC-Lavalin** Pablo Dewez
Citizens	Household 6	Resident *Chemin* Saint-Martin	Land owner	28 Jan.	Residence	Exploratory Consultation	**SNC-Lavalin** Pablo Dewez
Socio-economic organization	Integrated good neighbor committee	Marc Hudon	Coordinator	28 Jan.	Auberge des 21 (La Baie)	Exploratory Consultation	**SNC-Lavalin** Pablo Dewez
Environmental organization	ZIP Committee Saguenay						
Administration/elected member	City of Saguenay	Denis Coulombe	Director of the urbanism service	28 Jan.	Telephone	Information Request/ Exploratory Consultation	**SNC-Lavalin** Pablo Dewez
Socio-economic organization	Chicoutimi local employment center	Marc Tremblay	Economist	28 Jan.	Telephone	Information Request / Exploratory	**SNC-Lavalin** Pablo Dewez

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						Consultation	
Socio-economic organization	School board of Rives-du-Saguenay	Sébastien Renaud	Consultant / Company training support	28 Jan.	Telephone	Information Request / Exploratory Consultation	**SNC-Lavalin** Pablo Dewez
Aboriginal community	Mashteuiatsh Community	François Rompré	Coordinator of economy and business relationships	17 Feb.	Hotel Le Montagnais	Exploratory Consultation	**SNC-Lavalin** Pablo Dewez
Aboriginal community	Essipit Community	Marc Genest	Director economic development				
		Marc St-Onge	Coordinator of land development and consultations				
Aboriginal community	Pessamit Community	Jack Picard	Coordinator of negotiations				
		Louis Archambault	Consultant				

Appendix J2 – Description of Targeted Stakeholders

Appendix J2 – Description of Stakeholders

Name	Description Summary	Website	Consultation Phase
City of Saguenay	Saguenay (in Amerindian, "from where the water comes") was created in 2002 following the fusion of Chicoutimi, Jonquière, La Baie, Laterrière, Canton Tremblay, Lac-Kénogami and Shipshaw. Covering an area of 1,166 km^2, it is situated in the region of Saguenay-Lac-Saint-Jean and is the 7th largest city in Quebec with 146,000 inhabitants. Within its borders are many water courses and lakes, notably the Saguenay River and Lake Kénogami. The economic history of the region (150 years) has been marked by the forestry industry, the production of pulp and paper, the aluminum industry, tourism and agricultural activity, which alone represented 38% of the land use in 2005. The city mayor is Jean Tremblay.	http://ville.saguenay.ca/	Preliminary
Saguenay Port Authority (APS)	The Saguenay maritime facilities were brought about through a diversity of economic exportation activities shaping the history of the region, such as wood, pulp and paper and aluminum smelter products. A public institution, the Saguenay Port Authority, or *l'Administration portuaire du Saguenay* (APS), was officially created in 1999 in virtue of the Maritime Law of Canada. Its mission is to favor commercial exports as well as the development and industrialization of the inland region, providing utilities and environmental conditions that go with it. The APS holds a port terminal at La Baie (Grande-Anse Maritime Terminal) dedicated to general merchandise and solid and liquid bulk products.	http://www.portsaguenay.ca/	Preliminary
Good Neighbour Committee	This committee was created 20 years ago following an appeal against Rio Tinto concerning dust emissions. The goal was to establish a communication medium between the facility and its neighbours, in order to amicably settle disputes concerning nuisances generated by the facility. Today, the committee has enlarged its function to bring together major industries established in Saguenay, and more particularly in the Borough of La Baie, and its citizens. The committee is formed from three large groups: the Good Neighbour Committee (facilitator), the Industry Director Committee (made up of industry representatives, 1 representative per company, and representatives of key organizations of the City of Saguenay) and the Citizen Director Committee (5 representatives of residential sectors of La Baie.) The committee contains 6	Not available	Preliminary

			Consultation Phase
	work-themed sub-committees (railway, trucking, urban development, expansion, environment, industry) and meets around every 2 months.		
Promotion Saguenay Inc.	Founded following the fusion of economic development companies of municipalities in 2002, this corporation assembles businesses of different economic activities in Saguenay. Its mission is to contribute to the economic development of Saguenay in the industrial, commercial and tourism industries. It offers amongst other things support and services to companies, commercial corporations and investors in the region. It contributes to the revitalization of downtown areas and participates in the touristic development of Saguenay. Promotion Saguenay also sits on several different committees, including the Good Neighbour Committee.	http://www.promotionsaguenay.qc.ca/	Preliminary
Local Employment Center	The Local Employment Center is a governmental organization working to support people in need of employment or financial aid as a last resort. Many services are also offered to companies with vacant positions or wanting to be informed about the local labour force and the development of skills. The Center makes use of a network of collaborators allowing it to develop tailored training programs, according to specific needs of each company. It collaborates with, amongst others, the Rives-du-Saguenay School Board and more particularly company services (SAE).	http://www.mess.gouv.qc.ca/services-a-la-clientele/centre-local-emploi/ http://www.mess.gouv.qc.ca/services-en-ligne/centres-locaux-emploi/localisateur/resultats.asp?codeRegionale=02&idEtabli=R02	Preliminary
Rives-du-Saguenay School Board	Although it has around 150 years of history, the Rives-du-Saguenay School Board was founded in 1998 following the fusion of three school boards (Baie-des-Ha! Ha!, Chiocoutimi and Valin), providing primary and secondary education in the region. The establishments are made up of 31 primary schools, six secondary schools, an adult training center, five professional training centers, and a company service (SAE). In order to contribute to the development of companies and individuals, the SAE offers consultation and training services directed towards labour market needs. The SAE is made up of four training establishments, of which three are in Chicoutimi and one in La Baie.	http://www.csrsaguenay.qc.ca/	Preliminary
ZIP Saguenay-	Represented by Stratégies Saint-Laurent, the Priority Action Zone (ZIP) of	http://www.zipsaguenay.ca/	Preliminary

			Consultation Phase
Charlevoix	Saguenay-Charlevoix is a not-for-profit environmental organization founded in 1990. Its objective is to protect and enhance the Saguenay River and the Saint Lawrence River through the mobilization and engagement of shore-line populations of the region. Including a population of more than 200,000 inhabitants (of which 73% are in the City of Saguenay), its active zone extends over an area of more than 100 km on either side of the Saguenay River and over 160 km on the north shore of the Saint Lawrence River. Within this zone is found the marina park of Saguenay-Saint-Lawrence and the Saguenay Provincial Park.		
Les Verts Boisés du Fjord	*Les Verts Boisées du Fjord* was recognized in 1996 as a not-for-profit organization. Volunteer-based, its mission lies on the accessibility and the use of urban forests of Saguenay for leisure, education and conservation. It is authorized to receive (by purchase, donations or trade), develop and maintain eco-sensitive land recognized by the Quebecois government. The organization carries out youth activities in order to make them aware of preservation and use of forests neighbouring their schools.	http://www.lvbf.org/	Preliminary
Mashteuiatsh	Covering an area of around 15 km^2, the community of Mashteuiatsh is located 6 km north of Roberval, at the western border of Lac-Saint-Jean. The First Nation of Mashteuiatsh (“Pointed Place”) comes from the First Nation Ilnu (or Innu). The Mashteuiatsh Community is composed of 6,562 members (including 2,085 residents) that speak Nehlueun and French. The economy and community rely on art and handicrafts, commerce and services, construction, the forest industry, tourism, transportation and public administration. The tribe chief is Gilbert Dominique.	http://www.mashteuiatsh.ca/	Preliminary
Essipit	Covering an area close to 88 ha, the First Nation community of the Essipit Innus is situated in Les Escoumins, 40 km northeast of Tadoussac. The community is made up of 702 members of which 209 live within the territory. The economy relies principally on the recreation-tourism industry which is made up of a number of outfitters, as well as several residential centers and restaurants, with sales of more than 10 M$. The tribe chief is Martin Dufour.	http://www.innu-essipit.com/	Preliminary
Pessamit	The Innu community of Pessamit (“place of leeches, sea lampreys, and sea eels”) is located 54 km to the southwest of Baie-Comeau, on the north shore of	http://www.pessamit.ca/	Preliminary

			Consultation Phase
	the Saint-Lawrence River. Coming from the larger Algonquin family, the family includes 3,933 members (of which 2,862 are residents) and covers an area a little larger than 250 km^2. The traditional territory (Nitassinan) occupies alone an area of close to 138,000 km^2, extending up to the Caniapiscau Reservoir on the north side. This territory rich with 10,000 years of history was witness to significant commercial exchanges by many aboriginal nations (Innus and others) and European peoples. The arrival of industrial and vacation developments dividing the territory has however impeded the sociocultural practices of the Pessamiulnut. The tribe chief of the Pessamit Innus is René Simon.		
Anse à Pelletier collective	This collective is a group of citizens created following the announcement of the project of an opening and operation of an apatite mine of the Paul Lake in Saguenay, Lac-Saint-Jean. It is made up of landowners and residents of the Anse à Pelletier sector, in the Saint-Fulgence municipality. The collective aims to ensure the protection of the Fjord-du-Saguenay in the face of development of new industrial projects, notably through participating in public consultations.	http://www.collectifansepelletier.ca/	Expanded consultation
City of Saint-Fulgence	Also known as Saint-Fulgence de l'Anse-au-Foin, the city was created in 1972 following the fusion between the village and the parish of Saint-Fulgence. Covering an area of 394 km^2, it is situated in the region of Saguenay-Lac-Saint-Jean and is home to 2,031 inhabitants. Historically, the forest and agricultural activities dominated the local economy and remain dominant. The mayor of the city is Gilbert Simard.	http://www.ville.st-fulgence.qc.ca/	Expanded consultation
RCM of Fjord-du-Saguenay	Created in 1983, this RCM is part of the Saguenay-Lac-Saint-Jean region. Its administrative center is found in Saint-Honoré and is made up of 16 municipalities over an area of 38,935 km^2, for a total of 21,646 inhabitants. The forest, covering 92% of the territory, is composed of a significant variety of species that are found on nine controlled exploitation zones (ZEC) and the three parks of the territory: two national parks and one marine park. The Saguenay River splits the territory from the RCM from east to west. The prefect of the RCM is Gerald Savard.	http://www.mrc-fjord.qc.ca/	Expanded consultation
Eurêko!	The Chicoutimi Environment Committee was founded in 1978. At its beginnings, the organization focused on two major issues, the spilling of waste	http://www.eureko.ca/	Expanded

			Consultation Phase
	snow into the Saguenay and the dismantling of petroleum tanks. In 2010, the CEC became EURÊKO!, a not-for-profit organization that plays a group role in pressuring elected officials and government representatives, and that sensitize the population of the region of Saguenay-Lac-Saint-Jean to diverse environmental problems. The director general of EURÊKO! is Simon Gagné.		consultation
Regional environmental and sustainable development council of Saguneay-Lac-Saint-Jean (CREDD)	The CREDD of Saguenay – Lac-Saint-Jean is a not-for-profit organization founded in 1973. It is recognized as a regional preferred representative to the Ministry of Sustainable Development, Environment and the Fight against Climate Change (MDDELCC) for dialogue concerning the environment, environmental education and the promotion of sustainable development. It is a member of the National Group of Regional Environmental Councils of Quebec (RNCREQ).The director general of CREDD of Saguenay-Lac-Saint-Jean is Tommy Tremblay.	http://www.creddsaglac.com/	Expanded consultation
Chamber of commerce and industry of Saguenay – Le Fjord	La Chambre de commerce a pour mission de regrouper et de défendre les acteurs économiques, afin de favoriser le développement socio-économique et environnemental du Saguenay et du Fjord. Elle compte plus de 120 ans d'histoire et divers programmes de soutien aux entreprises. En juin 2016, la Chambre change de nom est devient la Chambre de commerce et d'industrie Saguenay-Le Fjord afin d'avoir une portée plus grande. La directrice générale de la CCISF est Marie-Josée Morency. The mission of the chamber of commerce is to group and defend the economic stakeholders, in order to favor the socio-economic and environmental development of Saguenay and of the Fjord. It has more than 120 years of history and offers divers company support programs. In June 2016, the Chamber changed its name and became the Chamber of commerce and industry Saguenay-Le Fjord in order to have a wider impact. The director general of the CCISF is Marie-Josée Morency.	http://ccisf.ca/	Expanded consultation
Marine Park of the Saguenay – Saint-Laurent	Recognizing the importance of protecting the environment, wildlife, flora and natural resources of a part of the Saguenay Fjord and the Saint-Lawrence estuary, the governments of Canada and Quebec created in 1998 with the support of the population, the marine park of Saguenay-Saint-Laurent. The park is situated at the junction of the Saguenay and Saint-Lawrence and	http://parcmarin.qc.ca/	Expanded consultation

			Consultation Phase
	covers a surface of 1,246 km^2. The mission of the marine park is to raise, for the benefit of current and future generations, the level of protection of its ecosystems for conservation purposes while favoring educational, recreational and scientific activities. The activities practices in the marine park are within a sustainable development framework. The regional representatives also participate in the achievement of the objectives of the marine park.		
Saguenay Watershed Organization (OBV Saguenay)	OBV Saguenay was formed following the announcement in March 2009 by the MDDELCC of the rezoning of the territory of southern Quebec into 40 zones of integrated management per watershed. In September 2009, the general assembly of the foundation of the Saguenay Watershed Organization officially created the new organization responsible for the implementation of the Integrated Management of Water per Watershed (GIEBV) for all the watersheds of the rivers that discharge into the Saguenay River. The mission of the OBV Saguenay is to ensure and to promote the protection, the valuing and the development of the watershed (hydrographic basin) of the Saguenay River, through respecting its ecosystem and in a sustainable development perspective. The general director of the OBV is Marco Bondu.	http://www.obvsaguenay.org/	Expanded consultation
Society of the Valley of Aluminum	Not-for-profit organization active on the international market and created in 2001, the Society of the Valley of Aluminum contributes to the stimulation of aluminum transformation activities and participate in the implantation, start-up and growth of companies situated in Saguenay-Lac-Saint-Jean. The organization plays a leading role and constitutes an entrance to investors and desiring exploiters in the aluminum field. The Society works in close collaboration with a network of partners in economic and strategic development of the Québecois, Canadian and international scene. The Society director is Malika Cherry.	http://www.valuminium.ca/	Expanded consultation
Association of the Enterprises of the Industrial Park of the Haut-Saguenay Inc. (AEPHIS)	AEPHIS was created in 1981 conjointly by the Economic Expansion Society of Saguenay, the City of Chicoutimi and a group of contractors of the Chicoutimi Industrial Park. Its mission is to defend the users' interests, to favor exchange between the occupants of the Industrial Park, to maintain a harmonious climate and a safe environment.	http://www.parcindustriel.info/	Expanded consultation

Appendix J3 – Communication tools Used during Preliminary Consultations

J3.1 – Interview guide

J3.2 – Project location map

J3.3 – Process flow diagram for the fabrication of pig iron (French only)

J3.4 – Images of pig iron and typical facility

Appendix J3-1 – Preliminary Consultations

Themes – Meetings with key stakeholders

1. Introduction

- Objectives
- Presentation of participants
- Role and mission of the organization (when applicable)

2. Presentation of the project

- Environmental and social assessment process
- Public consultation and information approach
- Presentation of the Pig Iron Plant

3. Opinion

- What is your opinion on the project?
- What are your main concerns?
- In your opinion, how is the project going to be welcomed by the host community?

4. Issues

- In your opinion, what are the main issues related to the project?
- In your opinion, what are the main factors that could hinder the project?
- How NAIC's project can contribute to the development of the city, and more globally of the region?

5. Consultation process

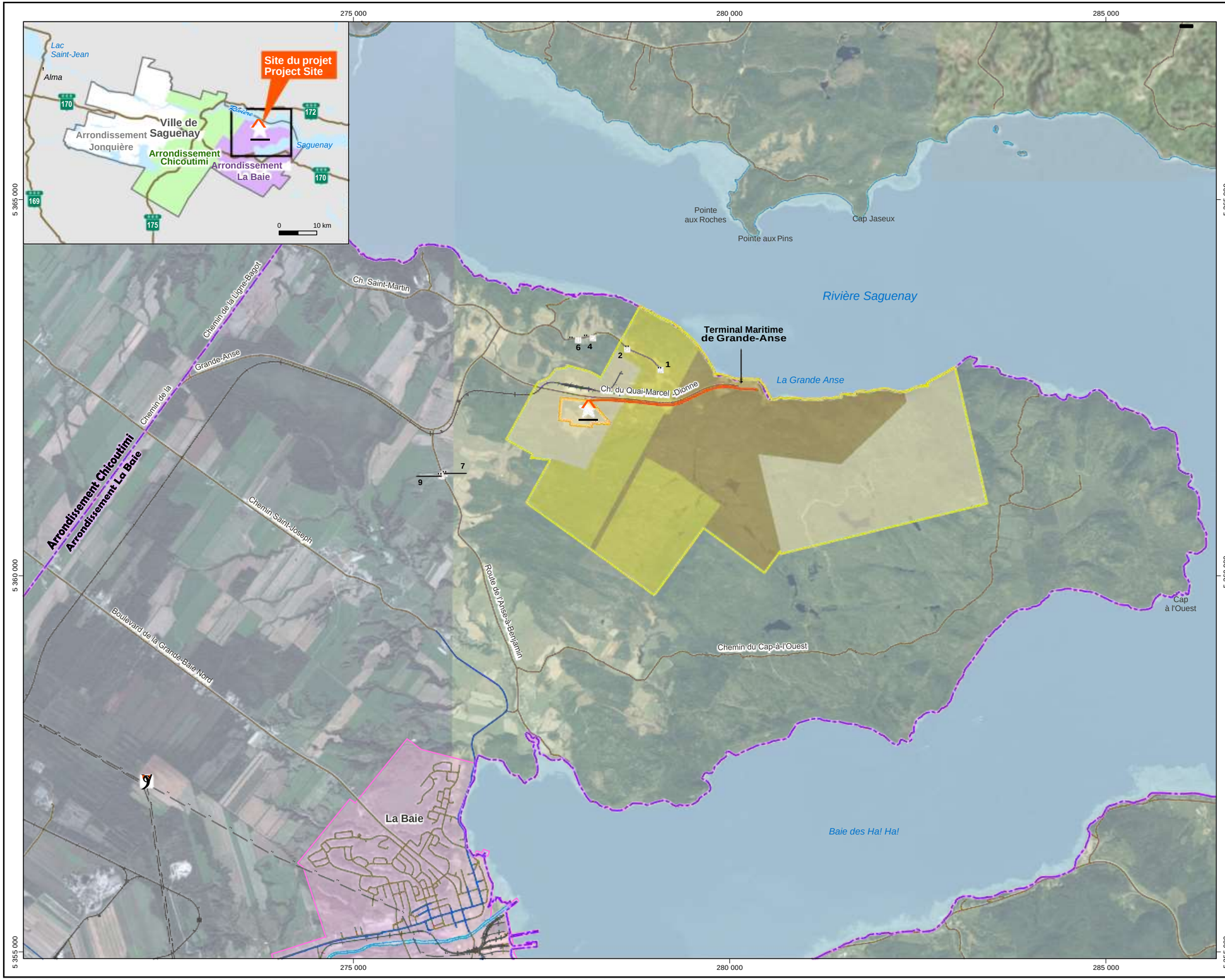
- In terms of information and consultation, what needs must be addressed?
- In your opinion, who are the priority stakeholder groups to keep informed or to consult about the project?
- In your opinion, which information and consultation mechanisms should be favored?

6. Other comments or questions

- Are there any other key stakeholders that you would recommend we meet during this environmental assessment?
- Are there any specific reference documents that you recommend we consult?
- Finally, are there any comments or questions you would like to address before concluding this interview?

7. Next steps

- Environmental assessment
- Public consultation



..1 Résidants à proximité du site du projet consultés / Residents near Project Site consulted

Composantes du projet
Project Components

- Site du projet / Project Site
- Emplacement approximatif du convoyeur / Conveyor Approximative Location
- Connection proposée au réseau d'Hydro-Québec / Proposed Connexion to Hydro-Québec Network

Infrastructures existantes
Existing Infrastructure

- Réseau de Gaz Métro / Gaz Métro Network
- Chemin de fer / Railway
- Ligne de transport d'énergie électrique / Power Line
- Réseau routier / Road Network

Limites administratives
Administrative Limits

- Limite d'arrondisssement / Arrondissement Limits

Affectation du territoire
Landuse Planning

- Unité de planification 119p / Planning Unit 119p
- Portuaire / Harbour
- Plan d'aménagement d'ensemble industriel / Industrial Complex Management Plan
- Industielle / Industrial
- Périmètre urbain / Urban Perimeter

NAIC

SNC-LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay / Pig Iron Production Plant - Saguenay

Carte 1 / Map 1
Localisation du site du projet / Project Site Location

Sources :
BDGA, 1/1 000 000, MRN Québec, 2012
Image satellite / Satelitte Image: Bing Maps Aerial
Réseau de gaz naturel, Gaz Metro, 2012
Adresse Québec, 1/20 000, MRN Québec, 2015

Projet / Project : 634451

Projection MTM, fuseau 7, NAD83

0 500 1 000 m
1/50 000

Document de t ravail

Rév. Rév.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified
00	2016/07/25	Préliminaire / Preliminary	L. Bathalon	P. Dewez

Format 11x17

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Fabrication des briquettes

Concentre de minerai de fer

Charbon

Liant

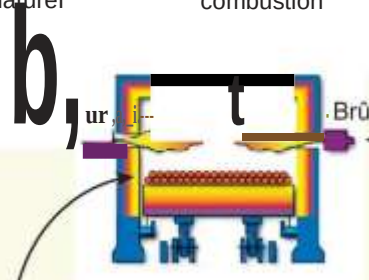
Briquettes froides

Reduction directe du fer

FOUR ROTATIF

Gaz naturel

Gaz de combustion



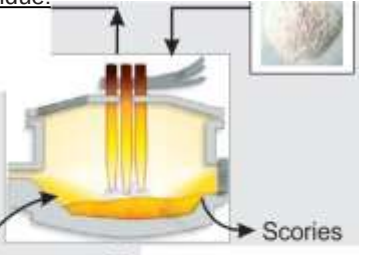
Briquettes réduites chaudes (Fe à 80%)

Fusion de fonte en gueuse

FOUR A ARC ELECTRIQUE

Fondant

Gaz residue!



Metal en fusion

Coulee de fonte en gueuse

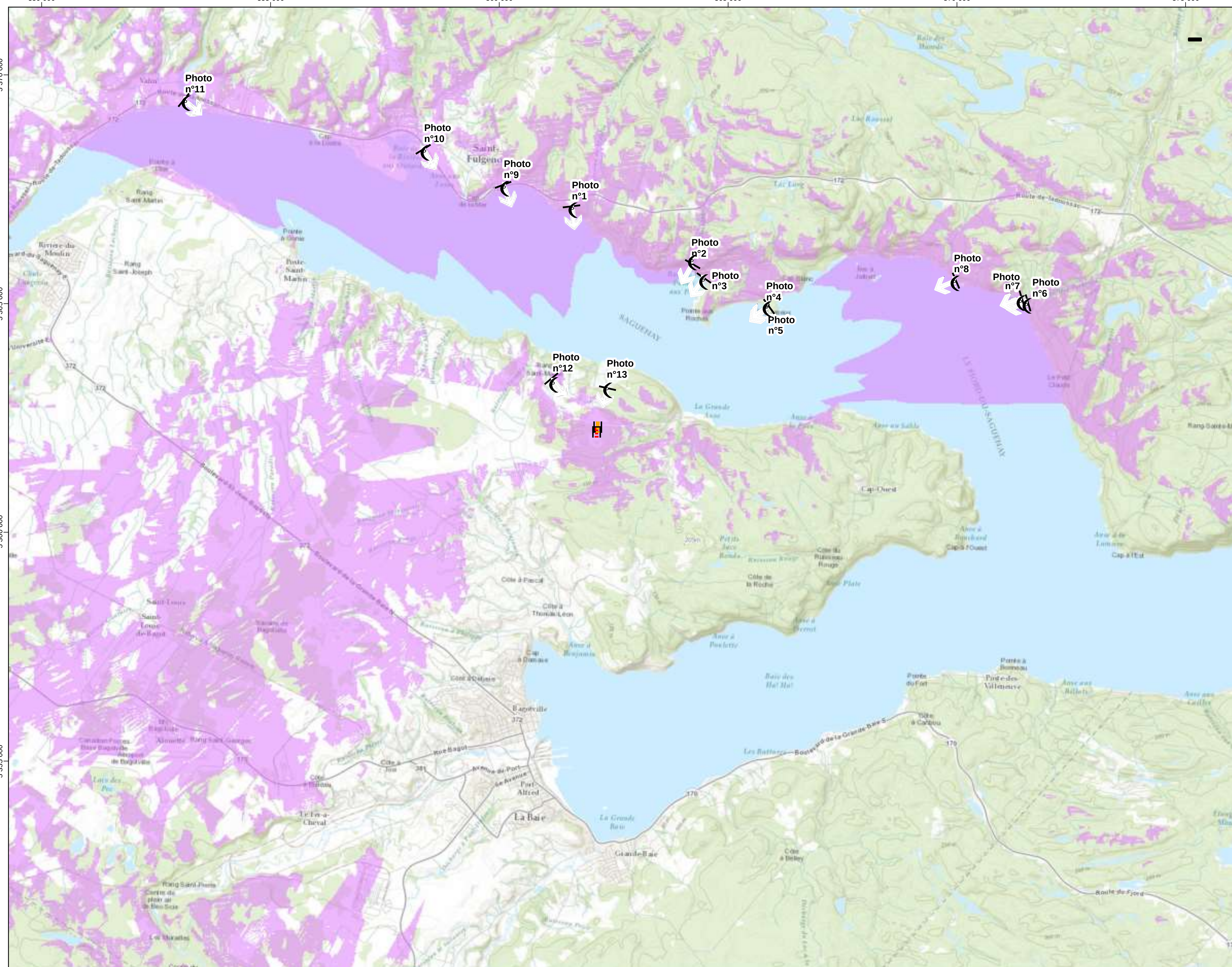
Fonte en gueuse

Appendix I

Visual Impact

I1 – Location of Photos and Visibility Analyses
I2 – Photographic Report
I3 – Visual Impact Variable Analysis

Appendix I1 – Location of Photos and Visibility Analyses



Composantes du projet
Project Components

Infrastructures et points d'observation

- Réacteur / Reactor
- Dôme / Dome
- Point d'observation / Observation Point
- Orientation de la prise de photo / Photo Orientation

Visibilité / Visibility

- Visibilité du réservoir et du réacteur / Visibility of Reservoir and Reactor

Modèle numérique d'élévation / Digital Elevation Model
RN Canada, 50K

NAIC
SNC-LAVALIN

NORTH ATLANTIC IRON CORPORATION
Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Carte I1/ Map I1

Localisation des photos et analyse de visibilité/
Location of photos and visibility analysis

Sources :
Carte topographique / Topographical Map : ESRI

Projet / Project : 634451

0 850 1 700 m

Projection UTM, fuseau 19, NAD83

1/85 000

00	2016/07/25	Final / Final	C. LaRoche	L. Lachapelle
Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description / Description	Préparé / Prepared	Vérifié / Verified

Format 11x17

Envir01: T:\Proj\634451 Pig Iron Saguenay\4.0_Réalisation\4.5_SIG\GEOMATIQUE\interne\diffusion\produits\EI_final\snc634451_ei_AnI_photos_visibilite_tab_f00.mxd

Appendix I2 – Photographic Report

Photo n° 1 (2016-06-01) : Vue à partir de l'auberge de la Tourelle vers le site du projet

Photo n° 1 (2016-06-01) : Vue à partir du Cap jaseux vers le site du projet

Photo n° 3 (2016-06-01) : Vue à partir du Cap jaseux vers le site du projet

Photo n° 4 (2016-06-01) : Vue à partir de la Pointe aux Pêcheurs vers le site du projet

Photo n° 5 (2016-06-01) : Vue à partir des Vinaigriers vers le site du projet

Photo n° 6 (2016-06-01) : Vue à partir du pont de l'Anse-à-Pelletier vers le site du projet

Photo n° 7 (2016-06-01) : Vue à partir de l’adresse civique 600 de l’Anse-à-Pelletier vers le site du projet

Photo n° 8 (2016-06-01) : Vue à partir de l’adresse civique 4 de l’Anse-à-Pelletier vers le site du projet

Photo n° 9 (2016-06-01) : Vue à partir de la rampe de mise à l’eau de saint-Fulgence vers le site du projet

Photo n° 10 (2016-06-01) : Vue à partir des battures de saint-Fulgence vers le site du projet

Photo n° 11 (2016-06-01) : Vue à partir de la halte routière de saint-Fulgence vers le site du projet

Photo n° 12 (2016-06-01) : Vue à partir du Chemin de la Grande-Anse vers le site du projet

Photo n° 13 (2016-06-01) : Vue à partir du Chemin Saint-Martin vers le site du projet

Appendix I3 – Visual Impact Variable Analysis

Tableau I1 : Variables de l'analyse de l'impact du paysage

Unité	Degré de résistance	Degré d'absorption	Degré d'intégration	Champ visuel	Distance de l'observateur	Positionnement dans la vue	Position relative de l'observateur	Degré d'exposition visuel	Observateurs mobiles	Observateurs fixes permanents	Observateurs fixes temporaires	Rayonnement de l'impact	Degré de perception de l'équipement	Importance de l'impact visuel	Durée de l'impact visuel
1	Fort	moyen	faible	ouvert	env. 12 km	arrière-plan	équivalente	moyen		100-200		local	moyen	**moyen**	permanente
2	Fort	moyen	faible	ouvert	6 à 12 km	arrière-plan	équivalente	moyen	peu nombreux	100-200		local	moyen	**moyen**	permanente
3	Fort	fort	faible	ouvert	env. 8 km	arrière-plan	inférieure	faible	nombreux	> 1000		local	moyen	**mineure**	permanente
4	Fort	moyen	faible	fermé	0 à 8 km	plan intermédiaire	équivalente	moyen	peu nombreux	< 100		local	faible	**mineure**	permanente
4a	Fort	faible	faible	ouvert	< 1 km	avant plan	équivalente	élevé	peu nombreux	0	employés	local	moyen	**moyen**	permanente
4b	Fort	fort	faible	fermé	env. 1km	arrière-plan	inférieure	faible	peu nombreux	< 100		local	faible	**mineur**	permanente
5	Fort	moyen	faible	panoramique	1,5km à 10 km	arrière-plan	inférieure	moyen	peu nombreux	<50		local	moyen	**moyen**	permanente
6a	Fort	moyen	faible	panoramique	4,5 à 10 km	arrière-plan	inférieure	moyen	nombreux	<50	peu nombreux	local	moyen	**moyen**	permanente
6b	Fort	moyen	faible	panoramique	4,5 à 10 km	arrière-plan	équivalente	moyen	peu nombreux	<50	moyen	local	moyen	**moyen**	permanente

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Appendix K

Technological Risks

K1 – Safety Data Sheets
K2 – Consequence Assessment Assumptions
K3 – Preliminary Emergency Response Plan

Appendix K1 – Safety Data Sheets

List of Products

1. Foam Control Agent (Amerel 1500 or 2000)
2. Nitrogen (N_2)
3. Bauxite
4. Bentonite
5. Iron Pellets (BMC)
6. Catalyst (MoCo)
7. Activated Carbon
8. Lime (CaO)
9. Cement
10. Diesel
11. Dimethyl Disulfide (DMDS)
12. Dolomite
13. Graphite
14. Pig Iron
15. Natural Gas
16. Methyldiethanolamine, activated (aMDEA)
17. Hydrous Aluminium Silicate
18. Sodium Silicate Solution

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Annexe K2 – Consequence Assessment Assumptions

Consequence Assessment Assumptions

Scenario	Assumptions
Natural gas – Standardized scenario	› Complete breakage of the feed line followed by a jet fire. › Diameter: 10 inches (25.5 cm) › Gas pressure: 10 bar (g) › Gas temperature: 25oC › Horizontal loosening, 1 m above the ground
Diesel – Standardized scenario	› Complete spillage of tank in 10 minutes followed by a pool fire. › Fuel tank capacity: 200 m^3 › Pressure: atmospheric tank › Temperature: ambient temperature (25°C) › Basin with an estimated surface area of 300 m^3 › Horizontal loosening, 1 m above the ground
DMDS – Standardized scenario/Alternative scenario	› Complete spillage of tank in 10 minutes, evaporation of DMDS and formation of a toxic cloud. › Evaporation starts upon discharge and continues for 60 minutes. › Tank capacity: 30 m^3 › Pressure: atmospheric tank › Temperature: ambient temperature (25°C or 0°C) › Basin with an estimated surface area of 50 m^3 › Horizontal loosening, 1 m above the ground
Natural gas – Alternative scenario – Jet fire	› Leakage from the feed line followed by a jet fire. › Leak diameter: 2 inches (5 cm) › Gas pressure: 10 bars(g) › Gas temperature: 25°C › Horizontal loosening, 1 m above the ground
Natural gas – Alternative scenario – Explosion	› Complete breakage of the feed line (same parameters as with the standardized scenario), formation of a flammable cloud, part of the cloud between the flammability limits is present in congested areas, ignition and explosion. › Utilization of the BakerStrehlow model with average congestion and low reactive materials. (*)
Process Gas – Alternative scenario	› Leak from a pipe of the process gas circuit, forming a toxic cloud (no ignition) or a jet fire (ignition). › Leak diameter: 2 inches (5 cm) › Gas pressure: 10 bars(g) (average in the circuit) › Gas temperature: 560°C (average in the circuit) › Horizontal loosening, 1 m above the ground › Composition of the gas: CO (55.7%), CO_2 (11.1%), CH_4 (16.2), N_2 (13.2), H_2O (3,5), C2+ (0.2).

* Source: FM Global 2012, INERIS, 1999

Appendix K3 – Emergency Response Plan

K3 Preliminary Emergency Response Plan

K3.1 Introduction

Note to the Reader

The Emergency Response Plan presented within the framework of the impact study is a preliminary version that will be revised once the organizational structure of North Atlantic Iron Corporation (NAIC) has been defined and once the inventory data, the exact location of the chemicals used and the mechanisms and roles of the various responders have been reviewed with the relevant authorities. More specifically, the Emergency Response Plan will be updated for the purposes of the request for the certificate of operation of the pig iron facility.

K3.1.1 Objectives

The objectives of the Emergency Response Plan are as follows:

- Make sure employees, contractors, external responders and the public are safe;
- Reduce the risk of damage and impacts on the environment and the community in the event of an accident;
- Plan emergency procedures to minimize the time and costs of response and recovery;
- Define the responsibilities of employees and external responders in the planning and implementation of the Emergency Response Plan.

The final version of the Emergency Response Plan will be consistent with Canada's national standard CAN/CSA-Z731-F03: Emergency Preparedness and Response.

K3.1.2 Scope of the Emergency Plan

An emergency is defined as a situation that could put lives at risk, damage property or the environment or undermine public safety. A chemical spill, a fire, and an explosion are examples of emergencies.

The Emergency Response Plan is intended for all employees, contractors and visitors using the NAIC site. The plant's staff is responsible for the safety of visitors and contractors who are not necessarily familiar with the details of the plan.

K3.2 Definition of Emergency Levels

Emergency levels are defined in order to determine the human and material resources needed during a response. Emergencies that could occur at the plant are classified into two categories: minor emergencies (1) and major emergencies (2).

Level 1 Emergencies

A level 1 emergency is an emergency that can be controlled with the equipment and personnel available at the plant. It has no effect on operations and has no major impact on the environment. Typical level 1 emergency situations include:

- a minor leak of toxic or flammable liquid/gas, including dimethyl disulfide (DMDS), diesel, natural gas or process gas;
- a minor leak of liquid potentially harmful to the aquatic environment;
- a minor molten metal projection or explosion;
- a minor dust explosion;
- a minor fire that can be controlled;
- a work-related accident with minor bodily injuries.

Level 2 Emergencies

This is an emergency that cannot be controlled with the equipment and staff available at the plant. It represents a danger to the health or safety of staff and facilities and may have an impact outside the site. External assistance is needed to control this type of emergency.

Typical level 2 emergency situations include:

- a major leak of toxic or flammable liquid/gas, including DMDS, diesel, natural gas or process gas;
- a major leak of liquid potentially harmful to the aquatic environment;
- a major fire/explosion;
- a localized fire that could spread;
- a bomb threat;

a work-related accident with serious injury.

External Situations

Emergencies include events of external sources such as accidents during the transportation of dangerous goods, earthquakes, bomb threats, etc. These events are classified as level 1 or 2 emergencies depending on their proximity to the plant site and their range.

K3.3 Organisation and Roles of the Responders

An Emergency Response Plan is properly implemented through an efficient organization of responders and a clear definition of roles. Figure K3-1 shows the relationship between the various internal responders and the warning structure. The plant's Emergency Director is responsible for coordinating the activities of the internal responders and follows up with the plant's management.

K3.3.1 Internal Responders

The roles and responsibilities of internal responders during an emergency will be assigned to the response personnel present onsite around the clock. Their preliminary roles and responsibilities are described in the data sheet presented at the end of this appendix. An internal responders' telephone list will be included in the final version of the Emergency Response Plan before the plant starts operating.

K3.3.2 External Responders

In addition to the internal responders, various external agencies can be called during an emergency. The role of the main external responders is described below. A preliminary phone list is shown in Table K3-1. This list will be included in the final version of the plan before the plant starts operating.

Figure K3-1 Relations between the Various Internal Responders

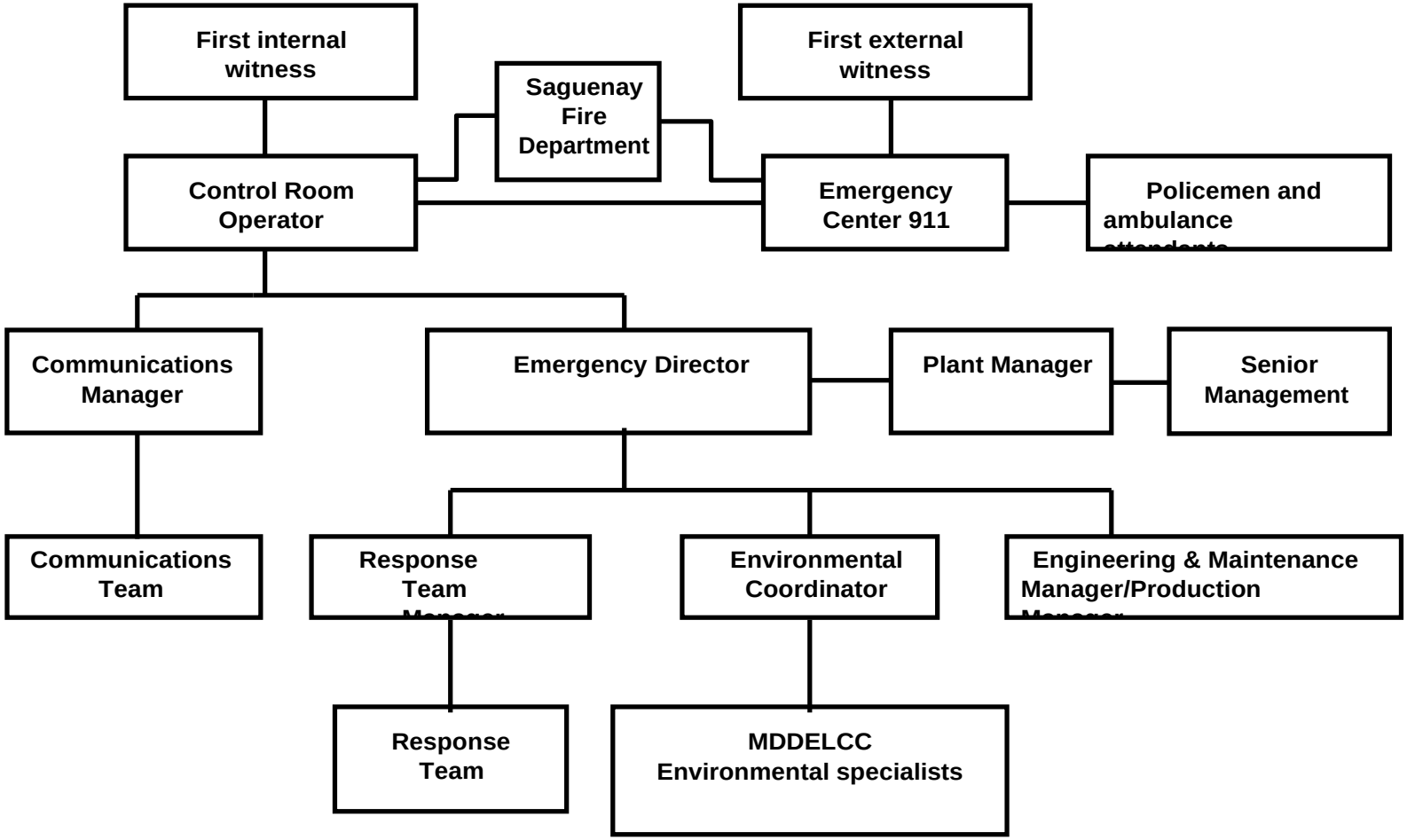

Table K3-1 External Responders' Phone List

Organization	Telephone
Emergency (fire, police, ambulance, gas leak)	911
Canadian National (emergency)	1-800-465-9239
CHEMTREC (Canadian Transport Emergency Centre)	613-996-6666
CHEMTREC (Chemical Transportation Emergency Center, United States)	1-800-424-9300
Poison Control Center	1-800-463-5060
Saguenay-Lac-Saint-Jean Health and Social Services Center	418-545-4980
Health and Safety Committee (CSST)	866-302-2778
Environment Canada (Emergency)	866-283-2333
Gaz Métro (emergency - natural gas leak)	1-800-361-8003
Hospital of Chicoutimi	418-541-1000
Hydro-Quebec	1-800-790-2424
Info-Excavation	1-800-663-9228
Ministry of Sustainable Development, Environment, and the Fight against Climate Change (MDDELCC) (emergencies)	866-694-5454
Civil Security (Regional Department of Saguenay-Lac-Saint-Jean and Côte-Nord)	418-695-7872
Fire Department of the City of Saguenay	General: 418-698-3380 La Baie: ext 4521
Saguenay Port Authority (APS)	418-697-0250 ext 200
Sûreté du Québec (RCM of Chicoutimi)	418-549-9266
City of Saguenay – Police Service	418-699-6000
Véolia (Jonquière)	418-548-8247

K3.3.3 First Witness

The first witness is the one who initiates the process and gives early warning information on an emergency situation.

This is usually an employee of NAIC or another worker in the area. He/She must notify the plant's Control Room, which in turn informs the 911 Emergency Center.

Exceptionally, the first witness could be an external witness. In this case, the warning process goes directly through the 911 Emergency Center.

K3.3.4 911 Emergency Center

The 911 Center receives emergency calls and routes them to responders as soon as possible.

The 911 Emergency Center is the privileged channel of communication for the support of the fire services and police officers from the region as well as paramedics. However, in the event of a major industrial accident with possible impacts outside the plant, the Saguenay Fire Department can be contacted first. The Fire Department will then start the municipal emergency process and alert the public, if necessary.

K3.3.5 The Fire Department

The intervention and support of the Fire Department is required when a fire or explosion occurs at the plant or during a rescue operation. The Fire Department must be informed as a matter of priority if a release of toxic substances is likely to have an impact outside the plant. The Fire Department can also be mobilized by contacting the 911 Emergency Center for all other emergencies on the plant site.

The Fire Department's response is led by a response officer whose role is as follows:

- Lead the response operations alongside the plant's Emergency Director;
- Coordinate security measures outside the plant;
- Request civil assistance if needed
- Order the warning of the public in the event of offsite impacts;
- Inform the public of technical and operational measures to be taken.

K3.3.6 Sûreté du Québec in the Chicoutimi Regional County Municipality (RCM) and Police of Ville Saguenay

The support of the Sûreté du Québec and Municipal Police can be secured through the 911 Emergency Center.

The Police shall:

- establish a security perimeter;
- control access to the security perimeter and the scene of the accident;
- ensure roads are safe;
- escort emergency vehicles;
- guide members of the public and workers into evacuation routes.

K3.3.7 Health and Social Services of Saguenay-Lac-Saint-Jean and the Public Health Department

This organization provides support during an incident and a network of first responders and emergency ambulance services. It also provides appropriate curative care and medical advice.

In the event of a serious injury or illness, the support of the local health and social services can be obtained via the 911 Emergency Center.

The Health Department shall:

- identify situations that may endanger the population's health;
- inform the public, responders and policy makers on health risks and on the protection measures to be taken;
- put in place the necessary measures to protect the population.

K3.3.8 Ministry of Sustainable Development, Environment, and Fight against Climate Change (MDDELCC)

The MDDELCC shall be called by the Environmental Coordinator in the event of a spill, fire or incident that could result in emissions of contaminants into the air, water or soil.

The MDDELCC shall:

- receive notices of accidental releases of contaminants;
- ensure that all environmental protection measures are applied;
- advise civil authorities and other responders on appropriate emergency measures;
- provide all the needed information on the laws and regulations applicable to the emergency and ensure that they are complied with;
- coordinate activities carried out to correct or minimize impacts on the environment.

K3.3.9 Environment Canada

In the event of an emergency resulting in the accidental release of hazardous materials into the environment, Environment Canada is called by the plant's relevant emergency personnel.

Environment Canada shall:

- provide scientific and technical advice as well as weather forecasts;
- advise on the properties, effects and behavior of hazardous materials;
- evaluate onsite the level of danger to people and the environment;
- assess measures to be implemented to remedy the situation during a spill.

K3.3.10 Civil Security Department

The Civil Security Department coordinates the assistance provided by various ministries involved in a major emergency.

K3.4 Action Plan to Be Deployed in an Emergency

The Emergency Response Plan is a detailed action program that is triggered when situations require rapid coordination of responses to protect personnel, the population, the environment and facilities. When the plan is activated, emergency responders apply specific contingency

plans that are tailored to the nature of the emergency. These plans define in detail all the situations alongside actions to be taken according to a specific response scheme (fire, rescue, spill, bomb threat, accidental death, etc.)

This section covers the main specific contingency plans that are all mutually complementary. The final version of the Emergency Response Plan will cover all emergency responses that could take place at the NAIC pig iron facility.

K3.4.1 Leaks or Spills

- The process equipment and ventilation system are stopped from the control room;
- Leaks or spills are stopped by closing the emergency shutoff valves stopping the pumps/compressors, plugging holes using appropriate methods or decompressing the process gas and vent it to the flare;
- Equipment involved in the incident are depressurized afterwards;
- Sources of ignition in the vicinity of the incident should be eliminated if a gas/flammable liquid is involved;
- The movement of a liquid discharged outside process areas is controlled with dikes or absorbent materials;
- An absorbent material is used to collect a liquid spilled outside and the contaminated soil must be excavated;
- Wearing protective clothing and respiratory protection equipment is mandatory;
- Response operations must be carried out upwind during an outside spill of a volatile liquid or gas.
- All contaminated materials must be disposed of in accordance with the regulations.

K3.4.2 Fire

- Process equipment are stopped from the control room;
- Fires are fought in a downwind direction, which helps increase the range of the extinguishing agents used and minimize exposure to smoke;
- Mobile equipment in the vicinity of the fire must be removed, if possible;
- Equipment nearby the scene that are likely spread the fire should be cooled;
- Wearing protective clothing and respiratory protection equipment is mandatory.

K3.4.3 Work-Related Accidents

First aid should be administered by properly trained personnel and professional help is sought as soon as possible. In the event of serious injury or death, the following steps must be followed:

- Secure the scene of the accident;
- Barricade the area to maintain the integrity of the scene;
- Immediately contact the Plant Manager;
- Inform the 911 Emergency Services, Police and the CSST;

- Communicate with Human Resources and the Communications Departments for them to notify the victim's family, if necessary;
- Do not move any item from the accident scene unless this item poses a danger to staff or may affect equipment or the environment;
- If items need to be moved, identify and keep them in a safe place;
- Prepare an accident report;
- Communicate with the Health, Safety and Environment Committee as well the Union (if applicable);
- Prepare a statement for employees and the media, if necessary.

K3.5 Natural Disasters

Natural disasters include severe storms, tornadoes and earthquakes.

Storms and Tornadoes

- Equipment should be stored inside the plant and anchored, if possible;
- Equipment that cannot be stored must be stabilized;
- Immediately stop all works inside and outside the plant;
- Staff must take shelter inside buildings as close as possible to the center of the building and away from windows.

Earthquakes

- Employees inside buildings must take shelter under desks or in room corners and away from windows and tall furniture;
- Employees outside the buildings must stand away from process equipment.

Bomb Threat

In general, the following procedures must be followed:

- Call the police;
- Do not move any objects (boxes, barrels, equipment, etc.).
- Do not use radios or cell phones;
- Check the immediate work area for the presence of a bomb or suspicious package. If any bomb or suspicious package has been noted, notify and evacuate people near the work area or building towards the assembly points;
- The level 2 Emergency Plan is triggered; the plant’s alarm is not enabled, pending police assistance; the Emergency Director assesses the situation and make sure staff and facilities are safe;
- A suspicious package is recovered only by police.

K3.5.1 Minute by Minute Response Scenario

Level 2 emergency response involves several internal and external responders. Interventions of this kind are much more complex. For this level of emergencies, minute by minute response scenarios can describe the sequence of activities as well as the task and the response time of each responder.

A minute by minute response scenario is shown in Table K3-2 as an example. It should be noted that response times are estimated based on information currently available. Responders have not all been consulted at this stage of the project and, therefore, the times indicated have not been validated. The details of this scenario and the response time will be clarified and revised in the final version of the Emergency Plan during the operation of the plant.

The example chosen is that of a major DMDS leak outside the plant due to a leak from the tank. The scenario considers that there is a shutoff valve.

Table K3-2 Example of a Minute by Minute Response Scenario – Major DMDS Leak from the Tank

Duration	Beginning	End	Responsible	Task
Initial dissemination of the warning				
0:00	**9:29**		**Leak from the DMDS tank**	
0:01	9:29	9:30	First witness	Call Control Room[1]
0:02	9:30	9:32	Control Room Operator	• Call the Emergency Director • Stop processes and ventilation
Dissemination of the warning				
0:01	9:31	9:32	Emergency Director	Decide on the response plan
0:02	9:32	9:34	Emergency Director	• Instruct the Control Room Operator to contact the Saguenay Fire Department to trigger the municipal Emergency Response Plan and alert the public • Radio Alert: ○ Head of the Response Team ○ Head of Engineering and Maintenance ○ Production Manager Environmental Coordinator ○ Industries in the vicinity via the emergency radio frequency • Call the Plant Manager
0:02	9:34	9:36	Emergency Director Head of the Response Team	Decide on appropriate action plan from rescuers
0:04	9:36	9:40	Emergency Director	Install an Emergency Control Room
0:05	9:33	9:39	Control Room Operator	• Alert Fire Department (link with 911) • Call the Head of Communications
0:15	9:33	9:48	Environmental Coordinator	Calls to : • MDDELCC
Evacuation of employees				
0:02	9:35	9:37	Head of the Response Team	• Mobilize of the Response Team and trigger the intervention scheme • Order the evacuation of staff not unnecessary for the

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Duration	Beginning	End	Responsible	Task
				response • Designate an assembly point
0:04	9:35	9:39	Response Team	• Quickly go where the protective equipment is • Wear personal protective equipment
0:08	9:39	9:47	Response Team	• Evacuate staff • Establish a security perimeter • Direct staff to assembly points
0:05	9:47	9:52	Head of the Response Team	• Count staff and communicate information to the Emergency Director
Rescuing the injured				
0:15	9:39	9:54	Response Team	• Rescue the injured • Stabilize the injured while waiting for the paramedics
5:45	9:54	15:39	Paramedics	• Rescue the injured • Transport the injured
Securing the premises and repair				
0:27	9:47	10:34	Response Team	Stop or immobilize the equipment
5:52	9:47	15:39	Response Team	Periodic measurements of air quality at the assembly points
5 :39	10 :00	15 :39	MDDELCC and Environment Canada	• Monitoring and assisting
4:55	10:34	15:29	Response Team	• Make repairs • Testing • Start-up
0:09	9:54	10:03	Police officers	• Establish a command post • Creation of a security perimeter
5:36	10:03	15:39	Police officers	• Control access to the security perimeter and into the scene • Secure roads • Escort emergency vehicles • Support the response team to guide workers to evacuation

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Duration	Beginning	End	Responsible	Task
				routes
0:03	9:57	10 :10	Firefighters	• Assess the risks of fire or explosion • Notify other industries nearby (Port, Railway, Rio Tinto) that could be affected by the vapor cloud
5:32	10 :10	15:42	Firefighters	• Minimize the risks of fire • Assist Response Team
1:30	10:18	11:48	Pump truck	Pumping of the spilled DMDS
0:10	15:39	15:49	Emergency Director and Plant Manager	Decide the end of the emergency and order the resumption of activities

Note: The times are indicated in minutes; the beginning and end of each task correspond to the time that has elapsed since the beginning of the scenario.

(1) A major leak will cause a strong odor of DMDS that would be detected easily.

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K3.5.2 Alerting the Population

A major emergency such as a major DMDS leak could have potential impacts outside the plant's boundaries. The population warning system is triggered by the Saguenay Fire Department following a notification by NAIC.

The procedure shall be established with the Fire Department. When the alarm is triggered, the nearby population downwind of the plant must:

› Take shelter inside to avoid the strong odor;
› Keep doors and windows closed;
› Stop all ventilations: air conditioning, dryer, furnace at the lowest level;
› Stay tuned to a local radio station or TV and follow instructions given.

K3.6 Evacuation Plan and Assembly Points

The evacuation of the plant will be necessary only in situations that cannot be controlled despite the application of emergency measures.

The complete evacuation notice is authorized by the Emergency Director or the Plant Manager.

When the evacuation is announced, all employees must move to one of the two assembly points identified during the evacuation.

Point 1: TBD

If an evacuation to Assembly Point 1 is not feasible (wind direction, physical barriers or other reasons), Assembly Point 2 should be chosen.

Item 2: TBD

Supervisors must ensure that all individuals under their supervision are present at the assembly points. Absences must be reported to the Emergency Director who will decide whether it is possible to perform a rescue.

The evacuation plan will be specified in the Emergency Response Plan when the detailed engineering plan is available.

K3.6.1 Recovery Operations

The resumption of normal operations is designed to reduce the financial impact.

End of the Emergency

The end of an emergency is declared by the Plant Manager and communicated to all employees.

In the event of a level 2 emergency, an "End of Emergency" notification is communicated to the authorities (Fire Department, MDDELCC, Civil Security, etc.).

Resumption of Operations

A team appointed by the plant's management will assess the damage and recommend actions and procedures to be employed to restart operations in a safe manner.

An investigation shall be carried out to determine the cause of the incident in collaboration with the public authorities and insurance companies when required.

Event Reporting

An event report shall be prepared by the Emergency Director within 24 hours of the event.

K3.7 Preventive Measures and Response Equipment

Inspection and Record Keeping

An inspection and testing program will be implemented to ensure facilities and equipment are in good condition. All risk facilities and equipment shall be inspected on a regular basis and information shall be kept in inspection records.

List of Emergency Response and Personal Protection Equipment

The list below shows the response equipment expected at the plant. This list will be completed in the final version of the Emergency Response Plan before the operation of the plant.

› Portable fire extinguishers and other equipment related to fire protection;
› Respiratory protection masks;
› Protective clothing;
› Small leaks patching kits;
› Portable pumps and hoses for liquid transfer;
› Absorbent and neutralizing materials.

List of Alarm Systems in the Protection Systems

This list will be completed in the final Emergency Response Plan before the plant starts operating.

K3.8 Facilities Plans

The final version of the Emergency Response Plan will include detailed plans of the facilities, when the plant's detailed engineering plan is available. Among other things, these plans will indicate the location of the following:

› Control room;
› First aid kits;

› Emergency equipment;
› Assembly points;
› Emergency exits;
› Hazardous materials.

K3.9 Training

A training program will be implemented and revised as necessary to ensure that internal responders are aware of the required emergency response principles, techniques and equipment.

This training program will be based on recognized North American standards:

› NFPA 471 - Recommended practice for responding to hazardous materials incidents;
› NFPA 472 - Professional competence of responders to hazardous materials incidents;
› NFPA 600 - Industrial fire brigades.

The Emergency Response Plan, which is combined with an evacuation drill, shall be tested once a year.

K3.10 Updating the Plan

The Emergency Response Plan will be kept up to date through an annual review. It will also be revised if the plant was subject to significant changes or if the emergency drills showed the need to make improvements. If significant changes are to be made in process equipment, the analysis of the consequences will be updated and the results will be incorporated into the plan.

The plan will be distributed to all employees and external agencies that may be involved in its implementation. Holders of the plan will be immediately notified of any change and will receive all updates. Procedures (numbered copies, distribution records of and revisions to the plan) will be developed to ensure all copies in circulation are under control, uniform and up to date.

Table K3-3 Roles and Responsibilities of the internal responders

FIRST WITNESS
ROLES
Anyone who witnesses an abnormal situation (oil, gas and chemicals leak, fire, injured person or person in danger, etc.) should raise the alarm and, if possible, take safety measures to take control of the situation and notify their immediate supervisor as soon as possible.
RESPONSIBILITIES
PREVENTION
Any action must be performed safely. **NOTE:** It is important to note that, regardless of who the first witness is, the operator of the control room must be notified as soon as possible in order to initiate the emergency response plan.
RESPONSE
> Quickly assess the extent of the danger and the risk to health, safety, property or the environment; > Immediately notify the operator of the control room; > Inform people in the area as well as those heading there; > Identify, if possible, the cause of the problem and stop if this can be done quickly and safely; > In the absence of danger, stay near the scene of the incident until the arrival of the emergency teams in order to brief them upon their arrival.

CONTROL ROOM OPERATOR

ROLES

Take emergency calls and brief key members of the plant's emergency response plan. In the event of a spill, seek to identify the spill material and assess its quantity. Control access to the site, stop processes and ventilation and trigger the alert system.

RESPONSIBILITIES

PREVENTION

Make sure to always have on hand the latest version of the emergency response plan.

Be familiar with the emergency response plan procedures.

> **NOTE:** The control room operator should note the exact time when he/she was informed, the exact time when he/she called everyone on the list, and the ambulance's time of arrival and departure.

RESPONSE

- Gather information from the first witness (name, location, injury, presence of fire, quantity and nature of the spill, time, origin and cause of the incident and where the witness can be reached);
- Contact the Emergency Director and effect the shut-down of processes, the closure of the supply valves and the ventilation system;
- Upon request, call the Saguenay Fire Department or 911;
- Monitor the plant's main entrance and allow access only to emergency staff;
- Inform the Emergency Director when the first external responders (ambulance, police, fire response team) arrive and get his/her permission before directing them onto the premises;
- Provide a plant radio to the firefighter responsible for the operation upon his/her arrival on the site and get him/her in touch with the Emergency Director;
- If necessary, establish a waiting area outside the operational areas for the emergency vehicles;
- Have the approval of the Emergency Director before allowing anyone access to the operational areas;
- Inform the Communications Manager;
- Upon request, check the staff count via the access control system and, if applicable, give information on missing staff to the head of the response team;
- Take calls from outside and address them according to the sorting protocol;
- Establish an events log (exact time he/she was informed, exact time he/she called everyone on his/her list, time of arrival and departure of external responders, etc.).

EMERGENCY DIRECTOR

ROLES

Ensure an adequate level of preparedness and coordination between the various responders during an emergency in order to quickly restore the situation, clean and restore the damaged site.

RESPONSIBILITIES

PREVENTION

- Make sure the emergency response plan is updated and distributed;
- Appoint a person to update copies of the emergency response plan;
- Make sure that updates are integrated to the distributed copies of the emergency response plan;
- Make sure the plant's response personnel is adequately trained;
- Monitor the exercise program.

NOTE: In an emergency, the Emergency Director has the authority to commit the funds needed for the response.

RESPONSE

- Evaluate the situation and trigger the appropriate emergency response plan;
- Give the command to the control room operator to contact 911 to obtain the help of external responders (firefighters, ambulance, police) or to inform them of a potential impact outside of the facility;
- Coordinate the internal and external response teams;
- Establish a mobile command post;
- Identify the safe zones and establish entry checkpoints;
- Determine response priorities;
- Decide what are the supplementary resource needs;
- Remain in contact with the control room operator and the head of the response team to monitor the situation's evolution;
- Inform the plant manager if evacuation of the facility is necessary;
- Lookout for situation changes and re-evaluate the response measures as needed;
- Arrange for search parties and evaluate the necessity for medical attention, as needed;
- Inform communication manager and plant manager about the situation's evolution;
- Decide if the alert has reached an end and transmit the information to the plant manager;
- Give the order for a complete evacuation in the absence of the general manager;
- Prepare a report detailing the events, including an estimation of the cost of rehabilitation. Deliver a copy to the plant manager and other authorities.

HEADOFTHERESPONSETEAM

ROLES

Coordinates members of the response team in emergency operations in the event of fire, hazardous materials spills, leakage of DMDS, natural gas, process gas or other incident requiring their skills.

RESPONSIBILITIES

PREVENTION

> Knowledge of the risks associated with the plant's operations and safety measures;
> Knowledge of personal protective equipment, their location and how they are operated;
> Knowledge of response procedures and related security measures;
> Have the information and training required to perform emergency operations;
> Participation in prevention exercises.

RESPONSE

> Respond to the Emergency Director's instructions;
> Call members of the response team and trigger the appropriate response pattern;
> Wear the personal protective equipment;
> Lead the use of emergency equipment and response activities;
> Progressively assess how the situation is evolving and choose the appropriate response strategy;
> Make sure the response team is safe;
> Have the data sheets of the product (s) involved;
> Count the number of staff present in the gathering places and transmit the information to the Emergency Director;
> Communicate information on the progress of response activities to the Emergency Director;
> Make sure a security perimeter is established.

RESPONSE TEAM

ROLES

Ensure safety during an emergency situation and collaborate with responders. Under the supervision of the head of the response team, the members of the response team will be the first operational responders in the event of a fire, hazardous materials spills, leakage of toxic substances or any other incident.

RESPONSIBILITIES

PREVENTION

- Knowledge of the risks associated with plant operations and safety measures;
- Knowledge of personal protective equipment, their location and operation;
- Knowledge of response procedures and related security measures;
- Receiving the information and training required to perform emergency operations;
- Participation in prevention exercises.

RESPONSE

- Wear the personal protective equipment;
- According to the directives of the head of the response team, control and eliminate the emergency situation using appropriate response equipment;
- Ensure the operations are safe and that affected production units are isolated or shut down;
- Provide an adequate response in terms of firefighting, spill control, medical support during rescue operations or any other emergency;
- Provide first aid and look for missing staff;
- Perform rescue operations and staff evacuation;
- Direct staff to weather shelters and safe places;
- Stop or secure the equipment without putting own life or safety in danger;
- Provide emergency blankets;
- Take frequent measurements of air quality in gathering places;
- Assist ambulance staff if necessary.

COMMUNICATIONSMANAGER

ROLES

Ensure effective communication during the risk management process through prevention, preparedness, response and recovery from an emergency situation. Prepare communication strategies in order to take control of all emergency situations and avoid panic.

RESPONSIBILITIES

PREVENTION

Define mechanisms for communicating with the public and the media in the event of an industrial accident.

RESPONSE

- Initiate an emergency communication process that is appropriate for the situation;
- Act as spokesperson for the company and monitor all communications;
- Prepare press releases, if applicable;
- Have the press releases approved by the plant manager before distribution;
- Establish and maintain communication with the operator of the control room;
- Ensure that relevant information is communicated at the right time to staff and the public;
- Determine the business recovery strategy.

COMMUNICATION TEAMS

ROLES

Under the supervision of the Communications Manager, ensure an effective risk management communication process through prevention, preparedness, response and recovery during an emergency. Develop communication strategies to control all emergency situations and avoid panic.

RESPONSIBILITIES

PREVENTION

> Update the contact information of people living in the immediate vicinity of the plant;
> Develop tools to encourage dialogue between internal and external responders and the public;
> Educate and inform the public about the risks and emergency measures in the event of a major incident;
> In collaboration with internal and external responders, communicate information on emergency drills to the population.

RESPONSE

> At the request of the Communications Manager, inform people living in the immediate vicinity of the plant on the procedures to be followed;
> Establish communications with the authorities, external organizations and the media;
> Communicate the relevant information to employees and the public upon request;
> Organize meals and refreshments;
> Communicate with employees' families;
> If necessary, contact the Family Help Manager.

ENVIRONMENT COORDINATOR

ROLES

Advise the Emergency Director on emergency measures to be taken to avoid impacts on the environment and meet Government requirements.

RESPONSIBILITIES

PREVENTION

> Be aware of the regulations in force;
> Have the emergency contact numbers of the external responders;
> Establish and keep up to date a network of environmental specialists;
> Be on the lookout for response techniques as well as damaged sites response techniques;
> Advise the plant manager on more efficient technologies.

RESPONSE

> Assess potential (or immediate) impacts on water, air or soil quality;
> Communicate immediately with government and other external responders and inform them of the current situation;
> Ensure that the response techniques used do not cause more damage to the environment;
> Advise the Emergency Director on appropriate environmental response techniques;
> Define a temporary storage mode for contaminated materials;
> Monitor potential environmental impacts as the situation evolves;
> Send contaminated materials to accredited disposal sites;
> Complete the incident report.

ENGINEERINGANDMAINTENANCEMANAGER

ROLES

Provide technical support to the Emergency Director with regard to facilities and equipment when preparing or updating the emergency plan and during response activities.

RESPONSIBILITIES

PREVENTION

- Keep updated plans of the plant's electric network and process diagrams;
- Be aware of the power switch systems for each sector;
- Establish and maintain periodic inspections of equipment and facilities;
- Restore any electrical or mechanical malfunction (defective equipment, incomplete updating of plans or control procedures, etc.).

RESPONSE

- Assess hazards associated with equipment and communicate the information to the Emergency Director;
- Have available the design of the facilities and pipeline systems;
- Support the Emergency Director and inform him/her of affected facilities, if necessary;
- Prepare a recovery plan (materials, equipment and services supply).

PRODUCTIONMANAGER

ROLES

Provide administrative support to the response team and remain the link between the plant's response team and higher management (head office, legal services, insurance, etc.).

RESPONSIBILITIES

PREVENTION

- Appoint prevention and response supervisors/managers;
- Approve the emergency plan;
- Provide response tools;
- Ensure that responders have adequate and up to date training;
- Establish a procedure for informing new employees on the steps to be taken in the event of an emergency.

RESPONSE

- Provide administrative support to responders;
- Communicate with the Emergency Manager to understand how the situation is evolving.

PLANT MANAGER

ROLES

Represent senior management. Provide the human and financial resources for the training and the implementation of the emergency plan.

RESPONSIBILITIES

PREVENTION

Allocate roles and responsibilities to internal responders.

Approve the financial documents for training, emergency equipment supply and emergency drills.

RESPONSE

- Exercise authority over the response team;
- Use authority to support or oppose any decisions that could endanger the safety of staff or the public;
- Approve press releases;
- Order site evacuation, if necessary;
- Order the normal resumption of production activities;
- Prepare a report on events and recovery costs and submit it to senior management.

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