Addenda A
Pig Iron Plant Project - Saguenay

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

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Pig Iron Plant Projet - Saguenay

Addenda A

Questions and comments on the construction of a pig iron plant on the territory of the Municipality of Saguenay by the North Atlantic Iron Corporation

Project Number: 3211-14-037

North Atlantic Iron Corporation

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1. Introduction

This document includes a number of additional questions and comments to North Atlantic Iron Corporation (NAIC) within the framework of the admissibility analysis of the environmental impact study prepared for the construction of a pig iron plant.

The document is the outcome of an analysis conducted by the Environmental Assessment Direction for Water and Industrial Projects, in collaboration with the administrative services of the Ministry of Sustainable Development, Environment and the Fight against Climate Change (MDDELCC) as well as some other ministries and agencies. This analysis made it possible to establish whether the requirements laid down in the Minister's Directive, and the Regulation respecting environmental impact assessments and reviews (Chapter Q-2, r. 23) were adequately addressed by the Project Proponent.

Before publicizing the impact study, the Minister of Sustainable Development, Environment and the Fight against Climate Change must ensure that it contains the information required in the decision-making process. It is therefore important that the information requested in this document be provided to the Ministry so that it can determine the admissibility of the impact study and, if appropriate, recommend the Minister to make it public.

The maps and figures in this addendum derive partially from the impact assessment or were created for the purposes of this document. In order to separate the revised maps and figures from the new ones, their nomenclature is defined as follows:

- The revised figures and maps are given their original title, followed by Rev01 (e.g. Figure 3.5, Rev01);
- The new figures and maps follow the sequential numbers of those included in the impact assessment, together with the term Addendum A (e.g. Map 8.3 - Addendum A).

Appendix D of the addendum on air emissions was entirely extracted from the impact assessment and corrected in places. The changes in the text are in italics, while changes in the tables are in bold.

In addition, the numbering system for the revised appendices of the impact assessment was retained to avoid confusion. Thus, the revision of Annex D of the impact assessment is again available in Annex D of this Addendum and is called Add-A Appendix D.

Finally, an errata section is presented in Section 3 of this document. It includes corrections made following the submission of the Environmental Impact assessment.

2. Questions and Comments

ANALYSIS OF THE VARIOUS OPTIONS

QC-1

In accordance with the MDDELCC's guidelines, a variant analysis was conducted. However, the Proponent needs to also present a table summarizing the comparisons of the different variants performed during the selection of the site and during the design of the facilities.

Answer QC-1

The main results of the sites and technologies analysis and the options selected are presented in Sections 2.7 and 2.9 of the Impact Assessment.

As part of this project, NAIC has taken into account various criteria to ensure the best possible integration of the plant into the host environment and in compliance with the sustainable development principles laid down in Quebec's Sustainable Development Act. In fact, Chapter 10 of the study also shows the values, principles and measures that NAIC is proposing to implement during the construction and operation of the project in order to comply with the principles of sustainable development. These guidelines can be improved over time based on recommendations from the host community and key stakeholders who will communicate with NAIC (neighborly Committee, Port of Saguenay, businesses currently operating in Saguenay current industries, public administration, etc.).

It should be noted that even though technical and environmental criteria were taken into consideration in the selection of the site and technologies, some economic and social criteria were also preponderant. In fact, as noted during the preliminary consultations, Saguenay is going through a difficult economic situation characterized in recent years by business closures or temporary cessation of activities. In this context, new investment and the construction of a new plant linked to the metallurgical industry already present in the region will give new opportunities to the local workforce and businesses. Besides, the plant location, in the Grande-Anse, responds to local and provincial development strategies, including the strengthening of the activities of the Intermodal Maritime Industrial Park and, more generally, an industrial port zone as recommended in the maritime strategy of the Government of Quebec.

NAIC's recommended guidelines for the construction of a plant respecting the principles of sustainable development include the following:

1) **Availability of an industrial site**: NAIC will build its plant in a site reserved for industrial development purposes that is identified in key regional planning tools in the city of Saguenay (Development Plan, Urban Plan, Zoning Regulations). The site, which is already prepared to host new industries, has a buffer zone separating it from the nearest homes and occupies a strategic position in relation to the plant's target markets and raw material supply sources. Specifically, the plant will occupy a space that is available in the Intermodal Marine Industrial Park southwest of facilities built by the Saguenay Port Authority (SPA) in recent years, which will optimize the spaces reserved for other projects (east of the project site) or existing infrastructure (the rail track for example);

2) **Efforts to reduce the plant's total footprint**: NAIC has performed three revisions of the layout and arrangement of the plant in light of available pig iron production technologies. Thus, the project, which was originally supposed to use a coal-based reduction process shifted to a production technology based on natural gas. This change, which means lower energy consumption, reduced emissions (nitrogen oxides, sulfur oxides and carbon dioxide) and better iron quality, was made following preliminary consultations with the community in compliance with the government's GHG guidelines. NAIC's plant is now more compact and now makes it possible to optimize the raw materials used and reduce its environmental footprint. Compared to other types of pig iron plants, NAIC's plant appears in the lowest quartile of factories producing the fewest emissions worldwide. To optimize equipment layout various factors are taken into consideration:

- Available lots;
- Minimization of the distances to be covered from one location to another to obtain supplies of materials;
- Fluidity of movement on the plant's access roads;
- Bearing capacity of the plant site's soils;
- Proximity of watercourses;
- Distance required to cool the gas between the electric arc furnace and its associated dust collector;
- Minimization of energy losses, especially between the outlet of the reduction reactor and the electric arc furnace; and
- Safety of the facilities.

In the end, the plant will occupy 10.7 hectares, i.e. about 7 ha less than initially planned

INTEGRATION INTO THE LANDSCAPE

QC-2

The visual simulation presented is limited to an observation point from the Auberge la Tourelle in St Fulgence. Considering that some of the equipment currently planned can be 123 m high (reactor tower), the Proponent needs to add to the visual simulations of various observation points from inhabited and frequented areas the images of the plant's facilities and images with the proposed mitigation measures. The visual simulation areas should be presented from the houses closest to Rang St. Martin and Anse-à-Benjamin, from the Saguenay Fjord which is recognized as an aesthetic site in the development plan, the road to Grande-Anse and the road to Anse-à-Benjamin in the western sector. Based on these simulations, mitigation measures such as visual screens may need to be reviewed and improved.

Answer QC-2

First of all, the guidelines issued for the preparation of the impact assessment does not require any visual simulation, but does require a description "of landscapes with the visual elements and features that are of interest from a local community or tourism perspective, and the landmarks characterizing the site". To comply with the guidelines, a complete description is presented in section 4.6 of the impact assessment.

It should be noted that "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". For people living in La Baie, "the site’s topography means that a very small part of the facilities will potentially be visible above the vegetation". For those living in the Cap-à-l’Ouest, "the vegetation cover and topography will contribute to hiding the equipment and to limit the visual impact while the number of observers is very limited”. At some locations the St. Martin Road offers visual fields that are limited by vegetation (forest).

It should be mentioned that the City of Saguenay has chosen to implement an industrial site at this particular location. Thus, it should be understood that other industries will also build facilities on this site. As discussed in Chapter 7, "The landscape in this area is expected to change as other industrial equipment is installed, which will help increase the degree of integration of the proposed equipment in a large industrial complex".

Visual simulation was performed from the Anse St-Fulgence in order to reflect the importance of the fjord as a site of aesthetic and touristic interest. This location offered a panoramic view and therefore a fairly realistic view - that was broad enough – of the visual effect of the plant from the north bank of the Saguenay River. Again, it is worth noting that other industries will occupy the Saguenay port site, and that this choice was made by local and regional authorities. Finally, regarding mitigation measures, it is not possible to install a visual screen considering the height of the equipment (123 m). However, as already mentioned, the project will include some landscaping efforts and lighting will also be controled. In addition, the color of the dome will be discussed during future consultations.

QC-3

With respect to the implementation of the plant, since the Saguenay Fjord is considered as a site of aesthetic interest, the Proponent needs to specify whether the Saguenay development plan has to be modified and, where appropriate, the arrangements made towards its implementation also need to be modified.

Answer QC-3

The Development Plan should not be subject to changes since the project is being implemented in accordance with the guidelines and land use plan laid down in the Development Plan, in relation to industrial development. In fact, the plant will be built on an industrial site: the site is located inside the Intermodal Marine Industrial Park, which is presented in the Development Plan as an industrial expansion project that is designed to meet the needs of industries that import or export goods via the Grande-Anse port facilities.

As for the municipal regulation (which follows the guidelines laid down in the Development Plan) it protects the industrial vocation of the project site by delineating a specific section (No. 71770) to be used mostly for industrial purposes in connection with the Grande-Anse port activities. Besides, this area is part of Planning Unit 119 for the Urban Development Master Plan of the city of Saguenay (La Baie district) which governs industrial development in the Grande-Anse area.

It should be noted that, as mentioned in the Development Plan (p. 3-67), the Saguenay Fjord extends from Tadoussac to Cap-à-l'Ouest. The plant site is therefore outside the fjord and the visual impact depends on which observation point the plant is seen from.

QC-4

There is no industrial activity affecting the current landscape of the study area. Considering the project site is highly sensitive to the installation of the equipment proposed by the Proponent, the latter must reflect this reality and see whether there are alternatives to a reactor and a stack whose heights are 123 m and 125 m respectively. Should these alternatives exist, the Proponent needs to present an analysis of these and justify the choice while taking into consideration other issues related to the project, including air quality.

Answer QC-4

The height of the reactor is dictated by the time required to complete reduction reactions inside the reactor. Since the pellets are fed from the top of the reactor and flow inside by gravity, it is not technically possible to place the reactor horizontally. The alternative to reduce the height of the equipment is using another reduction technology, including the one initially chosen for NAIC, i.e. a rotary kiln using iron briquettes and coal as a reducing agent. Due to greenhouse gas emissions associated with the use of coal, NAIC turned to another technology that only uses natural gas and allows the reuse of the process gases generated by the reaction. This alternative was discussed in Section 2.9 of the study and has the advantage of avoiding the emission of around 90,000 tons of greenhouse gas emissions per year.

Besides, the height of the reactor could be reduced by about twenty meters. One of the first versions of the equipment layout plan indicated that the reactor would be located much further west of the melting and casting building. This standard configuration required the installation of a conveyor between the reactor and the electric arc furnace and had the disadvantages of generating heat loss along the conveyor, requiring the heating of the conveyor by natural gas combustion and occupying a larger footprint. Moving the reactor above the melting and casting building, close to the electric arc furnace, makes it possible to eliminate heat losses, avoid natural gas combustion emissions, reduce the footprint, and increase total equipment height. The gain in terms of thermal energy results in a lower consumption of electrical energy. The environmental and economic gain was considered greater than the visual impact.

PROCESS FLOW AND INSTALLATIONS

QC-5

Figure 3.2 shows the simplified pig iron process flow diagram (section 3 of the main report). The Proponent needs to provide a more detailed description of the gas treatment process in order to facilitate understanding. In addition, for each stage of the process gas treatment process, the Proponent needs to indicate the chemical reactions used to monitor the progress of the treatment.

Answer QC-5

The last two paragraphs of page 8 of Chapter 3 are replaced by the following paragraphs which provide greater details concerning each stage of the gas treatment process:

“At the exit of the reactor, the process gas temperature is around 450°C to 470°C. The thermal energy generated by these gases is recovered in the form of steam in the heat recovery unit. The heat recovered is used at the absorption tower of the CO_2 removal unit. Once this stage is completed, the process gases are sent to a quenching and one scrubbing system located close to the reduction tower where exhaust process gas streams the heat recovery unit are cooled and cleaned.

This gas cleaning and cooling systems consist of the following equipment:

- Process gas quench orifice,
- Process gas venturi,
- Process gas separator,
- Process gas quench tower and
- Process gas knock-out drum.

The gases leaving the heat recovery unit pass to the quench orifice where they are cooled through direct contact with the water from the primary clarifier.

Then, they pass through a venturi where gas and water stream velocity increases, causing water to disperse in fine droplets and catch dust particles while facilitating promoting the settling of solids.

From the venturi the process gases are directed toward a separator whose role is to separate the liquid and gas phases. The liquid water bears the solids separated from the exhaust gas stream. In the separator, some cold water from the reduction area cooling tower is sprayed directly on the gas stream at two different levels inside the vessel. The water-saturated gas stream passes through droplet catcher and catches dirty droplets. At the bottom of the separator, solids are kept suspended thanks to clean water from the primary clarifier added in the conical part of the separator to avoid solids accumulating of the separator walls. The water is then drained toward the primary clarifier of the wastewater treatment plant.

From the process gas separator, the cleaned gases go to the process gas quench tower, a direct contact-packed tower used for cooling down the clean exhaust gas stream with cold water. At the moment of cooling, the saturation water is condensed from the gas, producing an excess of clean water that is collected at the bottom of the tower. This hot water is pumped to the process gas humidifier and then to the basin of the cooling tower. This way the system is capable of recovering the water generated by reduction reactions.

Finally, the process gases pass to the process gas knock-out drum whose role is to remove steams or any condensed water before the gases are compressed or used as combustible in the preheating tower. To recycle the process gas stream into the reactor, its pressure needs to be increased by passing the process gas into a compressor. The compression of the gas will increase its temperature. The compressed process gas is then cooled at the exit of the compressor as it passes through a packed tower where it is cooled through direct contact with cold water from the reduction area cooling tower. Once the process gas is compressed, it is sent to an absorption/desorption unit whose function is to remove the CO_2 *from the process gas in order to prevent its accumulation in the circuit. The* CO_2 *removal unit is described in Section 3.3.2.1.*

After leaving the CO2 absorption removal unit, the process gas is mixed with make-up natural gas. This mixture of reducing gas is humidified by direct contact with the hot water from the quench tower. The purpose of the humidification is to adjust the humidity of the gas while increasing its temperature and thus enabling a higher percentage of steam in the reduction gas.

After humidification, the reducing gas is sent to the process gas heater. The reduction gas is fed to the heater through the convective section where the combustion gases contribute to its preheating before it is sent to the radiation section. In this section the preheated reduction gas is heated by thermal radiation transferred from burner flames and refractory walls. The required heat is released by combustion under temperature control of a mixture of natural gas and process gas (process gas from the reduction circuit, at the exit of the second quench tower). The combustion air is fed by means of forced draft fans and is preheated in the convective section before going to the low-nitrogen oxide burners.

The reduction gas is directed to the reactor. Oxygen is injected into the reduction gas transfer line, thereby closing the reduction circuit. The oxygen injection increases the temperature of the reduction gas at the inlet of the reactor and therefore the efficiency of the reactions".

In addition, Figure 3.2 has been modified (Figure 3.2 Rev01) and is presented at the end of this section.

QC-6

The acid gas removal area will be enclosed with a dike in order to contain any discharge of the methylethanolamine solution. The Proponent needs to provide a layout of these facilities and describe the measures to be put in place to seal the installation.

Answer QC-6

The layout of these facilities will be available during the detailed works engineering and will be submitted when applying for authorization certificates.

QC-7

As part of the control and monitoring program, it would be necessary to apply maintenance and inspection programs to all gas treatment equipment (including dust collectors) and water treatment facilities (including sedimentation basins) to ensure they work optimally. In this respect, the Proponent needs to briefly present what they intend to set up for each of these facilities. The detailed control and monitoring program should be submitted for approval to the Ministry of Sustainable Development, Environment and the Fight against Climate Change when applying for a Certificate of Authorization.

Answer QC-7

In fact, maintenance and inspection programs will be applied to all gas and water treatment equipment.

The details of the maintenance and monitoring equipment program are not known at this stage of the project. The maintenance program will be developed at the detailed engineering stage and completed before the plant is put into operation. This program will be developed while considering the criticality of the equipment. There are various criteria used to determine equipment criticality. They include the operation, health and safety, the environment and quality of the product. They also include compliance with regulation at all times, which, by default, will lead to high criticality for all equipment related to air emissions and liquid effluent processing equipment. Then, the methodology consists, for each of the critical equipment, in identifying the probable cause of failure and thereby identify the specific piece of equipment that may be causing the failure. For each of these pieces of critical equipment, an action plan should be developed to reduce chances of failure. Actions that could result from this analysis include the following:

- Addition of control and monitoring measures equipment and measures;
- Establishment of a predictive maintenance program;
- Adjustment of the frequency of maintenance work;
- Adjustment of on-site inventory levels or establishment of a specific procedure for the supply of essential parts, etc.
- The control and monitoring program will be submitted for approval to the MDDELCC when applying for the Certificate of Authorization.

QC-8

The Proponent needs to specify whether the cement coating the iron pellets disintegrates in the reactor. If so, where will these cement residues be sent for final management?

Answer QC-8

The cement does not disintegrate in the reactor. It is found in the slag produced in the electric arc furnace.

QC-9

The Proponent needs to state whether the plant will be a source of dust containing crystalline silica. If so, what are the sources that will generate such dust?

Answer QC-9

The iron pellets contain 3.5% crystalline silica (see Data Sheet in Appendix K of the impact study). The handling and equipment transfer activities as well as the melting of the direct reduction iron are dust sources that are recuperated by dust collectors. Emissions of crystalline silica were considered at the emission points (A4 to A8). See answer QC-129 and the atmospheric dispersion results in Appendix D2, for details.

RAW MATERIALS AND FINISHED PRODUCTS

QC-10

The pellets will be stored on the dock and before being transported to the plant. This operation will be completed by the Saguenay Port Authority (SPA). Considering the receipt, storage and transportation of pellets will be used exclusively at the plant process, the Proponent needs to present the iron pellet storage mode during the reception at the dock and the measures to be taken to avoid discharging ferrous water into the environment.

Answer QC-10

The location of the pellets storage area at the dock could vary depending on current activities. The SPA is responsible for managing imported or exported materials handled at its dock. A preliminary area was defined for the unloading of the pellets considering the range of the type of conveyor generally used for the unloading. It is located about 49 m away from the edge of the dock. It is from this area, which is protected from the wind by concrete blocks, that the pellets will be reloaded onto trucks or a conveyor and taken to the plant. The storm water drain system built on the SPA dock is designed to ensure that storm water is filtered through a sieve and a bag before being directed to the Saguenay River.

Whether the conveyor or trucking option is used, the pellets will be taken to the plant as quickly as possible to free the dock and make it available to other industries.

QC-11

For all raw materials stored outside (external lime, dolomite and bauxite silos), the Proponent needs to specify the environmental protection measures in place in order to prevent any spills and dispersal by the wind.

Answer QC-11

The vents of the storage silos for the coated pellets, quicklime, calcined dolomite and bauxite are connected to the gas collection system of the smelting and casting building that directs the gas to the dust collector of this building. During the loading of the silos, the air displaced by the equipment will be collected and processed. All these substances being in solid form, it is not appropriate to add a retention structure. Silo loading operations will be supervised by an operator.

QC-12

Table 3.1 “Raw Materials and Products” (p.14, section 3 of the main report) does not specify whether the various different raw materials stored are hazardous or not. The Proponent needs to update the table by integrating this information.

Answer QC-12

All Data Sheets of the materials shown in Table 3.1 are in Appendices A and J. The table has been updated and presented on the following page (Table 3.1 Rev01) to indicate the hazardous nature of each substance. Chapter 8 also provides information on hazardous materials.

QC-13

In the event of the transportation of the pellets and pig iron being performed by conveyor, the Proponent needs to specify the environmental protection measures to be implemented to avoid any diffuse dust and noise emissions.

Answer QC-13

The proposed conveyor would be a pipe conveyor also known as cylindrical conveyor belt. The cylindrical conveyor belt seems the most appropriate for the high gradient between the plant and the dock. This type of conveyor has the advantage of completely wrapping the product transported from the feed point to the loading point and excludes transfer points. It has electric motors. The noise and dust generated by a conveyor are considered negligible.

QC-14

In cases where the pig iron is to be stored outside the plant site and at the dock, the Proponent needs to indicate the storage mode and measures taken to avoid any discharge of ferrous water into the environment.

Answer QC-14

As mentioned in Section 3.5.4, the pig iron will be stored under a shelter and will not be exposed to weathering. The pig iron will be solid and will not subject to erosion or leaching. Iron will have very little mobility. Runoff management at the dock is described in Answer QC-10.

Table 3.1 Rev01 Raw Materials and Products

Material	Use	State (L, G, S)	Transportation Mode	Frequency of Transportation	Storage Type/ Location	Maximum Quantity Stored	Average[1]/Maximum[2] Annual Consumption Or Production	Hazardous Nature
Raw Materials								
Iron pre pellets	Iron source	S	Ship (27,500 t)	24-30 ships/year	Temporary pile at the jetty; piles inside the storage or dome buildings	100,000 t	680,190 t/830,000 t	Not regulated by the Canadian Workplace Hazardous Materials Information System (WHMIS)
Quicklime (CaO), dololime, and bauxite	Melt	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	Toxic and corrosive
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	Corrosive
Bentonite	Briquettes binder	S	Truck	3 to 4 trucks/month	Silo inside the briquetting building	20 m^3	1,025 t/1,300 t	Toxic
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	Toxic and corrosive
Nitrogen	Inertization and pressurization of the system at start-up	G	Truck		Tanks		71,000 Nm^3 / 85,0000 Nm^3	Asphyxiating; explosion under the influence of heat
Others								
Diesel	Emergency generator and heavy mobile equipment	L	Truck	Based on needs	Tank/ Fuel station	200,000 l	TBD	Flammable

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[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)	Transportation Mode	Frequency of Transportation	Storage Type/ Location	Maximum Quantity Stored	Average[1]/Maximum[2] Annual Consumption Or Production	Hazardous Nature
Catalysts (cobalt oxide or molybdenum oxide)	Mo-Co for H_2S generation	S	Truck	1 truck/20-25 years	Building	50 m^3	NA	Toxic
Graphite electrodes	EAF electrodes	S	Truck	3-4 trucks/month	In bulk outside, near to the smelting and casting building	150 t or the equivalent of 10-15 rods	850 t/1,000 t	Not regulated by the WHMIS
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	Not regulated by the WHMIS
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	Not regulated by the WHMIS
Dimethyl disulfide (DMDS)	Control of corrosion in the preheating furnace	L	Truck	1 Truck/year	Tank outdoors in reduction area	30 m^3	25 t/30 t	Toxic and inflammable
Activated methyl diethanolamine (aMDEA)	CO_2 absorption	L	Truck	1 Truck/month	Drums or totes inside the CO_2 removal building	1 t	3.5 t/4.5 t	Toxic
Anti-foaming agent (Amerel 1500 or 2000)	Added to the aMDEA solution	L	Truck	1 Truck/month	Drums inside the CO_2 removal building	100 l	50 l/100 l	Irritating to the skin
Activated carbon	Filtration of the aMDEA solution	S	Truck	1 Truck/year	Drums	5.1 t	10 t/12 t	Not regulated by the WHMIS
Water conditioning chemicals	Cooling tower and boiler waters	L	Truck	1 Truck/month	Drums or totes inside the water building	2-4 t	12 t/14 t	See Appendix A for details; corrosive, toxic
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 treatment building	2-4 t	10 to 20 t/11 to 21 t	Not regulated by the WHMIS

Material	Use	State (L, G, S)	Transportation Mode	Frequency of Transportation	Storage Type/ Location	Maximum Quantity Stored	Average[1]/Maximum[2] Annual Consumption Or Production	Hazardous Nature
Coagulant (ferric chloride 33% solution, $FeCl_3$, or equivalent)	Coagulation of solids/Lamella clarifier	L	Truck	1 Truck/year	Drums or totes inside the water treatment building	1-2 t	3 to 6 t/3.5 to 6.5 t	Toxic and corrosive
Sulfuric acid	Ammonia scrubber and wastewater treatment	L	Truck		Tank		75 t/100 t	Corrosive
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	Non-hazardous residual matter
Pig iron	Final product	S	Ship	16-19 ships/year	Storage building; Bulk storage at the jetty	24,000 t	425,000 t/518,000 t	Not regulated

QC-15

The Proponent states that they will be supplied with iron pellets from Quebec factories such as Arcelor Mittal in Port-Cartier or Rio Tinto in Sept-Îles. Should these sources be no longer available and a new provider found, the Proponent needs to specify whether the composition of the pellets could be different, especially in terms of impurities? Should this be the case, the Proponent needs to indicate whether amendments to the reduction process may be necessary.

Answer QC-15

In the event of the supply source being different, the pellets should always meet a basic specification which produces nodular pig iron.

RESIDUAL MATTERS

QC-16

In Section 3.7.1, the Proponent needs to correct the assertion from the *Hazardous Materials Regulation (RMD),* adopted after the *Guidelines for reclaiming non-hazardous inorganic materials for use as construction material* (VMRINDSI Guide) stating that slag is hazardous materials. In fact, the Hazardous Materials Regulation was adopted in 1997, i.e. before the VMRINDSI Guide published in 2002 and does not rule on the danger by providing a list. To be deemed hazardous under the RMD, slag must bear the characteristic of a hazardous material (oxidizing, corrosive, explosive, gas, flammable, leachable, radioactive or toxic) or be considered as a related material (Article 4 of the RMD). The list in Appendix 4 of this Regulation is only intended for codification after it is verified that the materials bear the characteristics of a hazardous material.

Answer QC-16

The comment has been noted and a correction has been added in the errata section.

QC-17

Considering the numerous variables associated with the simulation performed for a possible classification of slag, it seems premature to determine a final slag storage system and recovery method. The Proponent needs to commit to performing analysis on slag originating directly from the process that will be used at the latest from the moment the plant is put into operation, in order to reach a definitive conclusion on their characterization.

Answer QC-17

As mentioned in Section 9.2.3 of the impact study, NAIC is committed to conducting analyses on the slag originating directly from the process from the start of the plant's operation. They will be sampled and analyzed in accordance with the RMD (Hazardous Materials Regulation) and the VMRINDSI Guide to confirm the type of recovery used. Besides, NAIC plans to run tests before the construction of the plant, using the pellets produced at the Arcelor Mittal plant in Port-Cartier. These pellets would be reduced in a direct reduction plant using the same reduction process, i.e. the HYL TENOVA reduction process, and the DRI thus produced will then be used in the electric arc furnace in the Forks Specialty Metals facilities to produce pig iron and slag that can be analyzed.

SLAG STORAGE

QC-18

In Section 3.7.1 The Proponent mentioned that the slag will be stored outdoors. The Proponent also has to assess the option of storing the slag inside and assess the impacts of such storage in particular with regard to groundwater, surface water, air emissions and slag reclamation.

Answer QC-18

Slags are not considered as hazardous materials under the Hazardous Materials Regulation. In addition, several studies completed to date show that the mobility of its components towards the receiving environment remains very limited. The groundwater or runoff water is unlikely to be contaminated. The slags will be cooled in non-forced air in their pot before being taken to the storage area where they will be demoulded. Dust could be generated as slags fall to the ground. Should dust be visible from more than 2 m as provided for in the regulation, they would be suppressed by water sprinkling. Slag handling requires space both on the surface and in volume and involves heavy equipment movement. The storage of slags inside a building is not considered necessary from an environmental point of view and its costs would be relatively high, considering the sizes required.

Furthermore, the slag may not at all be stored at the plant. In fact, during discussions with members of the Alfred Boivin Group, it was recommended to explore the possibility of directly recovering slag pots from the smelting building and transport them to one of the Group’s three quarry mining and sand pit sites near Bagotville Airport on a flat-bed truck. This will be included in the services offer to be elaborated by the Alfred Boivin Group. For more details on the issue of transport, see answer QC-92.

QC-19

Considering that there are more dry material deposits in Quebec, the Proponent needs to correct the information provided in Section 3.7.6. The Proponent needs to commit to eliminating non-recyclable or non-recoverable refractory bricks (validate opportunities with the VMRINDSI Guide) in an engineered landfill or in a construction and demolition debris landfill.

Answer QC-19

Non-recyclable or non-recoverable refractory bricks will be eliminated in accordance with the regulations.

QC-20

Considering that the MDDELCC does not allow the use of dust suppression products, the Proponent needs to change the wording used in Section 7.1.1. The wording used in Section 3.14.1 regarding products certified in compliance with the Quebec Standards Bureau (BNQ) is more appropriate.

Answer QC-20

The dust suppression products to be used will meet the current standard of the Quebec Standards Bureau (BNQ 2410-300).

QC-21

The Proponent needs to correct the information presented in Section 7.1.2.4 considering that the landfilling of non-recoverable concrete residues must carried out in a construction or demolition debris landfill or in an engineered landfill, since there are no more dry materials disposal sites.

Answer QC-21

That is correct. Section 7.2.1.4 should read as follows: "non-recoverable residual concrete will be sent to a construction or demolition debris landfill or to an engineered landfill".

QC-22

In Section 7.2.3, the Hazardous Materials Regulation does not identify slag as a hazardous material (see comment on Section 3.7.1). However, the Proponent needs to commit to establishing groundwater protection measures during the storage itself if slag could be recovered as a construction material.

Answer QC-22

The groundwater protection measures are presented in Section 7.2.3. The slags will be mainly stored on clay, which is a material whose permeability coefficient is 1 x 10^{-9} cm/s, i.e. much better, for example, than that required for a hazardous material.

Besides, the results of leaching tests carried out under various conditions show that the migration potential of the contaminants contained in the slag is very low and below the applicable standards.

Finally, a groundwater quality monitoring program is proposed. It consists of wells located upstream and downstream the storage area, in addition to those located around the plant.

QC-23

In section 7.2.3, the Proponent needs to provide results for slag categorization according to the VMRINDSI Guide (see comments in Appendix B below).

Answer QC-23

The table in Appendix B of the impact study has been revised (Table B1 Rev01) to include missing parameters. The criteria have also been revised based on the *Soil Protection and Contaminated Sites Rehabilitation Policy*, July 2016. The revised table and the complete analysis certificates are presented in Appendix B to this Addendum.

QC-24 Appendix B

In Section 9.2.3, it is not necessary to declassify slags (see comments on Section 3.7.1 above). The Proponent needs to provide some concentration missing results (see comments in Appendix B of the VMRINDSI Guide) in mg/kg to support the assertion that metals and metalloid, except copper, are below criterion A.

Answer QC-24

As mentioned previously, the table has been revised (Table B1 Rev01). In light of these results, the following is observed:

- A concentration slightly higher than criterion A for barium;
- A concentration higher than criterion A for copper;
- A concentration slightly higher than criterion A for tin; and
- A concentration equal to criterion C for manganese

These results should be interpreted based on the completed test protocol. The concentration of manganese in the Hamburg DRI used for the test is twice higher than the concentration recorded in the simulated DRI (with the typical manganese composition in the iron pellets of Port-Cartier), i.e. 400 mg/kg vs. 800 mg/kg. Besides, the specification for the manganese concentration in the raw material, the pellets, is very important for the quality of the finished product and this data will be monitored. The specification for the manganese concentration in the nodular cast iron is very low and requires pellets with low manganese content, such as the pellets from Arcelor Mittal in Port-Cartier. Thus, it is highly unlikely that there are large fluctuations in manganese, in the pellets and therefore in the slag. Based on the initial manganese contents in the pellets of Port-Cartier, the project designer and technology supplier predicts, by modeling, that the concentration in the slag will be equivalent to 1600 mg/kg, i.e. a concentration slightly higher than criterion A applicable to the Grenville geological province.

In fact, the same phenomenon occurs for copper. The copper concentration of the Port Cartier pellets is lower than 10 mg/kg. Its concentration in the direct reduced iron (DRI) is estimated at less than 13 mg/kg whereas the copper concentration in the Hamburg DRI is 31 mg/kg, i.e. three times higher. It is therefore very likely that the concentration in the slag produced in the NAIC Port-Cartier pellets will have a concentration below Criterion A, i.e. 50 mg/kg.

For barium, the concentration in the pellets is not specified by Arcelor Mittal. For tin, NAIC’s DRI concentration would be twice as high as that of the Hamburg DRI. However, the value given for the pellets being lower than the detection limit, the value calculated for DRI infers a value equal to the detection limit which is greater than the Hamburg DRI concentration. It is therefore impossible to be conclusive for this parameter.

Values higher than Criterion A require mobility tests consisting in subjecting the slags to conditions simulating the natural environment, for example through leaching tests in an acid or neutral mediums and based on durations defined by an analysis protocol. When subjected to these tests, the results show that contaminants are not very mobile, all the results being below the potability criteria.

QC-25 Appendix B

Regarding the information provided in Appendix B1, see the comment on Section 3.7.1 made above in connection with the RMD and the VMRINDSI Guide. Also see the comment on Section 7.2.3 made above in connection with groundwater protection.

Answer QC-25

See Answers QC-18, 22, 23 and 24.

QC-26 Appendix B

In Appendix B3 it is stated that all metals and metalloids in Appendix 2 to the *Soil Protection and Contaminated Sites Rehabilitation Policy* should be analyzed for their content in mg/kg. Therefore, the Proponent needs to provide the results for silver, arsenic, barium, cobalt, tin, manganese and molybdenum. These parameters must also go through a leaching test if they exceed Criterion A.

Answer QC-26

The missing results have been added to Table B1 Rev01. For the interpretation of the results, see answer QC-24.

QC-27 Appendix B

In Appendix B3, pages 4 of 14 and 9 of 14, the Proponent should indicate SPLP EPA 1312 rather than TCLP EPA 1312 for number CP9964

Answer QC-27

The analysis certificates are prepared by the laboratory which has confirmed that TCLP EPA 1312 does correspond to the SPLP EPA 1312 test.

QC-28 Appendix B

In Appendix B3, there is no weathering test result. The Proponent needs to provide this test which is essential in determining the category according to the VMRINDSL Guide procedure.

Answer QC-28

This test is essential when the particle size is smaller than 2 mm. The weathering test will be performed on slags whose particle size will be smaller than 2 mm.

QC-29

Annual quantities of 70,000 to 85,000 t of slag will be generated during the operation of the plant. The impact assessment states that these materials are not hazardous and will be recovered and reused as aggregates. Should the recovery of these residues be difficult and considering the large quantities of residues generated, the Proponent needs to identify and demonstrate, if feasible, that another type of arrangement is possible and viable. It is important that these materials can be arranged to avoid speculative accumulation. The Proponent will also make a commitment to dispose of these materials in an authorized site.

Answer QC-29

As mentioned in section 3.7.1 of the impact study, the project's economic study states that slag could be valorized and will not need to be managed as hazardous residual matters.

Information on the global slag market is provided in Appendix B of the impact study. Steel slag is considered as a commodity and is widely used as aggregate around the world. It should be noted that slags produced in Quebec are valorized despite the addition, during the melting process, of impurities in the form of scrap metal whose alloy contents are higher than those of iron pellets. However, it is important to focus on the local aggregates market because it is a proximity market. To be competitive, the aggregates must come as close to the place of use as possible.

Discussions are being held with various companies including the Alfred Boivin Group, a quarries operator and general civil engineering contractor. This company, which is one of the largest in the Saguenay region, operates quarries and sand pits and works in the construction sectors, mostly in road construction. According to the Alfred Boivin Group (personal communication, October 2016), the aggregates market in the region is worth over 1 million tons per year. Thus, the introduction of 70,000 to 85,000 tons per year of additional aggregates from NAIC-generated slags can be easily absorbed in the region, especially since Alfred Boivin Group has all the necessary equipment and large enough lands to transport, store, crush and integrate these additional aggregates into its own stock of materials.

NAIC's site is not large enough for slag accumulation. In the very unlikely event of slag not being re-used, NAIC undertakes to manage it in accordance with current regulations.

QC-30

With the exception of slag, the Proponent needs to provide studies and clarify the analyses performed to with respect to residual matter classification.

Answer QC-30

No analysis or study has been conducted on the hazardousness of the residual matters. The information shown is based on experience, knowledge and practice in this industry:

- Sifting fines consist mainly of iron ore and are reintroduced into the process;
- Sludge from the wastewater treatment unit and dusts consist mainly of iron and are reintroduced into the process;
- The scrubbing solution from the sulfuric acid scrubber is a dangerous material (ammonium sulfate);
- Centrifuge sludge is considered dangerous because it contains amine;
- Refractory bricks are usually recycled. Should they have to be eliminated, they will first be analyzed in accordance with the RMD;
- Activated carbon, catalysts, oils and solvents are hazardous raw materials, as per their data sheets, and will therefore be considered as hazardous residual matters.

HAZARDOUS MATERIALS

QC-31 Slag

In section 9.2.3 of the impact study, the Proponent mentions, several times, that some preliminary tests suggest that slag is not a hazardous matter and has a strong recovery potential. Considering no actual slag characterization has been completed, the Proponent needs to present the potential management mode (storage, disposal) to be used in the event of the slag proving to be a residual hazardous material.

Answer QC-31

See Answer QC-29.

QC-32

In the impact study, the Proponent mentions that a specific procedure is planned for exceptional cases of oil change on the site. The prohibition of any oil change within 10 m of a water environment, wetland or ditch must be corrected. The Proponent needs to undertake to keep a minimum distance of 60 m for this type of activity, as provided for by the *Regulation respecting standards of forest management for forests in the domain of the State,* Section III - Water Quality Protection.

Answer QC-32

NAIC is committed to keeping a minimum distance of 60 m for oil changes on the site.

STORM WATER AND WASTEWATER

QC-33 Effluent Discharge Objectives

At the Ministry, the acceptability of a discharge into the aquatic environment is assessed on the basis of the Effluent Discharge Objectives (EDOs) which determine the concentrations and contaminant loads that can be discharged into a water body while respecting the quality criteria on the edge of a restricted mixing zone. When the effluent is discharged into a very small water stream, as is the case here, there is no mixing zone for the dilution. The EDOs then meet the water quality criteria.

The impact of the discharge on the aquatic environment should be assessed by comparing the expected characteristics of the discharge with the preliminary EDOs. The proposed activities can thus be considered as a source of concern for the environment based on the number of parameters exceeding the EDOs, the frequency or magnitude of the exceedances. All these elements will be considered during the project's environmental acceptability study.

Answer QC-33

Table 7.4 has been revised and is presented on the following page to include the parameters in the EDOs presented in Appendix C to this addendum, as well as other parameters defined by the project designer. Since metals are present in the pellets and that water quality criteria exist for each of these metals, the project designer estimated the metal concentrations in the final effluent. The composition of the pellets was used to determine the concentration of metals ending up in the dusts generated at the reduction reactor. A large part of the equipment downstream the reactor are designed to remove dusts in the process gas by transferring them into the water. This is a conservative approach because when the concentration in the pellet was lower than a value, this value was used as the initial concentration while the actual concentration is likely to be much lower. Thereafter, the concentrations are estimated by their mass balance using the maximum solubility of each of the oxides or hydroxides of the metals present that will be precipitated by the addition of a coagulant to the lamella clarifier.

Chronic toxicity criteria are indicated and calculated with a median hardness of 59.5 mg/l. They are, therefore, slightly different from the values indicated for preliminary EDOs in Appendix C to this addendum, the water quality criteria for metals depending on the hardness of the receiving water stream. Data from the last sampling campaigns were considered in determining the median hardness value. The table in Appendix E2 has been revised and is presented in appendix E to this addendum.

Based on the EDOs available and also on the chronic toxicity criteria, it appears that the concentrations of the following contaminants would be higher than the chronic toxicity criteria (total phosphorus, mercury, lead, vanadium, zinc, total ammonia nitrogen and nitrates). The magnitude of exceedances is also indicated. The exceedance amplitudes vary from 3 for phosphorus to 25 for lead, i.e. from medium to high. It should be noted that the concentrations of lead and mercury are overestimated because their concentration in the pellet was estimated as equal to the detection threshold.

One of the options to be evaluated is to add a filtration step on activated carbon in order to significantly reduce the concentrations of metals, petroleum hydrocarbons and organic contaminants. Activated carbon will also be somewhat efficient in the removal of phosphorus and nitrates. This technology could easily be added in the event of metal concentrations proving problematic and contributing to the overall toxicity of the effluent. However, these are just estimates for now.

Table 7.4 Rev01 Quality of the Effluent based on MDDELCC Criteria

Parameter	Plant Effluent (no.2) mg/l	Plant effluent (no.3) mg/l	Acute Toxicity CVAA (mg/l)	Chronic Toxicity - aquatic lifecriterion CVAC or EDO (mg/l)	Exceedance Range	Notes
Flow rate	0 to 5.5 m^3/h	16 m^3/h	NA	NA		1
Conventional						
DBO_5	ND		ND	3		
Suspended solids	**<25**	10	37	17		2
Total phosphorus	ND	**0,100**	ND	0,03	3,3	
Metals						
Arsenic	ND	0,007	0,34	0,1500		
Chromium	ND	0,005	0,016	0,0110		
Cobalt	ND	0,047	0,37	0,1000		
Copper	ND	0,005	0,0086	0,0060		3
Iron	ND	0,100	3,4	1,3		
Manganese	ND	0,060	2,639	1,223		
Mercury	ND	**0,012**	0,0016	0,0009	12,6	3; 4
Nickel	ND	0,035	0,302	0,0340		
Lead	ND	**0,047**	0,042	0,0016	28,4	3; 4
Vanadium	ND	**0,117**	0,11	0,0120	9,7	
Zinc	ND	**0,117**	0,077	0,0770	1,5	
Organic materials						
Cyclohexylamine	ND	0,05	ND	0,2000		
Morpholine	ND	0,04	11	0,4800		
Other parameters						
Total nitrogen ammonia (total N) Sum mer (20°C,pH=7)	ND	**4,1**	19	1,2	3,4	
Azote ammoniacal total (total N) Winter (7°C,pH=7)	ND	**4,1**	21	1,9	2,2	
Residual chlorine	ND	0,002	ND	0,0020	1,0	
Chlorides	ND	130	860	230		
Petroleum hydrocarbons ($C_{10}C_{50}$) [4]	**< 2**	**<2**	0,11	0,01		5
Nitrates (NO_3)	ND	**5**	ND	2,9	1,7	
Nitrosamines	ND		ND	ND		
pH	ND	6.5-7.5	6.5 to 9	6.5 to 9		
Sulfates	ND	459	500	500		
Sulfites	ND		ND	0,20		
Temperature	Variable	40	ND	ND		
Dissolved solids		1000	ND	ND		

ND = Not available or not determined

1: 1: mg/l is the unit applicable, with the exception of the flow rate (m3/h), pH and temperature

2: The CVAC (chronic aquatic life criterion) is the preliminary EDO. The CVAA (acute aquatic life criterion) was defined as 20 mg/l greater than
3: When the value of the CVAA and HVAC fluctuates depending on hardness, a median value of 59.5 mg/l is used

4; The mercury and lead concentrations were below the detection limit in the pellets. The estimated concentrations are significantly overestimated.

5; The detection limit is 0.1 mg/l. For rainwater, it is probable that it is of diesel while for no.3, there may be various hydrocarbons

NAIC will assess various options to reduce the concentration levels, flow and temperature of the effluent discharged in order to work towards the zero discharge objective and minimize the overall toxicity of the final effluent. The aim of the feasibility study was not to optimize this asepct. However, in light of the results achieved to date and the stated environmental objectives, it appears that a more detailed analysis of the available options is necessary in order to minimize impacts on the receiving environment and meet water quality criteria for chronic toxicity, i.e. the EDOs, at the exit of the plant. NAIC undertakes to file the results of its study on optimized management of wastewater from the plant before March 2017. This study will include the optimization of the number of the water concentration cycles of the cooling circuits (as indicated in section 2.9.5 of the impact assessment).

The monitoring program will also be enhanced for the first year of operation in order to obtain more data and thus validate the assumed overall toxicity of the effluent.

As for the impact assessment, we maintain that the fish fauna populations will suffer no impact in watercourses 5, 7, 8 and 9, since there is no fish there. During the impact assessment and its interpretation with respect to aquatic life and the EDOs, the focus was on fish. However, fish habitat was not valued as much as the fish species themselves because they were not present in the affected watercourses (no. 5 and 8). The allocation of an ecological value from a protocol that assesses the quality of the stream regardless of the presence of fish (SVAP2) was conducted and presented in Answer QC-65. The ecological value of water streams 5 and 8 are described as being moderate. In consideration of the costs and relatively low concentrations of contaminants, it is assumed that the discharge will reduce the quality of the habitat without compromising its integrity; the degree of disruption is estimated to be moderate. The water stream will be affected along its entire length, which means a local scope impact. The impact will be long-lasting and its extent will be moderate.

As mentioned above, NAIC is committed to evaluating the various options available in order to reduce effluent concentrations and temperatures (see answer QC-34) as well as flow rates.

Overall, from an economic and environmental point of view, NAIC believes that it is more advantageous to focus on a wastewater management and treatment strategy that aims to reduce the concentration, load, flow and temperature of the final effluent using the best available and economically feasible technologies rather than building new infrastructure that would take the effluent to the Saguenay in order to have a dilution effect. The development of such infrastructure would have an impact on the environment since it would require in-water works.

QC-34

One of the main issues facing the pig iron plant project in relation to water management concerns the absence of dilution in the receiving environment. The three effluents of the plant (process, runoff and sanitary) will be discharged into a small intermittent stream (No. 5) which joins another small stream 550m further away (No. 8). This small streams flows for about 2.5 km before reaching the Saguenay. The discharged water will remain virtually undiluted over some distance before joining the Saguenay River.

Since the EDOs here correspond to water quality criteria and since contamination is likely to continue over a long distance downstream the discharge point, it will be essential that the Proponent ensures the best available treatment technology is used to maintain the quality of its discharges as close as possible to the EDOs established.

The contaminants most likely to have an impact on the environment are mainly ammoniac nitrogen, nitrate and some constituents of the additives used for the conditioning of the cooling water. This could result in acute and/or chronic toxicity in the effluent. The high temperature of the discharged water also looks problematic.

The Proponent needs to provide - if technically feasible – some improvements to the project to take into account these various aspects.

Answer QC-34

The chemical conditioning products were specifically selected due to their low toxicity. The best available technology economically achiveable (BATEA) is used for the removal of ammonia and nitrates, by means of an air stripping tower (see section 2.9.5 of the impact study). For metal concentrations, the preliminary calculations show that the EDOs could be exceeded. However, these estimated exceedances are not proven. Closer monitoring of the quality of the final effluent in the first year of operation will help better understand the problem.

It is important to note that the cooling of the effluent is already planned in the design of the project. Figure 3.5 was reviewed (Figure 3.5 Rev01) to indicate the presence of a heat exchanger. We should also mention that another correction was made to the figure; the precipitation of solids and metals in the lamella clarifier occurs before ammonia stripping and not after. Therefore, significant efforts have already been made to reduce the temperature of the final effluent by 50%. The waters coming out of the clarified water basin are at a temperature of about 80°C. The passage in the ammonia extraction tower will lower this temperature by about fifteen degrees. A heat exchanger placed before the sand filter can reduce the temperature of the final effluent by 25° C, leading to a discharge temperature of 40°C.

One way to further reduce the temperature of the effluent would be to increase water flow in the cooling circuit. However, this would result in increased consumption of drinking water and purge flow, leading to a greater final effluent flow rate. More water conditioning chemicals would also be consumed.

During winter conditions, the effectiveness of the air-coolers will be optimal. These are positioned upstream of the cooling tower, which will lower water temperature in the direct reduction sector and reduce the thermal load to be cooled by the cooling towers. Ultimately, a smaller quantity of water will evaporate, less make-up water will be required and the purge flow rate will decrease. The temperature of the effluent, however, will remain similar (close to 40°C).

As mentioned in Answer QC-33, NAIC is committed to evaluating the various options to reduce the flow of the final effluent, contaminant concentrations and the temperature of the effluent. It is also committed to submit the results of this evaluation to the MDDELCC before March 2017. The purpose of these steps is to minimize impacts on water quality and thereby on aquatic life in the river. The options considered include directing the effluent of treated process water to the storm water retention basin. The transition of this effluent in another basin before being discharged in the environment could make it possible to lower the temperature of the effluent and reduce impacts on the water stream.

QC-35 Discharge Points

In Section 3.14 the Proponent needs to specify if there will be one or more points of discharge into Watercourse # 5 and indicate their locations on a map.

Answer QC-35

The exact location of the discharge point is yet to be defined. The discharge will take place at the limit of the NAIC property, almost at the head of Watercourse # 5. Each discharge point will have its own checkpoint. However, discharges are likely to be combined after the checkpoints in order to have a single pipeline for discharges into the stream and limit the impact of the works. Detailed plans will be provided during the authorization certificate application process.

QC-36 Surface Water Quality

The receiving watercourse for the project's future effluents, i.e. Watercourse # 5, was sampled four times during the summer of 2016. The Proponent has stated that all the results will be provided in an addendum to the impact assessment report. The Proponent should note that other questions or comments could be made later.

On Page 7-19 - Hydrological and Hydraulic Characteristics of the Receiving Watercourse it is stated that: "... 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). However, the Proponent needs to note that aquatic is to be protected in all watercourses. Aquatic life includes fish communities, invertebrates, zooplankton, algae and macrophytes.

(http://www.mddelcc.gouv.qc.ca/eau/oer/Calcul_interpretation_OER.pdf).

Answer QC-36

The table presenting the surface water quality results has been updated following the sampling campaigns carried out after the submission of the impact study. These results are presented in Table E2 rev01 and are included in appendix E to this addendum.

Comment is noted and taken into account in the impact reassessment, in Answer QC-33.

QC-37 Industrial Wastewater Treatment

In Figure 3.5 showing the process water treatment diagram, it appears found sodium bisulphite is injected late in the process, i.e. immediately before discharge into Watercourse # 5. The Proponent should explain why chlorine is not destroyed further upstream in the treatment process, i.e. at the exit of the clarified water basin.

Answer QC-37

After verification with the project designer, it seems that sodium bisulphite injection is not necessary. The chlorine present in the biocide used in the cooling tower will easily react with the iron present in the water to form $FeCl_3$ ($Fe^{++} + NaOCl \rightarrow FeCl_3$) which will be removed from the clarifier in the form of floc. Residual chlorine at the exit of the lamella clarifier will be lower than 0.005 mg/l. Residual chlorine is not typically found in the final effluent of a reduction process. This aspect and a 0.002 mg/l EDO will be considered when evaluating various treatment options (see Answer QC-33). For example, if the activated carbon option is selected, injection with sodium bisulphite will not be necessary. The chlorine would be removed by the activated carbon. In consideration of the 0.002 mg/l EDO, and depending on the results of the monitoring program, the sodium bisulphite injection system can be added.

QC-38 Quality of the Process Effluent

On page 3-25 it is indicated that sodium bisulphite injection will make it possible to maintain the concentration of total residual chlorine in the effluent to the value of the detection limit, i.e. 0.001 mg/L. In table 7.4 on page 7-17, no expected concentration in the effluent is shown for this parameter. The Proponent needs to add this parameter to table 7.4 and indicate what the expected concentration in the effluent is. The Proponent needs to also specify the concentrations expected in the effluent for metals and total dissolved solids.

Answer QC-38

Table 7.4 was reviewed and presented above in Answer QC-33. The expected concentrations of residual chlorine in the metals and total dissolved solids have been added.

QC-39

In Table 7.4, the temperature of the effluent is estimated at 40°C "before final discharge into to the watercourse". Considering that the discharge will be directed to a small watercourse, the impact expected could be significant. The Proponent needs to propose a solution to decrease the temperature of discharged waters.

Answer QC-39

See Answer QC-34.

QC-40

In Table 7.5 on page 7-18, it is indicated that pyrophosphate tetrapotassium will be used in the cooling circuits, which should generate phosphorus in the effluent. However, the concentration expected in the effluent is not mentioned in Table 7.4. The Proponent needs to indicate the expected concentration for total phosphorus.

Answer QC-40

The expected concentration for total phosphorus in the effluent is less than 2 mg/l. Table 7.4 has been revised.

QC-41

The chlorine used for cooling water conditioning also needs be presented in Table 7.5. And so should the intended dosage.

Answer QC-41

It is not chlorine that is used as a biocide but sodium hypochlorite. The dosage is 100 ppm in continuous, as indicated in the Table in Appendix A1 of the impact assessment. It was not included in Table 7.4 because the chlorine is removed by sodium bisulphite injection. It was added to the revised Table 7.4.

QC-42 QC-42 Quality of Runoff Effluent

In addition to the suspended solids, iron and petroleum hydrocarbons, please indicate the most likely metal to be present in runoff due to the presence of slag be stored outside the plant. The Proponent needs to update Table B1 in Appendix B based on slags that are representative of those to be produced at the plant in Saguenay.

Answer QC-42

The metals most likely to be present in the slag are those present in the pellet; see the data sheet in Appendix K of the impact assessment. The results of tests performed on the slag, including metal leaching tests, demonstrate that the contaminants have very little mobility; with all metal concentrations being below the thresholds specified in the RMD and in the *Drinking Water Regulation*.

As noted in Answer QC-17, NAIC is planning to run tests before the construction of the plant, using the pellets produced at the Arcelor Mittal plant in Port-Cartier.

QC-43 Treatment and Monitoring of Sanitary Water

On page 9-5 Section 9.2.2.1 it is indicated that no monitoring of sanitary water, other than flow measurement, is planned because the treatment is well known. However, for proper long-term operation, the Proponent needs to undertake a monitoring of the following parameters on a quarterly basis: BOD_5, TSS, phosphorus and fecal coliforms.

Ref: http://www.mddelcc.gouv.qc.ca/eau/demande-autorisation/article32/index.htm

Answer QC-43

The sanitary effluent will be sampled and analyzed on a quarterly basis for BOD_5, TSS, phosphorus and fecal coliforms.

QC-44

Table 3.4 on page 3-28 summarizes the concentrations expected in the effluent of the proposed treatment system. The concentrations indicated in this Table do not match the values recorded on the MDDELCC site for this type of treatment (Ecoflo):

Ref: http://www.mddelcc.gouv.qc.ca/eau/eaux-usees/usees/fiches/fiches.html.

The Proponent needs to review the Table based on the concentrations recognized in the MDDELCC sheet.

As an illustration, when it comes to effluent discharges under 20 m^3/d, EDOs are not provided, but are transformed directly into discharge requirements. The effluent must comply with an annual average concentration that is lower or equal to 15 mg/l in BOD_5C and TSS when released into a watercourse draining a basin of less than 5 km^2. For fecal coliforms, an annual geometric average equal to or lower than 200 UFC/100, after reactivation (if applicable), will ensure safety in the area. The removal of phosphorus will prevent further degradation of the receiving environment, which seems quite rich (in light of the sampling results presented). Discharge requirements will be determined based on the processing technology chosen.

Answer QC-44

The performances indicated are those showing on the information sheet provided by the manufacturer Ecoflo. Following the consultation of the technical BF-13 information sheets (validated standard sheet) and BF-24 (sheet validated at the real scale) on the following website:

http://www.mddelcc.gouv.qc.ca/eau/eaux-usees/usees/fiches/fiches.html

The performances validated by the MDDELCC are shown in the revised version of Table 3.4:

Table 3.4 Rev01 Sanitary Wastewater Characteristics

Parameter	Concentration Before Treatment	Concentration After Treatment	Performance Based on Sheets BF-13/BF-24
BOD_5 (mg/l)	250	2	5 / 10
TSS (mg/l)	300	2	10 / 10
Total phosphorous (mg/l)	10	0.1	ND / 0.3
Fecal coliforms UFC/100ml	ND	<10	200 / 2000

ND = Not determined.

Based on the performance levels approved by the MDDELCC, the discharge requirements expressed in the comments will be met.

QC-45 Monitoring Programs - Process and Runoff Water

To protect the quality of surface waters, contaminants subject to an EDO will be monitored and toxicity testing should be carried out. As for treated process water, since it is expected that concentrations greater than the EDO are rejected for certain contaminants (ammoniac nitrogen and nitrates, among others), the Proponent needs to commit to monitoring, on a monthly basis, parameters that are subject to an EDO and the acute and chronic toxicity for at least one year. The frequency of monitoring will be subsequently revised downward if no toxicity is measured.

The monitoring frequency for runoff water, which will be released outside freezing periods, will be subsequently reassessed.

Answer QC-45

The monitoring program will target all contaminants for which an EDO has been set. The monitoring frequency is monthly for these contaminants as it is for acute and chronic toxicity.

QC-46

In section 3.14.2 of the impact assessment the Proponent mentions that: *"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"*. Based on the precautionary principle, these systems must be arranged systematically: for example, in the event of an oil spill, it is easier to contain it and thus reduce the contaminated area. The Proponent needs to make a commitment to this effect.

Answer QC-46

NAIC is committed to systematically installing filter berms in order to retain suspended solids (TSS) and hydrophobic absorbents to facilitate oil uptake.

QC-47

On page 3-28, the Proponent mentioned that there is no shower planned for employees in order to limit the amount of sanitary water that will need to be treated. However, Article 123 of the *Regulation respecting occupational health and safety states* "In any establishment where workers are exposed to heat stress conditions such that the heat stress index exceeds the continuous work curve in the graph in Schedule V, the employer shall ensure that the workers thus exposed undergo medical supervision and shall provide them with water at a temperature of between 10°C and 15°C, and one shower per 15 exposed workers" Considering the nature of operations carried out, it is highly likely that showers will be made available to workers in order to comply with this regulation. The Proponent needs to determine what impact this might have on the sanitary waste water treatment system.

Answer QC-47

An error appeared on page 28 of Chapter 3. Showers are definitely present at the plant site and were taken into consideration while setting the flow rate. In addition, workers will not be exposed to stress conditions exceeding the heat stress stated by the *Regulation respecting occupational health and safety states*. The plant is designed to minimize worker exposure to hot environments. For example, the sampling of the furnace will be conducted by a robot. The plant will be highly automated. Therefore, there is no impact on the treatment of sanitary wastewater.

QC-48

Waste snow management was not discussed, despite its possible contamination by the plant's operations. The Proponent needs to specify provisions for waste snow management in order to prevent water runoff generated during smelting to be found in the environment without proper treatment.

Answer QC-48

The snow will be stored on the plant site in an area draining into the storm water retention basin. The level of the basin will be lowered before the winter period in order to accommodate the water generated by snowmelt. The addition of coagulants allows the precipitation of metals and suspended solids.

QC-49

For the final effluent water discharge point, the Proponent needs to demonstrate that the receiving environment has the capacity to accommodate the loads anticipated based on the following requirements:

› Provide a characterization of the state of the banks and littoral of the receiving watercourse over a distance of 50 m upstream and downstream of the latter. This distance may, however, be revised upwards if the MDDELCC considers that the area of influence of the discharge point is likely to be higher (depending on the morphology of the watercourse, the velocity and flow rates of the discharge, the hydrological data of the watercourse, etc.). This description implies prior identification of the natural high water mark near the discharge point and limit of the bank. Components such as vegetation (especially the presence of aquatic grass beds), the type of substrate (soil) and the profile of the natural terrain near the banks and littoral must be described. Any area of sediment accumulation or susceptibility to erosion downstream from the discharge point must also be documented. The presence or absence of wetlands (pond, marsh, swamp or bog) must also be checked against criteria in the MDDELCC Guide "Identification and delimitation of wetlands in southern Quebec", just like the presence of references or potential habitat of threatened or vulnerable plant species or likely to be so designated.

› Provide the results of the Surface Water Quality characterization for the same parameters as those already analyzed in Appendix E2 "Results Tables" in Appendix E "Surface Water".

› Present a hydrological assessment of the receiving creek before and after the construction of the smelter. This assessment should take account of all discharge points (storm water, process and sanitary water).

› The differences in the hydrological assessment flow rates should lead to the construction of a structure to contain additional water flows before all discharge points. These facilities need to meet the following conditions:

  › The base flow in the watercourse must be preserved;
  › Water quality must be protected;
  › Watercourses must not undergo significant and adverse geomorphic changes (erosion control);

- There should be no increase in the flood potential; and
- Structures (flood control reservoir) need to be built outside the riparian environments.

The *Storm water Management Guide of the MDDELCC and Ministry of Municipal Affairs and Land Occupancy (MAMOT) (2014)* may serve as a reference.

The Proponent needs to describe and present developments planned in this respect

Answer QC-49

During the detailed engineering, the exact location of the discharge point will be determined. The characterization of Watercourse # 5 where the effluent will flow into will be carried out and submitted to the MDDELCC, alongside the application for a certificate of authorization for the construction and operation of the plant. This activity will include the characterization of the banks and littoral, a delineation of the high-water mark and the bank over a distance of 50 m upstream and downstream of the water discharge point. The description of the vegetation, substrates and profile of the land will be conducted by a surveyor. The characterization protocol will be submitted for approval beforehand and will comply with the Ministry's expectations. A preliminary inventory of the sites was conducted by Groupe Hémisphères (2012) and Envill (2011) to present the wetlands and streams present in the sector. The raw data are presented in Appendix A to this addendum. Wetlands have been identified and delineated. An ecological study was prepared and is presented in Appendix A to this addendum.
The Table in Appendix E2 of the report entitled "Results Tables" has been revised and is attached to Appendix E to this addendum.

The water balance was presented in section 7.2.4 of the impact assessment:

"*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".

The assessment took into account the process water and sanitary water. Storm waters were not taken into consideration because they already contribute to the natural flow of the watershed. Besides, as indicated in Section 3.6.6 of the study, the objectives of the drainage system design are as follows:

- The base flow in the stream must be preserved;
- Quality of water must be protected;
- Rivers must not undergo significant and adverse geomorphic changes (erosion control);
- There should be no increase in the flood potential; and
- Structures (flood control reservoir) need to be built outside the riparian environments.

The flow rate in Watercourse # 5 is unknown. However, since it is intermittent, one can state that the flow rate of the plant's water will represent 100% of the total flow in low water conditions.

NAIC took into account the *Storm water Management Guide of the MDDELCC and Ministry of Municipal Affairs and Land Occupancy* in the design of the drainage system whose main objective is to control runoff water so that the hydraulic flow that existed prior to the construction of the plant remains substantially the same after the plant is put into operation.

QC-50 Process Wastewater Treatment Methods

In Section 2.9.5 the Proponent presents two ways of managing the brine contained in the cooling waters of the reduction area: either return the brine upstream of the clarifier or concentrate it and produce solid salts. These two options should be detailed in this impact assessment and the Proponent needs to present the implications and environmental impacts of these methods and compare one to the other.

Answer QC-50

These options will be assessed in the coming months by NAIC and the conclusions of its evaluation will be submitted to the MDDELCC before March 2017. During this assessment, NAIC will take into account the EDOs stated and the chronic toxicity criteria. The purpose of this evaluation will be to assess the technical feasibility of various options leading to the reduction of the overall toxicity of the effluent and the final flow rate at Watercourse # 5.

QC-51 Surface Water Quality

The Proponent states, in section 7.1.2, that *"No in-water work will be required for the construction of the plant".* The construction of the outfalls of the various plant effluents may require works in a watercourse. The Proponent needs to clarify that.

Answer QC-51

The storm water retention basin will be built outside the receiving watercourse and its riparian area. However, it is true that some of the works will be carried out in Watercourse # 5 in order to connect the basin with the watercourse and direct the effluent there. The final plans are not available and will be submitted while applying for a Certificate of Authorization (CA) to build the plant. However, the following common mitigation measures will be applied to works taking place in water or on the banks and specified in the CA application:

- Install protective structures to prevent the intake of sediment or soil in the watercourse;
- Conduct works mainly during low-water periods or when the upstream water section is dry; and
- Restore the banks after completing the works by ensuring good stabilization and natural revegetation.

QC-52 Fish Fauna

In section 7.2.7.1, the Proponent mentions that the temperature of the plant effluent in Watercourse # 5 will be 40°C. It is also stated that "*the average values for ammonia nitrogen, total particles, nitrate, and petroleum hydrocarbon exceed the chronic toxicity criteria for aquatic life protection*". Since the receiving watercourses are surely home to species of amphibians, reptiles and invertebrates, the lack of wildlife inventory in the watercourses does not exclude the possible presence of wildlife. The temperature and the expected toxicity of the effluent are such that there may be a loss of habitat for certain species. The Proponent needs to present, if possible, some mitigation measures to minimize impacts on wildlife.

Besides, the impact on downstream areas frequented by fish, i.e. in Watercourse # 8 and the Saguenay River under the influence of the effluent is not discussed. The assessment must consider the movements of the plume and the mixing zone of the effluent associated with tides and impacts on fish and marine organisms at the various stages of their life cycle, marine mammals, seabirds and designated wildlife habitats or those not located nearby.

Answer QC-52

As noted in answers QC-33 and QC-34, NAIC is committed to assessing the various options available and to propose mitigation measures in order to reduce potential impacts on aquatic life and wildlife using this habitat. The results of this study will be available by March 2017.

A fish inventory was carried out into Watercourse # 5 (Envill, 2011). The results of this inventory show that Watercourse # 5 is fish-free. In addition, the presence of impassable obstacles along Watercourse # 8 and several beaver dams on Watercourse # 5 makes it difficult for fish to easily move upstream and colonize this habitat which, in fact, is hostile. The habitat potential there has been described as non-existent (Envill, 2011). The presence of amphibians and reptiles was analyzed in the impact assessment, but no inventory has been conducted. Watercourse # 5 may well host an invertebrate community but this community has not been inventoried.

The Envill (2011) inventory demonstrates that fish do not use Watercourse # 8 from the upstream segment up to the first impassable threshold listed. In addition, SNC-Lavalin has traveled the entire watercourse to verify the ability of fish to swim up Watercourse # 8 in the summer of 2016. This river is interspersed with numerous impassable obstacles; including the culvert under the Quai-Marcel-Dionne road and waterfalls with a significant drop (Appendix E1 to the Impact Assessment) located some 100m between Watercourse # 8 and the Saguenay River.

The Impact Assessment only considers the presence of fish from this last stretch of Watercourse # 8 and in the Saguenay River, with respect to the impact of the effluent's discharge. At that point, the effluent will have flowed over 2,700m before experiencing a more considerable dilution with the waters of the Saguenay River.

QC-53

Regarding the hydrological and hydraulic characteristics of the receiving watercourses described on page 19, the Proponent needs to confirm that they are not planning to use the basins created by beaver dams as sedimentation basins.

Answer QC-53

Beaver dams will not be used for that purpose. These will be subject to regular maintenance by the SPA in order not to threaten existing infrastructure, but without being completely destroyed to maintain wetlands in place and associated wildlife habitats. A storm water retention basin will be built in order to retain suspended solids prior to discharge to the river.

QC-54

The assessment of impacts on fish fauna on page 20 does not take into account the Guidelines for the conservation of wildlife habitats (no net loss of wildlife habitat). Regardless of whether special status fish, sport fish or else are present, habitat conservation must be achieved. In addition, the *Act respecting the conservation and development of wildlife* defines fish habitat as "*any fish, the eggs and sexual products of such a fish, or any aquatic mollusc or crustacean".* The Proponent has to take all this into consideration in fish habitat losses.

Answer QC-54

Considering fish habitat as defined by the *Act respecting the conservation and development of wildlife*, the environmental value of the component remains average according to the methodology, which does not alter the qualification of the significance of the residual impact. As mentioned previously, it is important to emphasize that the Project Proponent is committed to working towards environmental discharge objectives to ensure the absence of overall acute and chronic toxicity of its effluent and avoid habitat loss in general.

QC-55 Assessment of Impacts

For surface water quality, Section 7.5 of the impact study states that sediment and hydrocarbons control measures will be implemented at the outlet of ditches. These systems should not be installed in rivers. The Proponent needs to specify where they will be installed.

Answer QC-55

Sedimentation basins and sediment and hydrocarbon control measures will be implemented outside the existing watercourse.

GROUND WATER

QC-56

Appendix F provides information on groundwater. In addition to Map F1 which shows the location of observation wells and the groundwater level, the Proponent must submit the drilling reports used to determine the direction of the water flow and the hydraulic gradient.

Answer QC-56

The drilling reports are presented in Appendix F to this addendum.

QC-57

Appendix F also provides information on the vulnerability of the hydrogeological formation in this area. The **various** sources of information used refer to sections of the report. Looking at these sections, it is not possible to find information relevant to the vulnerability analysis. The Proponent needs to provide this information.

Answer QC-57

The sections listed in Appendix F3 on the vulnerability of the hydrogeological formation are presented in Appendix F to this addendum.

QC-58

The extract from the environmental characterization report - Phases I and II submitted (File No. 634451, dated March 16, 2016) - provides details on the drilling reports used to determine the direction of water flow and hydraulic gradient. Reading the extract from the environmental study, the elevation of groundwater near borehole NW-07-16 shown in Table 3 is 139.7 m, whereas Flow Map F1 provided in the impact study indicates an elevation of 136.7 m. The Proponent needs to make the necessary adjustments to reconcile this conflicting information. In addition, the Proponent needs to correct the hydrogeological data presented in the impact study, if necessary.

Answer QC-58

This is a mistake. Flow Map F1 should mention the same value as in Table 3 of the Phase II report, i.e. 139.7 m. This value corresponds to the elevation of the water measured in this well on 21 January 2016. This correction does not change the interpretation of flow conditions.

QC-59

The extract from the environmental characterization report - Phases I and II already submitted (File No. 634451, dated from March 16, 2016) - does not allow for a correct analyze of all parameters evaluated **in** the vulnerability analysis. Three parameters require further explanation: annual recharge, topography and hydraulic conductivity. The Proponent needs to indicate the water balance at the location of the study site. This value will be used to assess the potential recharge of the underground water table and support the "recharge" parameter in the calculation of the DRASTIC index. Section 3.2.3 of the environmental study submitted reports "topographic ridges" which seems to contradict the assessment carried out for the "slope" parameter interpreted between 0 and 2%. A map that clearly identifies the DRASTIC vulnerability of the bedrock (clay coated or not) must be provided. Finally, the advanced value for hydraulic conductivity was not justified in any way. The Proponent needs to explain the use of ratings for all parameters used to assess DRASTIC vulnerability.

Answer QC-59

The water balance in the location of the study site and the calculation of the annual recharge are presented in a new Table F3.2, included in Appendix F to this addendum.

A new location map identifying the DRASTIC vulnerability of the bedrock (clay coated or not) was produced and presented in Appendix F to this addendum.

The Table showing the calculation of the DRASTIC vulnerability index for the bedrock aquifer (clay coated or not) has been revised and is included in Appendix F to this addendum. It should be noted that this Table should be numbered Table F3.1.

QC-60

The Proponent needs to identify drinking water wells in the local study area. If the wells are within the area of influence, the Proponent needs to assess the risk of contamination by regular plant operations or as a result of a technological accident.

Answer QC-60

Two private water intakes were listed in the MDDELCC hydrogeological information system database in the local study area. Map 4.5 has been modified (Map 4.5 Rev01) to illustrate the location of these wells. It is included in Appendix F to this addendum. Based on the interpretation of groundwater drainage conditions in the area preferentially oriented eastward and towards the Saguenay River, and along rocky topographic depressions, these water intakes and houses are located some distance away, on the upstream side of the project's area of influence. It should be noted that it is the municipal water system that supplies water to the area.

Contamination risks due to the regular operations of the plant or to a technological accident are assessed in 7.1.3. The main points are highlighted below and some clarifications are made:

- Slag will be stored in an area with a clay substratum. The mobility testing of contaminants in the slag show that they are not very mobile and that concentrations are below the standards for drinking water;
- The majority of production equipment will be located inside buildings;
- The facilities for the area where the amine solution is present are located inside a retention dam to isolate runoff water from this area;
- Petroleum hydrocarbon separators will be installed at the electrical substation and in the diesel refueling area;
- The majority of materials used and stored at the plant are solids. Liquids such as the silicate solution, the chemical conditioning products for cooling water, the coagulant and sulfuric acid are stored inside a building;
- The fueling area and two diesel tanks will be surrounded by a retention dam;
- DMDS will be stored in an outdoor tank surrounded by a retention dam;
- The amine solution and the antifoam agent are stored in barrels inside a building; and
- A preventive maintenance program for equipment and sound environmental management activities will minimize breakage and spills.

QC-61

Groundwater monitoring will be conducted twice a year for the following parameters: pH, conductivity, chlorides, sulfates, sulfides, phosphorus, ammoniac nitrogen, dissolved iron, C_{10}-C_{50} and PAHs. The Proponent needs to also make a commitment to perform the characterization and monitoring of the metals (and metalloid) listed in the *Land Protection and Rehabilitation Regulation.*

Answer QC-61

NAIC is committed to adjusting the monitoring program so that monitoring is conducted twice a year for the following parameters: pH, conductivity, chlorides, sulfates, sulfides, phosphorus, ammoniac nitrogen, dissolved iron, C_{10}-C_{50} and PAHs. In addition to these parameters, NAIC will monitor for the metals (and metalloids) listed in the *Land Protection and Rehabilitation Regulation*.

The table in Appendix F presenting the results for the quality of groundwater has been updated following two additional sampling campaigns to confirm the presence of toluene in one of the wells. The two additional campaigns showed the concentration decreased by 73, i.e. from 12 to 9.1 µg/l. The table is attached again to Appendix F to this addendum.

WETLANDS, RIVERS AND VULNERABLE OR THREATENED PLANT SPECIES

QC-62 Wetlands

In section 7.1.4.2 of the Impact Assessment the Proponent mentions that: *“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 SPA. Therefore, there is no impact anticipated on wetlands in the study area as a result of the construction of the plant”.*

Since the platform is built for the construction of the plant, the Proponent needs to explain their assertion that there is no impact. Indirectly, the construction of the plant in this area leads to a tangible loss of wetlands and wildlife habitat, including for amphibians, reptiles and small mammals. This comment also applies to the assertion made in the next section (last paragraph on page 6).

Answer QC-62

The construction of the platform will be conducted by the PAS as part of the third phase of its land development plan. The extent of this third development phase is yet to be defined by the SPA which must consider the needs anticipated and expressed by various proponents. However, it is certain that this third phase will include all of the land planned for the construction of pig iron plant that will therefore begin on already cleared, stripped, leveled and ready-for-construction land. Since the works of the SPA will be completed relatively soon before NAIC’s works, it may seem that they are designed solely to accommodate this project. However, it should be noted that over 65% of the site has already been cleared, stripped or leveled as a result of work performed by the SPA in relation to its development plan. These works were conducted before the first discussions between NAIC and the SPA took place. It is therefore not correct to say that the site preparation works carried out by the SPA will generate impacts caused by NAIC's project. Besides, the SPA works will be subject to a federal environmental assessment, as required by Canada's Environmental Assessment Act.

Since these wetlands will have been destroyed (MH13) or modified (MH4) prior to the start of the NAIC project by the SPA platform construction, this impact is considered as indirect. An analysis report establishing the ecological value of the wetlands affected based on the requirements of the Guide on the Identification and Delineation of Wetlands in Southern Quebec (Bazoge, 2014) has been prepared and is presented in Appendix A to this addendum.

This analysis demonstrates that the MH13 wetland is now split into two separate wetlands, a cattail marsh (MH13a) and a treed swamp (MH13b). As for the MH4 wetland, it has remained intact, and corresponds to a wetland complex made of a forested bog and treed swamps. Wetlands MH13a and MH13b have a low ecological value while Wetland MH4 has an average ecological value. The total area of the latter will be reduced by 12%, i.e. 0.54 ha.

No potential habitat hosting vulnerable or threatened plant species has been identified in the study area. The same is true for occurrences of vulnerable or threatened plant species, none of which was reported by the CDPNQ.

QC-63

The sections of the impact study documenting watercourses (water and riparian environments) and wetlands do not refer to the MDDELCC's identification definitions and criteria published in the following reference documents:

- For watercourses, “Identification and delineation of water and riparian environments,” available here:

http://www.mddelcc.gouv.qc.ca/eau/rives/delimitation.pdf

- For wetlands: “Identification and delineation of wetlands in Southern Québec (2015)”, available at Publications du Québec.

The description of the aforementioned sensitive areas remains incomplete. In addition, the information presented in the impact study is limited to existing map databases and a photo interpretation of wetlands. In this regard, the Google Earth image shows what looks like a considerable discrepancy between the information presented in the Impact Assessment and the ground reality on the extent of these wetlands. A field survey campaign was conducted in 2012, but the study area covered by the surveys remains unclear. It should be noted that the MDDELCC's identification criteria have changed since 2012. The Proponent needs to provide, if already available, the description of the water and riparian environments as well as the wetlands in accordance with the documents mentioned in order to have a real understanding of the project's impacts on these sensitive environments.

Answer QC-63

Watercourses in the study area were mapped based on the references given in Section 7 of the MDDELCC document entitled “Identification and Delineation of Water and Riparian Environments”. In addition, watercourses located near the project area were characterized by Envill (2011) and Groupe Hémisphères (2012). The results are summarized in the impact assessment and in the summary table that contains the raw data (drawn from both studies). These are presented in Appendix A to this addendum.

The photo-interpretation works that refined the description of the wetlands, which is based on studies by GroupeHémisphères (2012) and Genivar (2010), was made from ortho-photographs dating from 2015 with a resolution of 20cm. All the information acquired by photo-interpretation was merged with the cartographic data of Ducks Unlimited Canada (07-2009) and with the ecoforest map, 4th inventory, MERN Quebec (2015). Therefore, the information presented accurately reflects the current situation.

The wetlands that will be indirectly affected by the preparation of the plant site by the SPA were analyzed for their ecological value as required by the Guide on the Identification and Delineation of Wetlands in Southern Quebec (Bazoge, 2014). This analysis was performed for the SPA as part of the study required by the Canadian Environmental Assessment Act and it is presented in Appendix A.

QC-64

The host platform for the installation of the plant will be prepared by the SPA for the following works: clearing, stripping, grading, construction of temporary site facilities, surveying, grading, and excavation of internal drainage ditches and construction of a temporary and mass excavation retention basin. To this end, works are planned inside swamps (MH4 and MH13) based on the description made in Section 4.3.1.2 “Wetlands” (p. 19, Section 4 of the Main Report). Considering the presence of wetlands, the Proponent needs to provide any information that would help identify the impact associated with the development of the plant site on these environments, including what was planned by the SPA with respect to the stages of the mitigation, risk avoidance and minimizing works in wet and aquatic environments during the development of the project. The Proponent needs to also describe the steps taken to minimize the footprint of these facilities. The argument must also include the measures to be implemented to preserve the ecological functions of wetlands adjacent to the area affected by the works. Section 5.2 (p. 19 and subsequent pages) of the guide entitled “Wetlands and Environmental Authorization” of July 2012, prepared by the MDDELCC can serve as reference for such an approach.

Answer QC-64

As mentioned in the Environmental Impact Study, NAIC intends to build its project on land belonging to the Saguenay Port Authority (SPA), which will have been converted accordingly (Section 3.13.2 of the impact assessment), see also Answer QC-62. Depending on the site’s configuration at the start of construction, site development works will not affect wetlands.

It should be noted that efforts have been made to reduce the total footprint of the project. The first configuration of the plant equipment occupied an area of 17.4 ha. The change of technology has reduced the footprint to 15.7 ha. During the feasibility study, the footprint was further reduced to 10.7 ha. The optimization of the equipment's layout takes into consideration various factors as listed in Answer QC-1. However, the reduction of the overall footprint has not resulted in reduced wetland area.

Wetlands that will be indirectly affected by the preparation of the plant site by the SPA were analyzed for their ecological value as required by the Guide on the Identification and Delineation of Wetlands in Southern Quebec (Bazoge, 2014). This analysis was performed for the SPA as part of the study required by the Canadian Environmental Assessment Act and is presented in Appendix A.

The Proponent cannot be held responsible for the actions and responsibilities of the SPA.

QC-65

Based on the inventory of wetlands, watercourses and vulnerable or threatened plant species that are directly and indirectly impacted by the plant's facilities, the Proponent needs to provide, if available, a summary of losses by ecological value, and by:

- area for each type of wetland;
- length for each type of watercourse (intermittent and continuous); and
- occurrence (number of plants and distribution size) for each type of vulnerable or threatened plant species.

The Proponent needs to also provide an analysis report establishing the ecological value of the wetlands and watercourses affected by the project. To determine the ecological value, the Proponent is requested to use methods and criteria recognized by the MDDELCC, including those proposed in the document "Guide to Developing a Wetland Conservation Plan" *(Guide d'élaboration d'un plan de conservation des milieux humides)* published in July 2008 by the MDDEP. The only criterion that was used concerns connectivity to the river system.

Answer QC-65

The ecological study on wetlands presenting these data is inserted in Appendix A to this addendum. Regarding watercourses directly or indirectly affected, the information requested is reported in Table QC-65. Details regarding vulnerable or threatened plant species are given in Section 4.3.3.1 of the impact assessment. The vulnerable or threatened plant species are also addressed in the environmental study (Appendix A).

The watercourses around the site were characterized and surveyed (Groupe Hémisphère 2012 and Envill 2011). The Watercourse Visual Assessment Protocol version 2 (SVAP2, USDS 2009) was applied based on available data from field surveys.

The results indicating the physicochemical quality of Watercourses # 5 and 8 are presented in Section 4.2.4 of the impact assessment while the results of the inventory of these watercourses are indicated in Section 4.3.2.3. The results of additional analyzes following the filing of the impact study on water quality at the sampling point located at the confluence between Watercourses # 5 and No. 8 are available in Appendix E.

Table QC-65 Length and Ecological Value of Watercourses Affected by the Project

Watercourse # [1]	Type (I/P)	Lenghth of Section Assessed (m)	Lenghth of Watercourse (m)	Ecological Value[3]	Potential Habitat	Presence of Fish
5	I → P	548	548	Moderate	Nul[4]	No
6	I → P	805	1873	Low	Nul[4]	No
8	P	2129	2403	Moderate	Nul[4]	No
8	P	100	2403	good	Moderate [5]	Yes

Note 1 Numbering of rivers according to the environmental impact study (SNC-Lavalin, 2016).
Note 2 I = Intermittent; P = Permanent; I -> P: Intermittent becoming permanent.
Note 3 According to the Assessment Visual Stream protocol version 2 (SVAP2, USDA 2009) based on available inventory data (Envill, 2011, 2012 and Hemispheres Group SNC-Lavalin 2016).
Note 4 According to the observations reported in Envill, 2011 regarding the potential of spawning, nursery andfeeding grounds for fish.
Note 5 According to SNC-Lavalin's observations, field visit in July 2016.

QC-66

Where it is demonstrated that the ecological value for project-impacted communities would be considered of low value, the Proponent needs to present the compensation plan proposed by the SPA for the loss of wetlands and watercourses. This compensation should normally include the following:

- Identification of compensation sites of equivalent ecological value and type in terms of biodiversity. To this end, the watershed impacted by the project those nearby must be considered as a study area;
- Demonstration of the technical feasibility of compensation for wetland restoration including an ecological characterization report and protective measures to be taken to ensure the sustainability of the environment subject to compensation measures over time. The selected areas must correspond, at the minimum, to the areas impacted (directly and indirectly);
- Demonstration of the technical feasibility of the compensation measure for the restoration of the watercourse and riparian strips, including a field characterization report to confirm the selection of river sections selected for compensation. The lengths selected must correspond, at the minimum, to twice the length of the watercourses affected;
- Demonstration of the technical feasibility of protective measures for vulnerable or threatened plant species, including an ecological characterization of the area to be protected, as well as measures to ensure their sustainability over time; and
- Confirmation of an appropriate protective status that complies with Quebec’s law on wetland compensation. To this effect, it is necessary to identify and provide for the legal steps required to ensure the sustainability of the environments affected and show that the ecological integrity of these sites could be maintained in the long term.

Answer QC-66

The work associated with the compensation of affected environments does not fall within NAIC's responsibility but rather within that of the SPA which will run the site preparation work. At this stage of the project's development, NAIC does not have the requested information.

WILDLIFE

QC-67 Terrestrial Mammals and Chiropterans

Although it is probable that there is a little population of moose or bear, the absence of crop in the area could mean that there is no activity. The lack of harvesting cannot be correlated with the limited presence of these animals. Part of these results may be explained by land tenure (limited access to private land).

In addition, the Proponent could have added: *"in contrast, there is a probable presence of coyotes considering the fact that they like this type of habitat"*.

Answer QC-67

In addition to harvesting results, the Impact Assessment also shows density per hunting sector based on the inventories of large-size wildlife species (Huot and Lebel, 2012; Lamontagne et al 2006; Dussault, 2015). It also confirms the presence of the species in the study area, where applicable. The sum of these data provides an adequate picture of the potential presence of these species.

Table 1 in Appendix G of the impact assessment on mammal species likely to frequent the study area provides a presentation of the coyote (Canis latrans).

QC-68 Marine Mammals

The information provided in Sections 4.3.2.1 and 7.2.7.2 of the impact study on the presence, in the sector, of fin whale seems inaccurate. The Proponent should cite sources stating the presence of the species in the area.

The Proponent needs to correct the information relating to the common seal since the species present in the Saguenay River is not *Phoca vitulina vitulina* (present in Eastern Atlantic) but *Phoca vitulina concolor*, instead. It is known to be present in the Baie des Ha! Ha! and must therefore be regarded as present in the study area. Its presence in the Saguenay-Saint-Laurent Marine Park is better documented because studies on this species focused on the marine park territort and not on the entire habitat of the species in the Saguenay River. There is little information concerning the status of the common seal population (COSEWIC, Assessment and Status Report):

https://www.registrelep%1esararegistry.gc.ca/virtual_sara/files/cosewic/sr_harbour_seals_0808_f.pdf

The Proponent identifies the major impacts of marine traffic on the beluga (noise, collision) but does not mention its impacts on other marine mammal species, the fish population at different stages of their life cycle and on other aquatic organisms. Since NAIC's activities will cause a 40 to 49 increase in the number of vessels per year (i.e. 16 to 20% of 2015 marine traffic), there will perhaps be a significant impact.

The Proponent has to correct and improve the Impact Assessment on the basis of the available information, in order to include the missing elements. Depending on the species potentially affected *in situ*, the Proponent needs to also indicate the existing protective or mitigation measures to be applied to reduce the impact of shipping on marine mammals.

Answer QC-68

As mentioned in Section 4.3.2.1 of the impact study, it is rather exceptional to observe the presence of these species in this section of the Saguenay River (Robert Michaud, Group for Research and Education on Marine Mammals, personal communication; Nadia Ménard, the Saguenay-Saint-Laurent, personal communication).

As to the Latin name of the common seal found in this sector, the sentence associated with this error should read as follows: “Two species of marine mammals are more likely to frequent the study area: the minke whale (Balaenoptera acutorostrata) and Phoca vitulina concolor. A third species, the beluga whale (Delphinapterus leucas) is part of the population of the Saint-Laurent Estuary that is deemed ‘threatened’ in Quebec and listed in the Species at Risk Act (SARA) but whose presence is rather observed further downstream of the study area”.

Regarding the common seal, the impact assessment mentions, in Section 4.3.2.1, that the species is likely to frequent the study area. The impact assessment therefore considers that the species may be present in the study area since it is known to be present in the Baie des Ha! Ha!

Finally, to integrate the impact assessment on other marine mammal species potentially present in the area, the last paragraph of Section 7.2.7.2 should read as follows:

“Marine mammals which are not subject to legal protection have a moderate environmental value. Since they draw strong interest and possess recognized qualities, their conservation and their protection is a concern. The beluga is one marine mammal that enjoys a protection status which gives it a considerable environmental value. However the degree of disturbance to their habitat caused by increased circulation remains uncertain and difficult to quantify. It must be assessed on a regional scale. A recent study (September 14, 2016) provides more information that can be transposed to the activities planned for the transportation of NAIC products substances. Marine transport is discussed in answers QC-95 and QC-97 of this document”.

It is important to reiterate NAIC’s commitment to participating in initiatives and working groups relating to the impact of marine traffic on marine mammals. In addition, NAIC wishes to clarify its commitment made in the penultimate paragraph of Section 7.2.7.2. Specifically, NAIC will request iron and pellets carriers to adhere to and comply with the protection measures that they voluntarily adopted. These measures are defined by the Working Group on Marine Transportation and the Protection of Marine Mammals in the Gulf of Saint-Laurent that develops practical solutions to reduce risks associated with marine transportation to which marine mammals are exposed in the estuary, while allowing the merchant navy’s activities to take place and without compromising security (available online, 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/). These measures add to those already provided for in the Regulation on Marine Activities in the Saguenay – Saint-Laurent Marine Park and to the regulations in force in the jurisdiction area of the Saguenay Port. These measures will also apply to the carriers of NAIC's raw materials and finished products.

QC-69 Amphibians and Reptiles

In section 4.3.2.4 of the impact study, it is stated that no inventory of amphibians and reptiles was carried out in or near potential receiving watercourses of project effluents. Their presence could influence the environmental requirements on discharges, especially if special status species are detected. **Since** there is a beaver dam, the habitat is permanent and most likely favorable to invertebrates, amphibians and reptiles.

If an already-completed inventory is available, the Proponent needs to provide it.

Answer QC-69

With regards to invertebrates, no inventory has been conducted as part of the impact study.

Following the analysis of species distribution and habitats represented in the study area, amphibian and reptile species potentially living in the study area are presented in Table 4 of Appendix G to the impact study. Four of these species have a special status (Table 4.13 of the impact study), including the wood turtle, the presence of which was considered very unlikely in the local study area as it is not its preferred habitat (which actually is meandering sand and gravel substrate watercourses and nearby terrestrial environments; Desroches and Rodrigue 2004).

Among the other three special status species, the snapping turtle and the pickerel frog could live in the habitat associated with Watercourse # 5, of which sections were flooded because of the presence of beaver dams. In addition to forest environments, the grass snake also lives at the edge of lakes and ponds, including areas where rocks are abundant, such as rock outcrops (Desroches and Rodrigue 2004). It could therefore be present in the local study area. But, the presence of beaver dams will be further controlled in the future because the SPA must ensure that those dams do not interfere with facilities on its property. They are regularly destroyed to allow free flow of water.

To confirm the presence of the pickerel frog, the snapping turtle and the grass snake in the areas under the influence of Watercourse # 5, NAIC will conduct a specific inventory of these species in 2017. This inventory will also identify other amphibian and reptile species. The inventory protocol will be submitted in advance to the Ministry of Forests, Wildlife and Parks for validation.

QC-70 Site Preparation, Vegetation and Terrestrial Wildlife

In sections 3.13.2, 4.3.1 and 7.1.5.1 of the impact study, the description of the vegetation does not specify the current state of the vegetation at the plant site or likely to be affected in the periphery considering the scale used. Depending on the type of vegetation, special status species could navigate (reported sighting of the Marsh Owl, *Asio Flammeus*, and the Canada Warbler, *Cardellina canadensis*, west of the plant site):

- Since it is mentioned in the section on site preparation that deforestation is required (Section 3.13.2), the Proponent needs to specify whether the plant site has a suitable habitat for the Canada Warbler;

- The Proponent needs to also specify whether the affected farm fields are favourable to the short-eared owl. Although there was no sighting of this species in 2012 by the consultant, and considering it does not necessarily use the same field year after year, it is possible that the species has been present for some years, which means there is a loss of habitat.

If these species are likely to be present, the Proponent needs to implement measures to reduce impacts during construction, mostly to avoid birds' breeding season as far as deforestation and changes in agricultural fields are concerned. The intensive nesting period falls between May 1 and August 15. A timeline of the works in relation to sensitive periods for wildlife should be presented in the EIS.

Answer QC-70

The map of the biophysical environment (Map 4.2) shows that the areas under the project footprint and those nearby are currently of three different types; i.e. the majority of them (over 50%) are anthropic (backfilled and leveled) and partially disrupted by cutting activities. The areas occupied by cattail marshes and wetlands, as well as a sector for agricultural types of activities. will be developed by the SPA for the construction of the project. As a result, this work will lead to habitat losses indirectly associated with NAIC because the project footprint is considered vegetation-free by the time construction works begin (see Answer QC-62 for details).

The Canada Warbler breeds in types of hardwood and usually moist coniferous forests which all have a dense and well developed shrub layer. Shrub and dense understory vegetations help conceal Canada Warbler nests that are usually laid on the ground or on nearby mossy logs or roots.

The Short-eared Owl has long been associated with marshes where the herbaceous vegetation reaches a height ranging from 50 cm to 1 m. But, it also dwells in several other types of open habitats such as wet meadows and some agricultural lands. Agricultural land accounts for 22% (2.3 ha) of the Project footprint, which constitutes an area that will be backfilled and graded by the SPA beforehand. The work conducted by the SPA is not considered in the impact assessment because it does not fall within NAIC's responsibility.

However, it is possible to mention that the area that could potentially host the Short-eared Owl in the Project footprint is about 4.4 ha. Following the construction of the platform, this area will become unusable by this species, but it corresponds to less than 1% of the suitable habitats available in the study area.

The comments and requests expressed in the last paragraph of the question have been transmitted to the SPA.

QC-71

The assertions of the Section 7.1.5.1 contradict those of previous sections 7.1.4 and 7.1.5:

“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, and that, for all species of birds, amphibians, reptiles and mammals of the sector as well as all special status species that may frequent the study area”.

The Proponent needs to specify these assertions.

Answer QC-71

The site preparation work fall within the SPA responsibility and are not evaluated as part of the impact assessment (see answer QC-62 for details). This section should have read as follows: “During the construction phase, the clearing activities are the main cause of negative impact on wildlife. However, in the case of this project, since the plant implementation site will be free of vegetation, no deforestation will be carried out. Consequently, no potential wildlife habitat will be destroyed and that, for all species of birds, amphibians, reptiles and mammals of the sector as well as all special status species that may frequent the study area”.

However, pre-construction of the platform by the SPA is considered as an indirect impact since it is necessary for the development of the plant by NAIC. There will be 0.64 ha of wetlands (see ecological study in Appendix A of this Addendum) and 2.3 ha of farmland affected.

QC-72 protected territories, conservation areas and sensitive sectors

The Proponent relates in section 4.3.4 Parks Canada’s mentions concerning spawning areas for rainbow smelt (Osmerus mordax) in the local study area. It should be noted that these sectors are actually wintering grounds of the species that spawn further upstream in the Saguenay River.

Source : Lesueur, C. 1998. *Acquisition de connaissances sur les poissons migrateurs et dulcicoles du Saguenay. Rapport du projet triennal: résultats obtenus de 1995 à 1998. Rapport du Comité ZIP-Saguenay au ministère des Pêches et des Océans Canada, au ministère de l'Environnement et de la Faune et à Patrimoine Canada*. 74 p. +annexe, http://www.dfo-mpo.gc.ca/Library/225646.pdf

Answer QC-72

This comment is noted. The map provided by Parks Canada specifically states: “breeding area/pre-reproductive Aggregation/Winter-Spring”.

QC-73 Wildlife

In the second paragraph of Section 7.1.5.1, the Proponent states: “Terrestrial wildlife is generally of interest to the majority of the population. However, there is a lack of concern regarding its conservation and protection”. The Proponent needs to indicate whether this assertion comes from a trusted source or if it is his own evaluation.

Answer QC-73

The methodology for the allocation of the environmental value as part of the impact assessment can be found in Section 6.2.1 of the EIS. An error occurred in the definition but environmental value remains moderate according to the definitions of ecosystem and socio-economic values.

The ecosystem value of terrestrial wildlife (except for special status species) is considered moderate according to the following definition: the component has a strong interest and recognized qualities, but its conservation and protection are subjects of concern without however having reached a consensus. The socioeconomic value is moderate when the component is valued (economics-wise or else) by a significant portion of the population without however being legally protected. Yet, this error in the definition, reported on page 7 of Chapter 7, does not entail any change in the environmental value of the component and therefore in the assessment of the resulting impact.

QC-74 Terrestrial Wildlife

Impacts related to noise and lighting during operations are considered negligible in Section 7.2.6, but no impact assessment has been conducted and no mitigation of these effects is proposed. As the site is surrounded by wildlife habitat, the Proponent needs to consider this aspect and outline mitigation measures they intend to put in place to minimize impacts.

Answer QC-74

Projected sound levels in the operational phase have been assessed and are presented in Section 7.3.5.5. The assessment of plant's projected noise levels are below the limits of the MDDELCC. Thus, the project's noise emissions are in line with provincial requirements for noise. Mitigation measures will be necessary during the engineering so that noise emissions of equipment is less than or equal to the levels in Table 7.9.

An average ecosystem value was attributed to wildlife (see explanation in the previous answer) and the degree of disturbance, measured at Section 7.3.5.5, is considered low. The value of the resulting intensity is low (Table 6.2). Associated with an extended point and a long period of time, the residual impact is low.

CONTROL OF INVASIVE ALIEN SPECIES

QC-75

The Proponent needs to make the following commitments:

- Clean the machinery excavator before its arrival at the work site to remove mud, fragments of plants and animals attached to them;
- Clean the machinery excavator just outside the site if it is likely to have been contaminated with invasive alien species;
- No excess soil containing invasive alien species will be used as a final cover material;
- No area where removed or altered soil will be left bare; and

The gravel-covered areas will be maintained and any vegetation that may appear there will be cut and removed.

Answer QC-75

To verify the presence of invasive alien species near the project area (where soil realignment activities are expected), a review of several studies was conducted including the verification of mentions of those species in inventoried plant species lists. As mentioned in section 4.3.1 of the impact assessment, verification of references known from MDDELCC site named SENTINELLE was also conducted. Reviewed field studies include:

- Génivar. 2010. Aménagement de terrains pour le projet de parc industriel maritime intermodal de Grande-Anse (phase 2). Évaluation environnementale;
- GroupeHémisphères. 2012. Inventaires biologiques sur le site du Port de Grande-Anse. Rapport technique;
- Aecom – Groupe IBI/DAA. 2011. Projet de desserte ferroviaire au terminal maritime de Grande-Anse. Étude d'impact.

In the first two studies, no invasive alien species has been listed or mentioned. In the third study, purple loosestrife has been identified as species potentially present but has not been located. Those indicators might suggest the absence of invasive alien species in the project footprint.

The required commitments cannot be taken by NAIC because the site will be already deforested by the time it is delivered and developed before the start of construction by NAIC (see Answer QC-62). Requests expressed in the question have been transmitted to the SPA.

GREENHOUSE GAS

QC-76

It should be noted that the project will be subject to a greenhouse gas emission cap-and-trade system since its annual GHG emissions will exceed the threshold of 25,000 t CO2 equivalent.

Answer QC-76

NAIC noted the comment and accepts that it will be subject to the greenhouse gas emission cap-and-trade system.

QC-77

In a context where Quebec has the objective of reducing its greenhouse gas emissions by 37.5% by 2030 compared to 1990, the Proponent needs to demonstrate that it has evaluated all options to reduce its emissions. The Proponent affirms, inter alia, having evaluated different options regarding the type of reducing agent to use (biomass, natural gas or coal) and have considered the capture and recovery of CO2 extracted from process gas. If other solutions to reduce GHG emissions were considered, they must be mentioned in the report, indicating, if applicable, why they were not selected.

Answer QC-77

First, it should be noted that the assessment of GHG emissions is probably overestimated. Indeed, the emissions calculation was made based on a 365 day per year operation and by increasing the nominal capacity by 10%. Compared to the annual average, emissions are overestimated by about 20%.

NAIC has made a major change in the project by replacing coal with natural gas as a reducing element. This change is important because it resulted in a complete change of the whole process section upstream of the electric arc furnace. Thus, according to the designer of the project, about 90,000 tons per year of greenhouse gases were avoided. This change has increased by 40 million Canadian dollars the capital cost of the project.

Also, HYL ZR Energiron technology would recover the CO_2 emissions generated in the CO_2 removal unit, i.e. a potential reduction of 155,000 tons of GHGs per year. However, as indicated in Section 7.3.4, the CO_2 reduction rate is relatively low from a commercial point of view and there is little interest on the part of companies involved in the production of industrial gases.

GHG emissions associated with trucking the iron and pellets between the dock and the plant have been estimated in the impact assessment in Section 7.6.2.2 on cumulative effects. In the event that the SPA developed its project to build a multi-user conveyor to serve its future clientele, 220 tons of greenhouse gases emissions would be avoided. The motors associated to the conveyor would be electrical. Also, it should be noted that emissions from material trucking between the plant and the dock are surely overestimated. One potential service provider for the transport of these materials affirmed being able to reduce the number of trucks by using three multi-axle trucks with a capacity of 100 tons.

Finally, it should be mentioned that special attention was paid to the design of plant facilities to minimize trucking within the NAIC site for the transport of slag and materials containing iron (dust and sludge), which therefore minimized GHG emissions associated with transportation.

NAIC confirms not having assessed other GHG reduction options.

QC-78

The Proponent needs to specify whether they considered the possibility of recovering and upgrading the heat energy of the hot gases generated by the electric arc furnace operations as part of cogeneration projects. If not, does the design of the plant enable the recovery of this heat should an attractive opportunity arise some day?

Answer QC-78

Yes, it has been considered and found not advantageous from an economic standpoint. Also NAIC prefers to focus on operations rather than on energy production that requires other skills. It should be noted that the direct reduction technology followed by the electric arc furnace allows operating the arc furnace at temperatures much lower than with conventional technologies, as shown in Table 2.5 of the impact assessment. The energy requirements of the traditional sector are 17 to 18 GJ/t of liquid iron while they are 9.9 to 12.6 GG/t of Direct Reduced Iron.

The design of the plant could help recover this heat should an attractive opportunity arise in the future.

REGULATORY CONTEXT

QC-79

The Ministry of Energy and Natural Resources wishes to inform the Proponent that the Mining Act and the Regulation relating to mineral substances other than petroleum, natural gas and brine apply in the study area of the project.

Answer QC-79

In section 2.7.2 on page 14, there is the mention of the compliance to the Mining Act and to the Regulation relating to mineral substances other than petroleum, natural gas and brine.

QC-80

The pig iron plant project in Saguenay is covered by the Industrial-Waste Reduction Program under the eighth paragraph of Article 0.1 of the Regulation on sanitation certificates in industrial environments subjecting steel establishments with pig iron as main activity.

The project submitted by the Proponent needs to provide the entire infrastructure, measurement and control equipment, sampling equipment, etc., necessary to meet the different operating conditions, and, for all types of waste.

The information given should determine the choice of a variant according to the best available and economically feasible technologies since the first consolidation certificate is issued for a period of ten years. Should the detailed information not be available at this stage of the development of the engineering project, the Proponent needs to commit to retaining the variants with the best technology available and economically feasible.

In accordance with the polluter-pays principle, the industrial establishment is assigned an annual fee. The latter consist of a fixed amount plus an amount based on the amount of certain contaminants released into the environment. Mine wastes are concerned by this pricing. An explanatory guide[3] on the calculation of the annual fee for holding a sanitation certificate is available.

Finally, a monitoring program and environmental monitoring must be submitted to the MDDELCC for approval as part of the Certificate of Authorization issued under section 22 of the Environment Quality Act for the operation of the plant. Subsequently, all the operating requirements will be included in the depollution attestation as provided in Section 31.13 of the Law on Environmental Quality.

Answer QC-80

The comments are noted.

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[3] http://www.mddelcc.gouv.gc.ca/programmes/prri/guide-droits-annuels.pdf

ENERGY SUPPLY

QC-81 Natural Gas Supply

The Proponent does not give in Section 3.10.1 an estimate of the required natural gas volume to operate the plant. The Proponent needs to provide this information. They must also specify whether the quantities required by the plant are currently available in the region and whether the gas network has the capacity to power the plant.

Answer QC-81

The estimated volume of natural gas required to operate the plant is provided in Table 3.1 and is of 165,000,000 Nm^3 per year. Gaz Métro has confirmed that the ongoing work at their La Tuque station aiming to increase network pressure will serve current and future customers, including NAIC.

QC-82

For the operation of the plant, the natural gas will be used in particular for the reduction process and for fuel. Gaz Métropolitain will bear the connection work to its network over a distance of 16 km from the existing network as well as obtaining the necessary authorizations. In order to have an overview of the potential impacts of the project and those associated with related projects, the Proponent needs to provide a map of the proposed route of the gas line to build and specify the average influence of work.

Answer QC-82

A new map was prepared (map 4.7 presented at the end of this section) to illustrate the proposed route. The route is not final and two options are being considered. The southern portion of the route is not shown because no action has been taken to date with the landowners. The pipeline requires a right-of-way of about 20 m.

QC-83 Electricity Supply

On page 38 of Volume 1 of Section 3.10.2, it is mentioned that in terms of electricity supply the project requires a capacity of 75 MVA. The Proponent needs to provide the calculations justifying the need for 75 MVA electric power.

Answer QC-83

The calculations justifying the need for 75 MVA are shown in the Table below.

Sectors	Required Capacity
Reception, storage and handling	0.8 MVA
Process (other than EAF)	9.3 MVA
Electric Arc Furnace (EAF)	55 MVA
Buildings and services	9.5 MVA
Total in kVA	**75 MVA**
Total in kW	**72 MW**

QC-84 (Section 3.10.2 - Power Supply)

Still on page 38 of Volume 1 of Section 3.10.2, it is mentioned that a “new 161 kV power line will be necessary for a distance of about 8 to 22 km depending on the connection solution that will be adopted”. The Proponent needs to submit details to justify the electrical connection of the project, notably concerning the processors, the agreement with Hydro-Québec and the place of arrival of the electric line.

Answer QC-84

The place of arrival of the power line is shown in Figure 3.1; it is item No. 26 corresponding to the main electrical substation. The agreement with Hydro-Quebec is not yet available. The power requirements for each area were expressed in the Table presented in the previous answer.

QC-85

Since other industrial projects are planned in the area, the Proponent needs to indicate whether steps have been taken to jointly plan the power, water and natural gas supply for different facilities to avoid duplicating facilities and power transmission corridors.

Answer QC-85

It is not the responsibility of NAIC to coordinate the work of the City of Saguenay, Hydro-Québec and Gaz Métro. In discussions with these three entities, NAIC has made clear that these three facilities will be necessary.

QC-86

Although the Proponent states that the construction of the power transmission line and the gas line are not their responsibility, this is essential to the operation of the plant. The Proponent needs to clarify and assess whether these projects will have cumulative impacts on pig iron plant project, particularly during construction.

Answer QC-86

NAIC cannot provide details because it does not have that information at this stage of the project and therefore cannot assess the impact of these projects by third parties. Potential routes of the pipeline and aqueduct were presented to the new map 4.7. As for the pipeline, the southern portion of the route is not shown because no action has been taken to date with the landowners. Concerning the power line, the connection point is not known. It will be located between the station of Chicoutimi and the station of Port Alfred. As far as the pipeline and aqueduct routes are concerned, they are at a preliminary stage. It should be noted that the two paths are expected to follow existing infrastructure, either the road or the rail track, in order to minimize impacts on private land. The pipeline’s right-of-way is about 20 m and that of the aqueduct is about 8 m. Discussions took place between the City of Saguenay and Gaz Métro on the location of the two facilities so that each of them can hold the necessary right-of-way in the development of their respective projects.

QC-87

The construction of a 161 kV power line over a distance which can vary from 8 to 22 km is required to allow the completion of the plant operation. Obtaining permissions for the project is required for work to be carried out by Hydro-Québec. In order to have an overview of the potential impacts of the project and those associated with related projects, the Proponent needs to provide a map of the route that will be followed for the construction of the new power line. In addition, it is necessary to know the average right-of-way that will be required and the types of electrical equipment that will be set up (poles, gantries, masts, etc.).

Answer QC-87

As mentioned in the previous answer, NAIC does not know the connection point and does not know the type of electrical equipment that will be set up. Hydro-Québec must consider the totality of the expressed and future needs in order to define the optimal solution to serve their customers.

WATER SUPPLY

QC-88

The area affected by the construction of the plant is already connected to the drinking water supply by the City of Saguenay. However, a further line of 250 mm to obtain a 210 m3/day flow is necessary to plant operations. Thus, a new water line will be built over a distance of 15 km from the City of Saguenay. In order to have an overview of the impacts of the same project and those associated with related projects, the Proponent needs to provide a map of the proposed route and must specify the average right-of-way required to work.

Answer QC-88

The preliminary route is shown on the map 4. The right-of-way would be about 8 m.

ABORIGINAL COMMUNITIES

QC-89

In sections 4.4.4.15 and 5.2.5, Table 5.1, Map 4.5, the impact study mentions the “Nitassinan Southwestern Part”. It would be advisable that the notion “Nitassinan” be withdrawn and that only the term “Southwestern Part” is retained. “Southwestern Part” is actually a territory which is discussed in the context of comprehensive land negotiations with the Petapan grouping. The Proponent needs to make this correction in the relevant sections.

Answer QC-89

The first paragraph of section 4.4.4.15 has been revised as follows:

“The study area is located in the territory called “Southwestern Part” which covers an area of 21,106 km2 (Map 4.5). This is a common land section to Innu First Nations who is currently the subject of discussions in the context of comprehensive land negotiations between the Petapan group (representing the First Nations of Mashteuiatsh, Essipit and Nutashkuan) and the governments of Canada and Quebec. This territory is a part of the application territory of the

Agreement-in-Principle of General Nature ratified in 2004 by the First Nations of Mamuitun (Mashteuiatsh, Essipit and Pessamit[4]*) and Nutashkuan along with the governments of Quebec and Canada".*

The fourth paragraph of Section 5.2.5 has been revised as follows:

"The representatives of the Innu communities of Essipit, Mashteuiatsh and Pessamit[5] *not only reiterated the issues mentioned above, but reiterated also the importance of recognizing their rights on the land portion identified as "Southwestern Part" (Map 4.5). Although these communities are not actively using the project site, the stakeholders interviewed expressed the importance of protecting both traditional activities near the site along the Saguenay River, and potential heritage sites around the Fjord, and consider that economic benefits should be shared fairly. The respondents stressed the importance of establishing good cooperation with the communities concerned".*

Table 5.1 (Issues and concerns raised during preliminary consultations) is adjusted as follows after the comment: Socio-Economic Issues (First Nations): The recognition of rights and collaboration with the Innu communities concerned with "Southwestern Part."

Map 4.5 has been revised and is presented at the end of this section (4.5 Rev01 map).

QC-90

In section 4.4.4.15, the Proponent writes: "The three communities concerned with the Southwestern Part should receive a treaty model during the month of March 2016". Since no agreement has been signed yet by the Parties, the Proponent needs to correct that statement.

Answer QC-90

See answer 89.

QC-91

In section 4.4.4.15, the information submitted could suggest that Pessamit is still part of comprehensive land negotiations, while the community withdrew from negotiations in 2005. The Proponent needs to correct that statement.

Answer QC-91

See answer 89.

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[4] Pessamit withdrew from negotiations in 2005.

[5] Even though Pessamit First Nation withdrew from comprehensive land negotiations mentioned in section 4.4.4.4.15 in 2005, their representatives usually participate in consultations associated to new industrial projects in the Saguenay-Lac-Saint-Jean region with the representatives of Essipit and Mashteuiatsh communities. This explains their presence in the preliminary consultation conducted as part of this study.

ROAD TRAFFIC

QC-92

The Proponent needs to define what the impact of the plant activity will be on the traffic between the plant project and Highway 170 (Highway 70 is currently under construction in the sector).

Answer QC-92

The impact of additional traffic on the transport network is described in Section 7.3.2.4 of the report. The additional number of vehicles serving the plant on the roads is also provided. The transportation of waste is also dealt with in that section, the section includes:

- The supply of raw materials for the plant will add 4-5 trucks a day on local roads;
- The workers will add about 85 vehicles per day; this traffic will be limited to beginnings and ends of shifts;
- Transportation of slag out of the plant site if they cannot be treated on an adjacent site, could add a dozen more trucks per day on local roads;
- The transportation of waste to be disposed of off-site (see Section 3.7 of the Impact Assessment) will add up to one truck per day on average; and
- The transport of iron and pellets between the plant and the dock will add 480 trucks a day on this stretch of road Quai-Marcel-Dionne.

Given the Proponent does not know neither the residences of employees and visitors of the plant, nor the exact sources of procurement, it is difficult to predict the paths of vehicles. As for the 4-5 additional trucks per day, it should be noted that they are likely to take the path of the Quai-Marcel-Dionne, the road of Anse-à-Benjamin to the pathway of Grande-Anse and Highway 170 (the latter two being the main roads linked to the project), the other arteries of the local study area are closed to trucks. When the construction of Highway 70 is completed, it will probably be used instead of Highway 170.

The slag will be valued as aggregate. Discussions are underway with various companies including Alfred Boivin Group, quarries operator and general contractor in the field of civil engineering. On the assumption that they would be locally valued, and that three aggregate sites are about 17 km from the plant, south of Bagotville airport, the route taken by the trucks would then be the Quai-Marcel-Dionne pathway, the road to Anse-à-Benjamin up to the path of Grande-Anse and the path of Plateau S. Following preliminary discussions with the contractor, it is possible that the slag be transported in their pots which are then deposited on a flat-bed truck dedicated to this purpose for transportation between the plant and the NAIC quarry. The weight and dimensions of flat-bed truck respect the dimensions allowed by the regulations.

Employees and visitors have light vehicles. Concerning trucks transporting raw materials, their type and size will depend on the transported material and on the carrier. Fluxes (quick lime and dolomitic lime) are the most commonly transported materials; trucks will be completely closed. Slag will be transported in flat-bed trucks. In all cases, the weight of trucks will comply with the ongoing rules.

During the operation, increased traffic due to NAIC employees, suppliers and subcontractors result in a low degree of disturbance, resulting in a **minor** impact on the road network.

QC-93

The Proponent needs to establish what will be the increase in road traffic due to the supplying of the plant with raw materials, particularly in terms of hazardous materials, and also the level of residual materials to be eliminated; the Proponent needs to also assess the impacts of all this, including the noise level and road safety primarily for local roads. In addition, they must specify which roads will be used and the types of vehicles involved.

Answer QC-93

The increase in road traffic due to the supplying of the plant, the transportation of waste and the number of workers is described in the previous answer. The routes are also described in the previous answer.

The assessment of the noise impact of transporting materials between the dock and the plant is provided in Section 7.6.2.2 of the impact study.

For other vehicles on the local network, it represents less than 20 trucks per day and 85 light vehicles per day (4 to 5 trucks for raw materials, a dozen trucks for slag and 85 light vehicles for workers). According to the 2014 and 2015 annual reports by the SPA, product handling at Grande-Anse terminal generated a volume of around 10,000 trucks per year (30 to 40 trucks per day) on the road of Grande-Anse. The addition of trucks and light vehicles could result in an increase of less than 3 dBA, which will generate a low impact on the soundscape.

The increase in traffic associated with plant operations will be actually quite low considering the current rate. Part of the journey is made on a busy road mainly by users to get to the port facilities or to the Quai-Marcel-Dionne road and to Anse-à-Benjamin road up to the path of Grande-Anse. The latter connects to the Highway 170, the intermodal marine industrial park and the marine facilities of Grande-Anse; and for this reason it is considered as an industrial road. The major population centers will not be crossed by heavy traffic. The safety of road users will be further strengthened with the completion of Highway 70.

QC-94

The Proponent needs to specify whether the truck transportation from the port to the plant may be a source of dust containing crystalline silica.

Answer QC-94

The road between the port and the plant is paved. No diffuse dust emission from trucks carrying the pellets is expected.

MARINE TRANSPORT

QC-95

The increased traffic on the Saguenay River is a direct result of the project. The impacts of marine transport and mitigation measures can be discussed more in depth, particularly from a security standpoint; and that, in the context of other projects also having an impact on navigation planned in this sector.

Answer QC-95

Navigation in public ports is governed by rules that dictate the authorized maneuvers, including speed. All pilots of ships traveling on the Saguenay River are qualified and competent in terms of security. Regarding mitigation measures for marine mammals, the PSA participates in the work of a committee set up at the initiative of the DFO's Species at Risk Management Division and the Working Group on Marine Traffic and Protection of Marine Mammals in the Gulf of Saint-Laurent (*G2T3M*) in order to develop an Action Plan on the threat of anthropogenic noise for beluga whales in the Gulf of Saint-Laurent. NAIC intends to participate.

QC-96 Operation and increased vessel traffic

In Section 7.6.2.2 of the impact study, increasing marine traffic could be mitigated by a transportation management to reduce the number of trips of empty boat returns. The Proponent should check with the SPA whether it would be possible to implement means to associate the different users of its port facilities in order to optimize the use of vessels and thus reduce the total traffic.

Answer QC-96

To optimize marine transport on the Saguenay River's waterway, NAIC will promote the use of a boat that delivered its cargo to the Port of Saguenay for the shipment of its cast. This measure will aim to minimize the number of passes on the Saguenay and avoid unnecessary passing boats without cargo.

QC-97

The Proponent did not comment on the cumulative impacts related to the increase of marine traffic, awaiting the evaluation by the SPA for all pending development projects. However, it is relevant to make the following comments in relation to the overall marine traffic on the Saguenay River:

- A cumulative impacts study of the effects on marine mammals is highly necessary to determine the specific projects submitted to the SPA in detail. This study should include noise and disturbance effects, collision, mortality and spills risks, etc. Marine traffic management recommendations in the critical habitat portion of beluga whales in the Saguenay River should also be identified in this study (number of daily crossings, restriction period, circulation corridor, etc.) to reduce noise when boats are docked or at anchor;
- The Working Group on Marine Traffic and Protection of Marine Mammals in the Gulf of Saint-Laurent (G2T3M) is legitimized to propose concrete solutions to reduce the risks associated with shipping in the Saguenay River, as already conducted for the Port of

Cacouna. This consultation exercise led to voluntary steps to speed reduction and avoidance of certain parts of the river with a high density of whales. The SPA should ensure that the proposed measures are effectively implemented by all of its customers; and

- An increase in marine traffic of large ships can have significant impacts on the protection of critical habitat for the Saint-Laurent beluga whales in the Saguenay River, the approval of new projects in Saguenay involving a significant increase in marine traffic should consider the recommendations of the approach initiated by the industrial port zone of Saguenay.

Answer QC-97

As mentioned in the impact study, the degree of habitat disturbance of marine mammals caused by the increased flow rate is uncertain and difficult to quantify. NAIC cannot alone determine the degree of disruption of its activities on this scale. The impact should be assessed on a regional scale and should involve all traffic on the Saguenay River. The impact study conducted by the SPA for the marine terminal project on the northern shore of the Saguenay River includes the cumulative impact assessment for a 235 ships increase (60 for the project Ariadne Phosphate, 160 for the project LNG Quebec and a projection of 12 additional vessels to various Agésilas-Lepage docks and Grande Anse). The study of the SPA has not taken into account the additional traffic generated by the NAIC project because the information was confidential then and unavailable.

This information can be transposed to the activities planned for the transport of NAIC materials through the Saguenay River to the port of Grande-Anse, which will lead to a maximum increase of 49 ships annually (handy-like bulk carriers and self-unloading vessels weighing 27,500 net tons). In addition, the Port of Saguenay considers, in their realistic scenario, that in the coming years there should be overall a doubling of the number of ships passing on the Saguenay River to reach its facilities (WSP, 2016), the same assessment was made in Section 7.6.2.2 with cumulative impacts of the NAIC project (increase of approximately 270 ships per year in the NAIC study compared with 235 ships a year for the SPA study). Taking into account the traffic increase projections at Agésilas-Lepage and Grande-Anse docks, the additional traffic would be around 280 for a cumulative of 505 vessels, slightly more than twice the current traffic.

The main focus of the WSP study (2016) is not only the displacement (wave action creating erosion, increase of collision risks, disturbance of marine mammals by increased underwater noise and artificial light), but also waste (ballast and routine) and spills as a source of impacts of shipping on the Saguenay River.

This assessment describes the potential impacts of increased traffic on the Saguenay River but does not quantify the impact apprehended. It considers marine traffic increases as relatively small, reaching a maximum of about 4 to 6 movements per day. However, the following places are considered as the most susceptible:

- The mouth of the Saguenay River because of the current density of marine traffic and the importance of this sector to the economy of the region;
- The coves and bays along the Saguenay River, because they are essentially inhabited areas and used for the practice of various activities;

- The Saguenay-Saint-Laurent marine park, which is home to, among others, the known habitats of the Saint-Laurent beluga; and
- The sector of projected port infrastructure, due to the increase of associated traffic.

Finally, the exercise carried out by WSP (2016) estimates that the increase of shipping on the Saguenay River is associated with low risk but will be more significant in the following locations:

- At the mouth of the Saguenay River;
- In the narrow curves of the 25 km-portion downstream; and
- Near the projected North Shore port (SPA).

NAIC is committed to participating in initiatives and working groups on the assessment of the impact of marine traffic on marine mammals of the Saguenay River. This commitment aims to contribute to finding solutions and implementing concrete measures to reduce the risks associated with marine transport necessary for the operation of its plant.

These measures should be discussed with key stakeholders from the Ministry but also in conjunction with the Working Group on Marine Traffic and Protection of Marine Mammals in the Gulf of Saint-Laurent (G2T3M). NAIC does not have the authority to apply restrictions to other customers of the SPA.

NAIC agrees to require its carriers to comply voluntarily with preventive measures identified by the G2.

SOUND LEVEL STUDY

QC-98 Construction Phase

The assessed level of noise due to the construction site is presented in Table 1 below (see Table 7.7 of the Impact Assessment). The Proponent has assigned limits, at points 1 and 2, to initial noise, since it considers that the noise level exceeds the basic limit prescribed by the MDDELCC.

Table 2 Noise due to construction site (value in dBA)

Assessment Point	Estimated Assessment Level (L_{Ar_12h})	Limit proposed by the Proponent	Basic limits prescribed by the MDDELCC
1	40	55	55
2	21	55	45
3	36	62	45

The MDDELCC considers that this approach is biased because the sound signature of a site is totally different from the initial noise whose intensity is due to sporadic passages of vehicle. Despite this, the valuation levels of individual noise due to construction activities (LAr) remain well below the limits prescribed by the MDDELCC.

Answer QC-98

We agree with some of this comment to the effect that “particularly the assessment of noise levels due to construction activities (LAr) remain well below the limits prescribed by the MDDELCC”.

However, we disagree on the fact that the approach under consideration is “biased” and the limits are inaccurate at points 2 and 3. The approach adopted in the impact study to determine the initial noise impact and noise limits conforms to the document entitled “Guidelines on sound levels from an industrial construction site (MDDELCC)” presented in Appendix H4 of the report.

QC-99

The Proponent needs to explain why the particular noise values in Table 7.8 of the impact study are 2 dBA lower than those presented in Table 7.7 of the same document.

Answer QC-99

The sound levels in Table 7.7 are for a period of 12 hours of daylight (LAr 12h). The evaluation levels day/night (LAr dn) in Table 7.8 are for 24 hours. Since there will be no work at night, the LAr dn levels over 24 hours are lower than the levels LAr over 12 hours.

QC-100 Operating phase

The impact of noise associated with the transport of materials by trucks between the port and the plant was carried out using the LAr dn indicator. It was established that this level would be 43 dBA or 14 dBA lower than what is already perceived in point No. 1. The impact was considered weak at point 1, even by adding to this noise source the noise emissions from the plant.

The MDDELCC agrees with the fact of using Lar dn indicator, since the noise source, being of the same origin, has the same statistical signature.

However, the Proponent needs to justify the choice of selecting point 2 to assess the impact of traffic during construction and point 1 to assess the impact of ridership during operation.

Answer QC-100

Evaluation points 1 and 2 were reversed. Point 1 is located closer to the section of Grande-Anse road that will be used for construction. Paragraph 7.3.5.3 of the section should have read as follows:

“Regarding the possible increase of noise caused by traffic and trucking workers associated with the project, it is expected that 65 to 130 trucks and 100 to 390 workers will use every day the Grande-Anse road from the Anse Benjamin road. The equipment transshipped at the dock represents a traffic of about 30 to 40 trucks per day. The traffic of dock employees’ light vehicle is low, around 5 to 6 vehicles per day. The sound level of projected traffic on the Grande-Anse road is LAr dn: 60 dBA 30 m away from the center of the road. The sound level projected at the nearest R1 receptor that is over 700 m away from the road is LAr dn: 36 dBA. The initial noise level at R1 is LAr dn: 57 dBA (see Table 4.24). The impact of noise from traffic and trucking workers during construction will be ***weak****”.*

Point 2 is located closer to the section of the Grande-Anse road that will be used to transport materials between the dock and the plant during operation. Paragraph 7.6.2.2 of the section should have read as follows:

"Regarding the possible increase of noise emissions caused by the transportation of materials (pellets and pig iron), it is expected that 480 trucks per day will commute between the dock and the plant on the road to Grande-Anse. According to the 2014 and 2015 annual reports from the Port of Saguenay, product handling at Grande-Anse Terminal generated a volume of around 10,000 trucks per year (30 to 40 trucks per day) on the road to Grande-Anse. The light vehicles traffic of dock employees is low, around 5 to 6 vehicles per day. The projected sound level of traffic between the port and the plant, which will be mainly composed of trucks, is LArdn: 65 dBA 30 m from the center of the road. The sound level projected to the nearest receptor R2 which is more than 400 m from the road, is LArdn: 43 to 45 DBA. The initial noise level R2 is LArdn: 43 to 45 DBA (Table 4.24). The noise impact of goods transportation between the dock and the plant will be low. Even by adding the noise source to the plant's noise emissions, the impact on the soundscape will remain of little importance".

QC-101

The noise level modeling results are displayed in the form of an iso-contour curve, on the H-1 map in Appendix H of the impact study. The Proponent presents these exact values into evaluation points in Table 2 below (see Table 7.10 of the impact study).

Table 2 – Noise from operations (dBA value)

Assessment Point	Estimated assessment Level ($L_{Ar\ 1\ h}$)	Limit at night Proposed by the Proponent	Basic Limit at night prescribed by the MDDELCC
1	36	40	40
2	15	50	40
3	34	40	40

The value at point # 2 does not match what could be estimated from the examination of the iso-contour curve of the H1 map in Appendix H of the impact study.

The Proponent needs to confirm the estimated level of assessment at point # 2.

Answer QC-101

The evaluation points No. 1 and No. 2 were reversed. Corrected Tables are shown below. Conformity and project impact assessment are not affected.

Table 7.7 Rev01 Projected sound levels - Plant Construction

Point	Area	Period (1)	MDDELCC Limit (2) $L_{\text{Ar T}}$ (dBA) (3)	Assessment Level (4) $L_{\text{Ar T}}$ (dBA) (3)
No 1 4893, St-Martin, La Baie Road	Agricultural (3) 2218	Day	$L_{\text{Ar 12h}} = 55$	21
		Evening	$L_{\text{Ar 1h}} = 45$	W.O(5)
		Night	$L_{\text{Ar 1h}} = 45$	W.O(5)
No 2 4583, St-Martin, La Baie Road	Industrial (4) 71774	Day	$L_{\text{Ar 12h}} = 55$	40
		Evening	$L_{\text{Ar 1h}} = 45$	W.O(5)
		Night	$L_{\text{Ar 1h}} = 45$	W.O(5)
No 3 4413, Anse-à-Benjamin, La Baie Road	Agricultural (3) 2236	Day	$L_{\text{Ar 12h}} = 62$	36
		Evening	$L_{\text{Ar 1h}} = 45$	W.O(5)
		Night	$L_{\text{Ar 1h}} = 45$	W.O(5)

Notes :

1. On day time from 7:00 a.m to7:00 p.m; in the evening from 7:00 p.m to 10:00 p.m; at night between 10:00 p.m and 7:00 a.m.
2. L_{Aeq} + adjustments, rounded up.
3. cf. Table 4.26.
4. On day time: T = 12:00 p.m ; in the evening and at night : T = 1:00 a.m.
5. Without object : work is performed between 7:00 a.m and 7:00 p.m.

Table 7.8 Rev01 Intensity of anticipated sound impact of plant construction

Point	Area	Assessment Level day/night $L_{\text{Ar dn}}$ (dBA) (1)			Impact intensity
		Initial noise (2)	Particular noise (3)	Anticipated ambient noise (4)	
No 1 4893, St-Martin, La Baie Road	Agricultural (3) 2218	57	19	57	Weak
No 2 4583, St-Martin, La Baie Road	Industrial (4) 71774	43 and 45	38	44 and 46	Weak
No 3 4413, Anse-à-Benjamin, La Baie Road	Agricultural (3) 2236	60	34	60	Weak

Notes :

(1) $L_{\text{Aeq T}}$ + adjustments, rounded up.
(2) cf. Table 4.34, L_{dn}.
(3) Particular noise is calculated from assessment levels of Table 7.7 and the number of equipment defined in Table 3.1.
(4) The anticipated ambient noise represents the logsum of the initial noise and the particular noise.

Table 7.10 Rev01 Projected sound levels of plant operations

Point	Area	Period [1]	MDDELCC Limit [2] $L_{Ar\ 1h}$ (dBA)	Assessment levels [3] $L_{Ar\ 1h}$ (dBA)
No 1 4893, St-Martin, La Baie Road	Agricultural [3] 2218	Day	45	15
		Night	40	
No 2 4583, St-Martin, La Baie Road	Industrial [4] 71774	Day	55	36
		Night	50	
No 3 4413, Anse-à-Benjamin, La Baie Road	Agricultural [3] 2236	Day	50	34
		Night	40	
Project’s Propriety limit	Industrial 71770	Day and Night	70	Lower than 70

Notes

1. On day time: from 7:00 a.m to 7:00 p.m; at night: from 7:00 p.m to 7:00 a.m [MDDEP 2006].
2. L_{Ar} : sound level assessment, including adjustments for impact noise, tonal and special situations noises, according to Memorendum of Instructionnoise 98-01 (MDDEP 2006).
3. On an existing agricultural inhabited field.
4. On an existing industrial inhabited field.

Table 7.11 Rev01 Intensity of anticipated sound impact of the plant operations

Point	Address	Assessment levels day/night $L_{Ar\ dn}$ (dBA) [1]			Impact intensity
		Initial noise [2]	Particular noise [3]	Anticipated ambient noise [4]	
No 1	4893, St-Martin, La Baie road	57	21	57	Weak
No 2	4583, St-Martin, La Baie Road	43 and 45	42	46 and 47	Weak
No 3	4413, Anse-à-Benjamin, La Baie Road	60	40	60	Weak

Notes

1 $L_{Aeq\ T}$+ adjustments, rounded up.
2 cf. Table 4.24, L_{dn}.
3 Particular noise is calculated from assessment levels of Table 7.7.
4 The anticipated ambient noise represents the logsum of the initial noise and the particular noise.

QC-102

The anticipated effect of operational noise in inhabited areas was evaluated according to Schultz approach. These results, shown in Table 7.11 of the Impact Assessment, describe the impact as low in the three points of assessment.

If any error occurred in estimating the level of assessment at point # 2, the Proponent needs to reassess the impact at this point.

Answer QC-102

See Table 7.11 updated in the previous answer (QC-101). The importance of the environmental effect of noise from the plant remains **low**.

QC-103

The evaluation of the estimated noise level does not include a penalty. This hypothesis will have to be validated during the monitoring program.

This proposal is considered adequate, but requires more details. Thus, the Proponent needs to submit the possible mitigation means, should the level of assessment be higher than 40 dBA at a vulnerable point.

Answer QC-103

Should the level of assessment be higher than the noise limit during the monitoring once the operation of the plant has begun, an analysis will be performed to determine the cause and specific mitigation measures will be identified to correct the situation (as indicated in section 9.3.2 of impact study). Possible mitigation measures may include sound insulation, a confinement, and addition of silencers or administrative action depending on the cause.

QC-104

The Proponent needs to state whether the modeling of noise level also includes iron ore transportation by truck from dock to plant. If this is not the case, the Proponent needs to add this element to the modeling.

Answer QC-104

The projected sound level of transportation is covered in Section 7.6.2.2 of the report. See updated paragraph in answer QC-100.

In addition, this evaluation is very conservative because it assumes that the transportation of pellets and pig iron between the plant and the dock will be carried out by truck rather than by conveyor. By the same token, standard trucks weighing between 25 to 30 tons were used to estimate the number of additional trucks. Following an audit of a service provider, it is likely that trucking between the plant and the dock can be performed by multi-axle trucks carrying 100 tons of material on the current paved road. Trucking would be reduced by three times.

QC-105

Modeling of noise level and air emissions must include the scenario of multi-user conveyor which could be used for iron ore transportation from dock to plant. The Proponent needs to assess the impact of the use of a multi-user conveyor rather than trucks to supply the plant with raw material. It must especially indicate whether the supply duration and periods (day/night) would be similar.

Answer QC-105

The proposed conveyor is of the tubular type “pipe conveyor” or called cylindrical conveyor belt. The cylindrical conveyor belt seems more appropriate to negotiate the significant difference in height between the plant and the dock. This type of conveyor has the advantage of completely wrapping the product transported from the feed point to the loading point and excludes any transfer point. The motors are electric. The conveyor’s noise is negligible.

Duration and times of loading and unloading remain the same. However, the duration of trucking will be longer than the duration of the transportation by conveyor. Both can occur on day time or at night.

QC-106

A Modeling for projected sound levels for the operation of the plant was produced. Whereas the various activities at Grande-Anse Port are audible, with little attenuation over long distances (several kilometers) because of the presence of the Saguenay River and the surrounding mountains, the Proponent needs to specify whether this aspect was considered in the noise analysis. As the plant will be located overlooking the Saguenay River, the Proponent needs to demonstrate the measures taken to prevent the exploitation of the pig iron plant has noise impacts over long distances along the Saguenay River, including the north shore.

Answer QC-106

The site chosen for the plant’s setting up is more than 1.3 km from the Saguenay River and there is a hill between the site and the river. The noise of the plant will be mitigated by distance and by the hill before reaching the river. According to modeling that takes into account the topography (Appendix H, Map H-1) the noise of the plant will be negligible on the edge of the river, and will be even more neglibgible beyond it.

CONSULTATION

QC-107

On page 10-3, the Proponent states that they intend to join the existing neighborliness committee. It should specify to what committee it refers.

Answer QC-107

The Integrated Committee of Good Neighborhood is described in Annex J2-1 of the report describing the stakeholders in the region.

AIR EMISSIONS

QC-108 Target Market

It is mentioned in section 2.5.4 that the raw material, 700,000 tons of iron pellets, “can easily come from local export industries, or Arcelor Mittal or Rio Tinto pellet plants, respectively located in Port-Cartier and Sept-Îles. “

The Proponent needs to make a clarification since currently Rio Tinto does not produce iron pellets in Sept-Îles.

Answer QC-108

Rio Tinto, formerly Iron Ore Company (IOC), produced pellets at its plant in Sept-Îles when the project began to be evaluated by NAIC. The preferred supplier is Arcelor Mittal’s pellet plant at Port-Cartier.

QC-109 Control of CO2 emissions

In the second paragraph of section 2.9.7, it is written: “The option chosen by NAIC is to oxidize the exhaust gas to convert the H_2S into SO_2“.

The Proponent needs to indicate whether this option is the first option mentioned in the first paragraph of this section, which is “incineration of waste gas containing CO_2”.

Answer QC-109

Yes, it is correct. The incineration of the waste gas containing CO_2 corresponds to the selected option which consists in oxidizing the waste gas to convert the H_2S into SO_2.

QC-110 Production Capacity

In Section 3.2, the MDDELCC understands that all the environmental impacts, including those on the quality of the atmosphere (atmospheric dispersion study) was rated for a maximum annual production capacity of 518,600 tons of nodular pig iron, that is 59.2 t/h of pig iron.

The Proponent needs to confirm that understanding.

Answer QC-110

Your understanding is correct.

QC-111 Process Description

In Section 3.3, it would have been appropriate that the introductory text of the process description underlines that there is:

- Reuse of the process gas formed during the reduction of the iron pellets after treatment in a CO2 removal unit;
- Reintroduction of sludge from water treatment and dust from dust collectors in the process after their agglomeration in the form of briquettes.

The text of the second paragraph suggests that in addition to iron pellets and natural gas, other raw materials used are limited to quicklime, dolomitic lime and bentonite. However, when reading Chapter 3, it is found that cement, a solution of silicates, bauxite and oxygen are also raw materials of the nodular pig iron manufacturing process. In addition, the methyldiethanolamine (MDEA) is used at the CO2 removal unit.

The Proponent must review the text of the second paragraph of Section 3.3 in this regard.

Answer QC-111

The suggestion about the introductory text is noted. The first two paragraphs are listed below. It should be noted that the list of raw materials is shown in Table 3.1 and the failure to name them in the introductory text does not indicate that they are not used. The text has been adjusted to indicate the “main” raw materials:

«The production of nodular iron grade is the reduction of iron oxides in the raw material (iron ore pellets) into metallic iron, removal of impurities (gangue) by adding a flux when melting of liquid metal and its casting into shapes called ‘pigs’.

When heated, natural gas provides the reducing elements such as carbon monoxide and hydrogen. Main materials used in the manufacturing process are quicklime, dolomitic lime and bauxite used as a flux as well as bentonite and silicate solution, used for the agglomeration of the briquettes. Natural gas will also be used as a fuel source.

It should be noted that the process gas formed during the reduction of iron ore pellets is cleaned and reused:

- *As fuel at the preheat furnace;*
- *As reducing element after treatment in the CO2 removal unit; and*
- *The dust from dust collectors as well as sludge from water treatment unit will be reintroduced into the process after agglomeration in the form of briquettes to maximize the iron recovery rate*».

QC-112

Figure 3.2 (Simplified process diagram of the pig iron plant) identifies that atmospheric emissions of agglomeration unit could be directed to the dust collector of the electric arc furnace (EAF).

Yet, section D1.6 identifies the emission point A8 as the agglomeration unit chimney which receives the atmospheric emissions of the dust collector of the feeding silo (fine screening, sludge from water treatment and dust bag filters unit), the dust collector of the briquettes mixer/compactor, dust collector of briquettes storage silos, the sludge dryer of the water treatment unit and the briquettes dryer.

The Proponent needs to specify where air emissions from various activities carried out in the agglomeration unit will be evacuated.

Answer QC-112

Figure 3.2 has been corrected (Figure 3.2 Rev01), it is presented at the end of this section. Treated emissions from the agglomeration unit will be emitted into the atmosphere through a single chimney and will not be directed to the dust collector of the electric arc furnace (A4 emission point), all as described in Section D1.6 of Annex D1. This is the A8 emission point.

QC-113

The Proponent needs to specify where the combustion gases (natural gas) used in sludge dryer are directed.

Answer QC-113

The combustion gases from the sludge dryer are directed to the chimney of the agglomeration building (A8 emission point).

QC-114

The Proponent needs to specify how or by what security system they plan to ensure, at all times, the proper functioning of the dust collector placed after the agglomeration unit.

Answer QC-114

All collectors will be subject to regular inspections and a preventive and predictive maintenance program, see answer QC-7. The dust collector will also be equipped with a continuous particle detector, to enable early detection of anomalies and quickly take appropriate corrective measures.

As regards the dust collector from the melting and casting building, the most important of the plant in terms of size and volume of gas to be treated, we have first to say that it was located away from the melting and casting building to allow the gas to cool down between the arc furnace and the dust collector. At the exit of the arc furnace, the gas temperature is 800 ° C and must be lower than 40 ° C before entering the filter sections. Arc furnace gases will be cooled by other effluents treated there and bearing less thermal load.

In addition, gases from the electric arc furnace will be cooled with water by indirect contact, before being sent to the dust collector. The dust has sixteen sections for changing bags without compromising the overall efficiency of dust. Two protection systems will prevent direct discharge of dust in the atmosphere. A temperature sensor at the entrance of dust collector will activate an emergency valve that will effectively draw fresh air to preserve the integrity of the dust collector. The fresh air will cause upstream pressure to drop and reduce the suction capacity to the dust collector. This is a last-resort control equipment and it is not intended to be used during normal operation. In cases of extreme emergency; e.g. in case the valve cannot be activated, the electric arc furnace is stopped.

A second emergency valve is located just downstream of the gas cooler. Just as the other valve, it will be activated if the setpoint temperature (around 580°C) is reached in order to preserve the part of the pipe downstream. The actuation of this valve is even more unlikely than that of the valve just upstream of the dust collector. The dust collector being considered as acritical equipment, controls are in place for it to be operational at all times.

Also, all fans main precipitators will be redundant, a second fan will be on standby and may be activated in the event of failure of the first.

QC-115

It is found in Figure 3.2 that nitrogen from the buffer silos of direct reduced iron (DRI) is directed to the EAF dust collector. The Proponent needs to explain where this nitrogen comes from. Since a dust collector does not purify such substances (for example, NOX), they should be considered for the assessment of project impacts on the quality of the atmosphere.

Answer QC-115

As for the question about the source of nitrogen, the fourth paragraph on page 8 of Chapter 3 is enhanced as follows:

«A rotary valve located at the bottom of the reactor regulates the continuous gravity flow of the downward load in the reactor. The DRI is distributed in two buffer silos pressurized by automated mechanisms. From these silos, reduced and hot pellets, while containing 94% of metallic iron, are transferred to the feed hopper of the electric arc furnace.

The DRI is distributed in two alternating buffer silos. Both silos are pressurized with nitrogen to prevent oxidation of the DRI. When the silo is filled with DRI, the nitrogen contained in the silo is pushed towards the vent. As shown in Figure 3.2 Rev01, this vent is connected to the dust collector of the melting and casting building since the nitrogen exiting from the buffer silo can result in particles».

In addition, the first sentence of the fourth paragraph of Section 3.3.2 should be read as follows:

«*The iron pellets and briquettes (a ratio of approximately 95/5) are fed to the top of the reactor via hoppers, and flow by gravity through the hot reducing gas and ascending the bed of the countercurrent reactor. The pellets and briquettes are distributed in both hoppers alternately. A first hopper is first filled with material and then pressurized with nitrogen to the operating pressure of the reactor. Once the hopper pressurized, the rotary valve at the bottom of the hopper is opened and the material flows by gravity into the reactor. The valve is closed and the hopper is pressurized to the vent that carries the gas to the electric arc furnace collecting system because there may be dust entrainment. While one of the hoppers is being filled, the second discharges its contents to the reactor, ensuring a continuous mode of operation*».

The flow of these vents has been taken into account when assessing the total flow fed to the dust collector A4. A new figure (Figure 3.9) showing the arrangement of the dust collector and the various emission sources connected to it is presented at the end of this section.

QC-116

In Figure 3.2, the MDEA should be identified as an input to the CO_2 removal unit and natural gas as fuel for the thermal oxidation unit.

Answer QC-116

Figure 3.2 was reviewed (Figure 3.2 Rev01) to identify natural gas as fuel in thermal oxidation unit. A reference has been added to Figure 3.3 in the “CO_2 removal unit” box.

QC-117 Receipt and handling of iron pellets

In the second paragraph of Section 3.3.1, it is stated that for the purpose of handling dock iron pellets to the operation of the plant site, there are two options: either the construction of a multi-user conveyor or transport by truck. It is also stated that all material handling operations between the plant and the ship will be the responsibility of SPA.

Whereas the construction of the plant is, according to the timetable presented to the Section 3.13.1 scheduled in 2017, the Proponent needs to provide more precision in terms of the option chosen, including whether such a conveyor may be running according to the start of the operation of the plant.

Answer QC-117

Two options are presented to transport pellets and are currently considered by NAIC and SPA. Since the conveyor project was not at a stage of advancement to suggest it will be ready at the same time that the operation of the NAIC plant, an alternative has been proposed: trucking material between the plant and the dock. The preferred option by NAIC, if available, remains the conveyor.

The proposed conveyor is of tubular type (“pipe conveyor” or cylindrical conveyor belt). The cylindrical conveyor belt seems most appropriate to negotiate the significant difference in height between the plant and the dock. This type of conveyor has the advantage of completely wrapping the product transported from the feed point to the loading point and excludes transfer point.

QC-118

The Proponent needs to specify whether the fully enclosed conveyors to be used in material handling will be equipped with dust collectors.

The Proponent needs to also present a simplified diagram of the activities that will be present in the agglomeration unit in the same way as that provided for the CO2 removal unit (see Figure 3.3). According to what is stated in Sections D1.6.1 and D1.6.2 of Annex D of the impact study, the agglomeration unit would comprise two dryers powered by natural gas. In addition, according to what is written in the first paragraph of section D1.6 of this Annex, the agglomeration unit would own a single chimney that will evacuate emissions from the two dryers and the present dust collectors in this unit.

Answer QC-118

All points of transfer of the conveyors are inside buildings and dust will be collected into a dust collector corresponding to emission points A5 (transfer building) and A6 (storage building).

Your understanding of the agglomeration unit activities is correct. The activities of the agglomeration unit are presented in a new figure (Figure 3.8) presented at the end of this section.

QC-119 CO_2 Removal

The Proponent needs to specify in Section 3.3.2.1 if CO_2 removal units exist currently in other steel plants.

At the incineration process (thermal oxidation) of H_2S, the reactions formulas, the operating temperature and the H_2S destruction efficiency must be provided.

Answer QC-119

The CO_2 removal units are not typically used in steel plants. This process is however well known and proven. It is used in factories to liquefy natural gas and some refineries. In the production of direct reduced iron, to date, only the Tenova HYL process incorporates this technology.

The operating temperature of the thermal oxidizer unit is 900 to 930 ° C with a residence time ensuring a destruction efficiency of 99% H2S. The involved reaction formula is the following one:

$H_2S + (3/2)\ O_2 \rightarrow SO_2 + H_2O$

QC-120 Flare

It is mentioned in the Section 3.3.2.5 that “in normal operation, only vents gases of getter washing waters and direct contact cooling upstream of the tower basin and upstream from the primary clarifier are sent to the flare”.

It is also indicated in this section that the flare has a destruction efficiency of methane and other organic compounds of at least 98%.

The Proponent needs to specify which other organic compounds is referred to. It should also indicate whether these compounds correspond to the compounds of the gas normally routed to the flare.

The Proponent needs to also explain in the light of the impacts of nitrogen in the gas fed to the flare during start and stop of the reduction process. Indeed, it is registered in the Section 3.3.2.5 that the flare will burn safely process gases during periods of starts and stops of the reduction unit. According to Sections 3.3.3 and 3.3.4, there will be nitrogen use in its operations to purge the equipment.

Answer QC-120

The design criterion for the efficiency of destroying compounds sent to the flare is 98% and is based on the contaminants likely to be found. This criterion is standard enough for flares and is based on the American standard AP42 “Properly operated flares achieve at least 98 percent combustion efficiency in the flare pen”.

As indicated in sections 3.3.2.3 and 3.3.2.4, describing the start-up and shut-down activities of the reduction unit, the process gas is routed to the flare for a period of about 2 hours. During this period, the composition of the process gas will vary. During a startup, the reactor is first filled with nitrogen. When the process gas is diverted to the flare, then they are richer in nitrogen and contain less gas reduction. Then, the nitrogen concentration decreases as the reduction reactions reach equilibrium. During this two-hour period, the composition of gases from the reduction is enriched to achieve the desired target. Natural gas is added as support to the flare gas to fill the gap heat (less hydrogen-rich gas and CH_4). The addition is done in a controlled manner according to the calorific value of the process gas generated so as to maintain a constant calorific value of gas flared off, and will stop when the process gas reaches the desired target. The same phenomenon occurs when stopping while at the beginning of the period of flaring reduction, gases are “rich” and their concentration and calorific value decrease as nitrogen is added to the circuit. In this case, the amount of natural gas will gradually increase to maintain the calorific value of the gas to burn and stop when there is no process gas to lead to the flare.

The presence of nitrogen in the gas sent to the flare has the impact of reducing the heat capacity of the gas to be burned that will be offset by the addition of natural gas. So there is no impact in terms of air emissions.

The composition of the process gas and that of the vent gas sent to the flare is confidential and provided under separate cover. It should be noted that the composition of the process gas sent to the flare is based on the richest concentration.

A correction should be made to sections 3.3.2.3 and 3.3.2.4. Both paragraphs are listed below.

3.3.2.3 Starting the reduction process:

“... From the tenth hour of start time, before the addition of natural gas as a reducing element, the preheated gas are diverted to a knock-out drum and directed to the flare. The temperature at the outlet of preheating furnace increases gradually to 850 ° C at the eleventh hour of starting”.

3.3.2.4 Stopping the reduction process:

“... From the sixth hour, the feeding of the reactor with reducing gas is replaced by nitrogen and the reducing gas is diverted to a knock-out drum and then to the flare. The reactor is emptied. The amine solution is cooled...”

QC-121 Flare

In Section 3.3.2.5, whereas the use of a flare and a driver can have multiple impacts, the Proponent should present alternatives to the use of a flare, the impacts of each of these alternatives and compare them. In the event that the use of a flare would be the best alternative, the Proponent needs to indicate what their plan to ensure the quality and quantity of gases that are going to flare?

Answer QC-121

The flare is used to evacuate the process gases safely during starts and shutdowns of the reduction unit by completely burning them instead of sending them directly to the atmosphere. In consideration of the variability of flow rates and gas composition, the flare is the best solution to evacuate safely and less damaging to the environment. In the case of NAIC, a flare to reduce the discharge of about 1,350 t CO_2eq/y compared to a vent that would send unburned gases, containing methane, directly into the atmosphere.

QC-122 Steam production

The heat capacity of the auxiliary boiler specified in Section 3.4.1 is 3.7 MW, while in Table D1.6 Schedule D, it is indicated 4.45 MW PCS as power supply to maximum load for this boiler.

The Proponent needs to specify the nominal heat capacity (MW) of the boiler.

It would have been appropriate that it be specified in Section 3.4.1 that the auxiliary boiler will use natural gas as fuel and air emissions will be released through a stack being connected thereto.

Answer QC-122

The nominal heat capacity of the auxiliary boiler specified in Section 3.4.1 is 4.45 MW and not 3.41. Indeed, the auxiliary boiler will use natural gas as fuel and air emissions will be released through a stack being connected thereto (A2 emission point).

QC-123 Nitrogen production

He is registered in Section 3.4.3 that the nitrogen production plant with a capacity of 2200 Nm^3/h will be provided by a third party.

The Proponent needs to provide information on atmospheric emissions associated with this station. These must, if necessary, be taken into account for the assessment of project impacts on the quality of the atmosphere.

Answer QC-123

There is no air emissions associated with this process. Nitrogen is mainly produced by membrane separation of air. The compressors are powered by electricity. Fugitive emissions are simply air compounds (nitrogen and oxygen).

QC-124 Raw Materials and Products

The Proponent needs to provide in Table 3.1 information concerning:

- The nitrogen used for starting and stopping the reduction unit;
- The sulfuric acid used in the wastewater treatment acid-scrubber.

Answer QC-124

Nitrogen and sulfuric acid were added to Table 3.1.

QC-125 Raw Materials

As mentioned in the QC-109, Rio Tinto does not currently produce iron pellets in Sept-Îles. The Proponent needs to make a correction to their statement of Section 3.5.1 to the effect that “The majority of procurement will be by ship from Quebec plants such as Arcelor Mittal in Cartier or Rio Tinto in Sept-Îles”.

Answer QC-125

See Answer QC-108.

QC-126 Industrial Wastewater Treatment

It is listed in Section 3.6.4 that ammonia from the effluent will be removed in an extraction tower by upward air flow and, subsequently, “a sulfuric acid scrubber will treat the air before emission to the atmosphere”.

The emission point from the scrubber A9 is identified in Table 3.5.

The Proponent needs to provide the formulas of the reactions for the conversion of ammonia and the treatment effectiveness of the latter.

In addition, since part of the clarified water treated by the first clarifier is returned to the reduction sector for washing and cooling of process gases and that this water contains ammonia, the Proponent needs to specify the impacts of this recirculation in emissions from the pre-heating furnace chimney and from the flare (see simplified process diagram in Figure 3.2).

Answer QC-126

The ammonia is formed inside the reactor and is in gaseous form. When the processes ammonia-containing gases are brought into contact with water, most of the ammonia is transferred to the water and trace amounts remain in the gaseous fraction. There is no transfer of ammonia from water to process gases.

In addition, traces of ammonia are converted mainly (99.5%) into nitrogen and water vapor. About 0.5% of NH_3 turns into nitrogen oxides either when the process gas is used as fuel in the preheating furnace or in the thermal oxidizer. Ammonia is included in the elemental form (hydrogen and nitrogen) in the concentrations provided in Table D1.2.

Performance as guaranteed by the equipment supplier is 5 mg/Nm^3 in the flue gas of the A9 stack.

The reaction formula is as follows:

$2\ NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$

In contact with sulfuric acid, ammonia is converted into ammonium sulphate.

QC-127 Atmospheric Emissions

Reading Section 3.8, it seems that there is confusion about the concepts of emission source, emission point and atmospheric emissions.

An emission source is an activity (e.g., unloading equipment), a piece of equipment (e.g. boiler or furnace) or a process (e.g. drying, reduction) generating emissions.

Stacks, roof vents and roof or wall fans correspond to emission points, while flue gases correspond to atmospheric emissions.

Section 3.8, which deals with atmospheric emissions generated by the project, does not identify the points of discharge of emissions from different sources. In fact, emissions from different sources are routed to a single data source (for example, emissions from the H_2S thermal oxidation unit are routed to the stack in the preheating furnace; emissions from the sludge dryer and the briquettes dryer of the agglomeration unit are sent to the same emission point, i.e. the stack of the agglomeration unit). Information included in the previous sections of Chapter 3 must be added to information in Appendix D in order to have a more complete picture of the air emission pattern of the entire project.

For Section 3.8, the Proponent needs, therefore, to present a table identifying for each of the emission points (e.g. dust collector of the electric arc furnace, preheating furnace stack), the emissions conveyed, along with the identification of contaminants present there, the source of these emissions, as well as treatment or purification systems (e.g. scrubbers) used at the emission points.

This Table is essential to the evaluation of contaminants to be considered in each of the emission points for the atmospheric dispersion study.

Answer QC-127

The points of emissions to the atmosphere are those listed in Table 3.5 and correspond to those used for the atmospheric dispersion study as shown in Table D2.5, Appendix D2. Table 3.5 has been revised to add emissions from sources routed to each point of emission. The calculations of annual emissions are those corresponding to a 10 mg/Nm^3 emission rate for all dust collectors.

Appendix D1 describes each of the emission sources associated with each emission point identified with the letter A followed by a number.

For the sake of clarity, Section 3.8 has been corrected as follows:

3.8 Atmospheric Emissions

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

- The process gas preheater using as fuel a mixture of natural gas and process gas from the reduction furnace. The flue gases are discharged through Stack A1;
- The CO2 removal unit where acid gases contained in the process gases (CO2 and H2S) are fed into a thermal oxidation unit to convert the H2S into SO2. The flue gases, from the combustion process, are evacuated through the A1 stack;
- The auxiliary boiler fueled by natural gas, whose flue gases are discharged through Stack A2;
- The flare: In order to quickly burn gases channeled to the flare, a pilot flame is always on. The pilot requires the combustion of natural gas (A3 emission point). In addition to the pilot, the vents of the washing and cooling water degassers are also continuously burnt at the flare;
- Ammonia emissions from the acid scrubber of the wastewater treatment unit (A9 emission point). The ammonia comes from the process gases which are washed with water. The water is treated via an extraction tower where the ammonia is transferred from the water to the gas stream which is further treated in a sulfuric acid scrubber.

Permanent emission sources of the melting and casting sector include the following:

- The gasses generated by the melting of DRI in the electric arc furnace, the EAF opening, and the melting process are collected by the building's ventilation system and directed to the main dust collector and then evacuated through Stack A4;

The preheating of the casting ladles generates flue gases discharged from Stack A4.

Dust sources related to the transfer and handling of materials (pellets, fines, briquettes and DRI) include the following:

- The unloading of the pellets in the transfer building whose vent is connected to a dust collector (Stack A5);
- The loading of pellets in the storage building whose vent is connected to a dust collector (Stack A6);
- The pellets screening and coating operations inside a building whose vent is connected to a dust collector (Stack A7);
- Uploading operations for the hoppers of dried sludge, fines, dust and bentonite inside the briquetting building whose vents are connected to a dust collector (Stack A8);
- The mixing and compaction of the materials forming the briquettes generates dust that is collected in a dust collector (Stack A8);

- The briquettes transfer in the storage silos generates dust that is collected in a dust collector (Stack A8);
- Fluxes silos loading operations (quicklime, calcined dolomite and bauxite) whose vents are connected to the dust collector of the EAF and therefore discharged through Stack A4;

The loading and unloading operations of the coated pellet daily silo, the reactor feeding bins and the two DRI suge bins (upstream of the EAF) generate dust. The bins vents are directed towards the gas collection system for the main dust collector of the smelting and casting sector and therefore discharged via Stack A4.

In addition to handling and transfer of materials activities, the briquetting unit has two dryers:

The two dryers (indirect combustion unit) for the wastewater treatment sludges and the briquettes, both located in the briqetting unit, will generate flue gases. These flue gases are discharged through Stack A8.

Intermittent sources used in emergencies or during shutdown and start-up include the following:

- The cooling of the off-specification DRI conveyor generates dust that is sent to the dust collector of the gas collection system in the smelting and casting areas (stack A4);
- During shutdown and start-up in the reduction area, process gases which cannot be used as fuels will be burned at the flare (Emission Point A3);

The emergency generator’s diesel engine will generate combustion products; the exhaust gas will be evacuated through Stack A10.

Finally, trucking activities within the plant correspond to intermittent emissions sources whose total emissions are grouped under the A11 Emission Point (note: for the atmospheric dispersion modeling, see Appendix D2, materials transportation corridors were considered). Materials whose transportation generates dust and combustion emissions include the following:

- Slag from the smelting area and the storage area;
- Sludge from the wastewater treatment unit and the briquetting unit;
- Fines between the fines silo and the briquetting unit;

Dusts between the EAF dust collector and the briquetting unit.

The combustion emissions generated by the pig iron and pellets transportation from plant to port as well as the fugitive emissions associated to pellet handling and storage at the port have been considered in terms of cumulative impacts.

Table 3.5 rev01 presents the estimated annual atmospheric emissions from stationary and mobile sources for the maximum capacity of the pig iron plant, i.e. 8760 operating hours. All emission rates are based on a production rate equivalent to 110% of the plant’s hourly nominal capacity (518 000 tons of pig iron/year). When emissions are variable, estimates of annual emissions are based on average emissions.

A more detailed description of each of the emission sources including assumptions of emission calculations is presented in Appendix D1 which was revised following the various comments and reproduced in Appendix D.

3.8.1 Emission Standards

Table 3.6 rev01 shows a comparison of the plant's design criteria and the air emission standards set by the Quebec Clean Air Regulation (CAR) and by the Canada Multi-Sector Air Pollutants Regulations (SOR/2016-151) (MRAP). As presented in this Table, atmospheric emissions related to the NAIC project in Saguenay meet the applicable standards.

According to Article 148 of Chapter IX, Section IV relating to steel factories, a pig iron or steel production process must not emit particles into the atmosphere beyond the limit values specified in Appendix C of CAR. The limit value for particulate emissions set out in Appendix C is defined according to the process feed rate, which is determined by the total weight of the materials fed into an industrial process through a complete cycle of operation, excluding liquid and gaseous fuels and air. The definition of process boundaries is important to define the applicable standard. The operations related to electric arc furnace loading, smelting and casting are included. The calculation of the emission standard of the total particles will then be compared to the emission rate of Stack A4 at the EAF dust collector.

Coating and the briquetting operations are subject to Article 9 of the CAR, limiting particulate emissions based on the process feed rate. Dryers are included in the agglomeration unit. Drying occurs through indirect contact and only combustion emissions will be generated and will be evacuated via the single stack building (A8).

Transfer, fall and handling activities are covered by Article 10 and must not generate emissions of particles higher than 30 mg/Rm^3 into the atmosphere. That limit will apply to emission sources A5 and A6.

Emissions of nitrogen oxides from the auxiliary boiler are covered by Article 65 of Section III, Chapter VI of Title II of the CAR and by the Federal Multi-Sector Air Pollutants Regulations (MFRAP). The most stringent standard of the two regulations will be respected.

As for the preheating furnace, it is powered by a fuel mixture consisting of natural gas and process gas. The composition of the process gas is similar to that of refinery gas. Process gas is free from halogenated compounds and metals. According to the MDDELCC, preheating furnaces are covered by Section V, Chapter VI of the CAR. This section mainly concerns the use of solid fuels, such as coal, coke, biogas, pellets, waste oil, tires, rubber residues, asphalt shingles, etc (reference: CAR implementation guide, page 191). We rather believe that the preheating furnace should be covered by Section III, Chapter VI of the CAR whose emission standards for oxides of nitrogen are more stringent. The sampling results of the monitoring program for the first year of operation which will target all contaminants under Division V of Chapter VI of the CAR and the analysis of the process gas composition, will allow a better understanding of the CAR section applicable to the preheater furnace operations.

Nitrogen oxide emissions are also covered by the Multi-Sector Air Pollutants Regulations (MFRAP). The most stringent standard of the two regulations will be respected.

If two emission standards of a contaminant are applicable to the same emission source, the most restrictive will always be respected.

Table 3.5 Rev01 Estimation of the yearly atmospheric emissions of the pig iron plant

	A1		A2	A3 Flare			A4 Electric Arc Furnace		A5	A6	A7	A8 Briquetting Plant Stack			A	A10		A11	TOTAL
Contaminants	Process Gas Preheater	Thermal Oxidizer Unit	Auxiliary Boier	Water Vents	Emissions from Events	Flares' Pilots	Melting and Cadting Buildings (FAE)	Laddle preheater	Transfer Building Baghouse	Storage Building Baghouse	Screening and Coating Building Baghouse	Sludege Dryer	Briquettes dryer	Baghouses A.B. C	Ammonia Scrubber	Emergency Diesel Generator	Total fixed sources	Trucking within plant boundary limits	All sources
Conventional Contaminants conventionnels (t/y)																			
NOx	55.7	0.61	0.55	0.20	0.05	0.14	50.9	2.8	0	0	0	0.35	0.21	0	0	1.56	113.1	0.01	**113.1**
CO	78.8	0.94	1.08	0.92	0.22	0.17	8.3	6.2	0	0	0	0.78	0.45	0	0	0.12	98.0	0.002	**98.0**
SO_2	1.56	43.6	0.01	0.02	0.005	0.001	0	0.05	0	0	0	0.01	0.004	0	0	0.002	45.3	< 0.001	**45.3**
PMt = PM2.5	7.13	0.08	0.10	0.56	0.13	0.02	42.2	0.56	1.16	1.93	1.16	0.07	0.04	3.07	0	0.01	56.17	0.08	**59.2**
COT	10.3	0.12	0.14	1.70	0.40	0.02	5.3	0.81	0	0	0	0.10	0.06	0	0	0.03	19.0	0.08	**19.1**
COV	5.16	0.06	0.07	1.69	0.40	0.01	5.3	0.41	0	0	0	0.05	0.03	0	0	0.03	13.2	< 0.001	**13.2**
NH_3(t/y)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.45	0	1.4	< 0.001	**1**
Greenhouse gases (t/y)																			
CO_2	122,874	154,719	1,501	1,050	86	235	35,839	8,686	0	0	0	1 086	633	0	0	153	326 830	1.05	**326,831**
CH_4	2.42	0.03	0.03	5.16	0.42	0.005	0	0.17	0.00	0.00	0.00	0.02	0.12	0	0.00	0.01	8.39	0.00	**8.4**
N_2O	2.16	0.02	0.03	0.01	0.001	0.004	0	0.15	0.00	0.00	0.00	0.00	0.01	0	0.00	0.02	2.43	0.00	**2.4**
GHG CO_2eq	123,594	154,726	1 ,510	1,162	95	237	35,839	8,737	0	0	0	1 092	639	0	0	161	327 791	1.05	**327,792**
Metals (kg/y)																			
As	0	0	0	0	0	0	0.17	0	0.003	0.006	0.003	0	0	0.010	0	0	0.19	0	**0.19**
Co	0	0	0	0	0	0	1.12	0	0.023	0.039	0.023	0	0	0.064	0	0	1.26	0	**1.26**
Cr	0	0	0	0	0	0	9.01	0	0.23	0.39	0.23	0	0	0.61	0	0	10.5	0	**10.5**
Cu	0	0	0	0	0	0	0.56	0	0.012	0.019	0.012	0	0	0.032	0	0	0.63	0	**0.63**
Hg	0	0	0	0	0	0	0.30	0	0.006	0.010	0.006	0	0	0.016	0	0	0.34	0	**0.34**
Pb	0	0	0	0	0	0	1.12	0	0.023	0.039	0.023	0	0	0.064	0	0	1.27	0	**1.27**
Ni	0	0	0	0	0	0	0.86	0	0.017	0.029	0.017	0	0	0.048	0	0	0.97	0	**0.97**
P	0	0	0	0	0	0	4.29	0	0.12	0.19	0.12	0	0	0.30	0	0	5.0	0	**5.0**
SiO_2	0	0	0	0	0	0	1969	0	40.5	67.7	40.5	0	0	112.7	0	0	2230	0	**2,230**
V	0	0	0	0	0	0	4.29	0	0.12	0.19	0.12	0	0	0.30	0	0	5.0	0	**5.0**
Zn	0	0	0	0	0	0	4.29	0	0.12	0.19	0.12	0	0	0.30	0	0	5.0	0	**5.0**
Volatils Organic Compounds (kg/y)																			
Pentanes	2440	29	3.5	ND	ND	5.3	0	194	0	0	0	24	14	0	0	6.3	244	0.001	**244**
Hexane	1689	20	2.5	ND	ND	3.6	0	135	0	0	0	17	10	0	0	0.001	166	< 0.001	**166**
Benzene	2.0	0.02	0.003	ND	ND	0.004	0	0.16	0	0	0	0.02	0.01	0	0	9.9	10	< 0.001	**10**
Toluene	3.2	0.04	0.005	ND	ND	0.007	0	0.25	0	0	0	0.03	0.02	0	0	0.4	0.7	< 0.001	**0.7**
Formaldehyde	70	0.84	0.10	ND	ND	0.15	0	5.6	0	0	0	0.7	0.4	0	0	1.1	8	0.001	**8**
Dichlorobenzene	1.1	0.01	0.002	ND	ND	0.002	0	0.09	0	0	0	0.01	0.01	0	0	0	0.1	< 0.001	**0.1**

Note. the values being rounded. the results might be slightly different from the values presented at Appendixe D1.

Table 3.6 rev01 Emission Standards

Equipment	Regulated Activity	Regulated Contaminant	Facility Design Criterion	Raw Materials Considered	Emission Standard (1)	Emission Rate
Pig Iron production Process	Melting and casting of pig iron	Particulate matters	Baghouse guarantee, 9.2 mg/Rm^3 PM emissions estimated at 4.88 kg/h	DRI; 69.85 t/h Fluxes; 4.18 t/h	15.93 kg/h Article 148	4.88 kg/h (source A4)
Briquetting process for fines, dust and sludge	Drying and Briquetting	Particulate matters	Baghouse guarantee, 9.2 mg/Rm^3	Fines; 2.3 t/h Sludge; 0.28 t/h Dusts; 0.28 t/h Bentonite; 0.14 t/h Silicates; 0.20 t/h	9.64 kg/h Article 9	0.36 kg/h (source A8)
Coating process	Cement coating of pellets	Particulate matters	Baghouse guarantee, 9.2 mg/Rm^3	Pellets; 94.71 t/h Cement; 0.52 t/h	16.59 kg/h Article 9	0.13 kg/h (source A7)
Baghouses from the transfer and storage buildings	Handling of pellets and products	Particulate matters	Baghouse guarantee, 9.2 mg/Rm^3	NA	30 mg/Rm^3	9.2 mg/Rm^3
Preheating furnace	Combustion of natural gas and process gases	Particles	NA	NA	≤45 g of particles/GJ (Article 88 CAR)	3.2 g of particles/GJ
		NOx	≤25 g/GJ	Power at supply of 70.6 MW	≤125 g de NOx/GJ (article 89 CAR) or ≤26 g/GJ (article 65) ≤25 g/GJ (Article 7 du RMPA; Gap between the preheated air and ambient air > 155°C)	25 g de NOx/GJ
Package boiler	Natural gas combustion	NOx	≤18 g/GJ	Power at supply of 4.5 MW	≤26 g/GJ (article 65 of the CAR; nominal calorific capacity ≥3 and ≤30 MW) ≤18 g/GJ (article 6 du RMPA, yield > 90 %)	≤18 g/GJ

(1) Reference conditions or “R” refer a temperature of 25 °C and a pressure level of 101.3 kPa

QC-128 Atmospheric Emissions

Another essential piece information for determining atmospheric emissions is the composition of process gases (PG) supplied to different processes or equipment (e.g. PG used as fuel in the preheat furnace, PG powered through the process furnace, PG fueled at the CO_2 removal unit, PG routed to the flare at start-up and shutdown of the reduction process). The Proponent needs to provide these compositions. Attention should be paid to the presence of metals or halogens in these PGs.

To this end, it is indicated in the first item listed in the first paragraph of Section 3.8, “the process gas composed of [...] methane.” The Proponent needs to specify whether it is the PG supplied at the preheating furnace or that used as fuel for that furnace. The Proponent needs to also specify the other compounds of this PG.

It is also shown in section 8.4.1.9 that the PG found in the circuit between the reactor and the CO_2 removal unit can form a flammable gas cloud in the event of a leak, due to the presence of compounds such as carbon monoxide, methane, ethane, hydrogen and C3+.

At various points in Section 3.8, “flue gas”. The Proponent needs to specify this refers to gases emitted by the equipment (preheating furnace, casting ladle heater) or by the process (oxidation of hydrogen sulfide).

Answer QC-128

Section 3.8 was revised in Answer QC-127 to indicate from which equipment the flue gases were from. Appendix D1 describes in detail each of the sources and the compositions of the fuels used in the calculations. The characteristics of the gases emitted at the stack are provided in a table that is always presented at the beginning of the section. Then, information related to each source contributing to the emissions is provided. Appendix D1.1 has been revised, enhanced and presented in Appendix D to this addendum to provide various clarifications.

The composition of the process gas and the proportion of natural and process gases are confidential information submitted under separate cover. The information represents the core of the HYL-TENOVA process and required significant research and development, which provide NAIC with a competitive advantage over other processes.

Since there is no halogenated compound in the raw materials, there will be none in the process gases either, nor in the preheating furnace or the flare emissions. There will be no emissions of dioxins and furans.

Regarding metals, these are present in the raw material and iron pellets. Iron, present in the form of oxides, is contained in a matrix which also contains concentrations of various metals. At the exit of the reactor, reduction gases will generate dust. To reuse the process gas as fuel to the preheat furnace, it is necessary to clean it. A variety of equipment is placed downstream of the heat recovery unit to cool and purify the gas from the dust to be transferred into the wash water. For more details, see Answer QC-5. The process gas; which is either used as fuel, treated at the CO_2 removal unit or sent to the flare; is free of particles and metals.

The composition of the process gas supplied under separate cover indicates that traces of ammonia are present. We checked the composition of process gases (PG) used as fuel to PGH and the PG routed to the flare during start-up and shutdown of the reduction process. Traces of ammonia will be transformed mainly to nitrogen and water vapor by combustion. Considering that 0.5% of the ammonia is transformed into NOx combustion, these sources emit a total of 3 g/h of NO_2, which is an insignificant amount compared to the total emissions of the plant's NOx estimated at 15,9 kg/h.

QC-129 Table 3.5

In Table 3.5 of Section 3.8, no emissions of metals were considered. Since the gas reduction process comes into contact with iron pellets, it eventually contains metals as well as silica (SiO2), arsine and phosphine which can be emitted into the atmosphere. The Proponent must assess whether this is indeed the case.

If these contaminants are present, the Proponent needs to integrate the modeling for the three proposed scenarios (Scenario 1: Normal Operation; Scenario 2: Operating in a Transient Area with Auxiliary Boiler and Flare including trucking; and Scenario 3: Cumulative Impact of all Emission Sources Including Loading and Unloading Activities at the Dock).

Answer QC-129

The reactor's operating conditions do not allow the formation of metal or phosphine or arsine in gaseous emissions. These last two contaminants are instead associated with electric arc furnace emissions using scrap, which is not the case for NAIC. However, dust is generated with the process gas. This dust will consist primarily of iron and other components of the pellet. The function of the majority of equipment downstream of the heat recovery is to cool and clean the process gas (see answer to QC-5). The process gas used as fuel and as a reducing element in the preheat furnace and into the thermal oxidizer is free of solids and metals.

Metal emissions were estimated at all dust collectors in the plant, depending on the composition of pellets and DRI. The detailed emission calculations are presented in the reviewed version of Appendix D1. The results of the atmospheric dispersion modeling and comparison with the standards and criteria are presented in the reviewed version of Appendix D2. The two revised Appendices are presented in Appendix D of this addendum.

The simulations were repeated and the results are presented in Appendix D2.

The results show that the only parameter approaching ambient air standards or criteria is crystalline silica, which slightly exceeds the annual criterion outside the industrial area, considering the maximum dust emission of 30 mg/Rm^3 at dust collectors and the MDDELCC's default initial concentration. No sensitive receptor is present in the potential exceedance area, as shown in Figure D2.10. The plant's contributions to the maximum ambient concentrations for the rest of metals are all less than 1% of ambient air standards or criteria.

QC-130 Estimated Annual Atmospheric Emissions from the Cast Iron Plant

The Proponent should explain how the annual emissions estimates listed in Table 3.5 were calculated for the auxiliary boiler since while using the emission rates in Table D1.6 of Appendix

D and 8560 hours of operation for the minimum load and 200 hours of operation for the maximum load, estimates of annual emissions shown in Table 3.5 for the auxiliary boiler differ from the calculations.

Answer QC-130

Table D1.6 in Appendix D has been revised. The calculation presented initially considered that the boiler had stopped 200 hours per year, which is not the case. Emissions were recalculated by multiplying the emission rate at low and maximum load per 8560 hours and 200 hours respectively.

QC-131 Emission Standards

In Section 3.8.1, reference is made to the Canadian Multi-Sector Air Pollutants Regulations (MRAP). The MDDELCC delivers no opinion regarding the requirements related to this regulation, since it fall under federal responsibility.

The Proponent needs to consider questions QC-132 and QC-133 to determine the emission standards for various project components.

Answer QC-131

Comment noted.

QC-132 Article 148 of the Clean Air Regulations Applicable to the Pig Iron Production Process

Contrary to what is stated in Section 3.8.1, the Proponent needs to consider that the application of Article 148 of the Clean Air Regulations (CAR) is limited to emissions from the electric arc furnace including, under Article 130 of the CAR, its loading and casting.

The particulate matter emission limit value to be applied will be determined from Appendix C of the CAR based on the feeding rate of the electric arc furnace. The inputs to be considered in determining the feeding rate are reduced iron pellets (DRI) and fluxes.

Answer QC-132

Comment noted. Table 3.6 was reviewed and presented in Answer QC-127.

QC-133 Article 9 of the Clean Air Regulation (CAR)

The Proponent needs to consider that each of the following processes is subjected to Article 9 of the CARCAR:

- Coating process;
- Sludge dryer;
- Agglomeration process for sludge, dust from dust collectors and pellet screening fines;
- Briquette dryer;
- Reduction process in the reactor;
- CO2 removal process.

The particulates emission limit value to be respected for each of these processes will be determined from Appendix C to the CARCAR, depending on their feed rates.

Answer QC-133

Table 3.6 has been reviewed and the text of Section 3.8.1 presented in Answer QC-127 too has been reviewed.

Sludge dryers and briquettes are included in the briquetting unit and generate only combustion emissions which are released through the single building stack (A8).

As for the reduction process in the reactor, Article 9 it is not applicable. Dust carried into the gas from the reactor is removed by water washing in order to allow the reuse of the process gas as fuel. There is no emission point from the reactor.

Besides, the CO_2 removal unit cannot operate independently from the reduction unit which is not the source of dust emission. More detailed explanations are provided in Answer QC-5.

QC-134

A chain of pressurized systems will be set up, including for the treatment of process gas and for iron pellet reduction. In the event of one of the systems in the chain being missing, the Proponent needs to specify the measures to be taken to avoid any release of untreated process gas into the atmosphere. The Proponent also needs to specify measures taken to protect scrubber equipment other than that of the electric arc furnace.

Answer QC-134

The reduction unit is equipped with a flare to prevent direct release of inflammable gas or untreated gas into the atmosphere during start-up and shutdown periods or during transient conditions that may occur during operational problems. The pilots of the flare will be equipped with flame sensors observable from the control room to ensure the presence of the flame at any time.

All dust collectors will be subjected to regular inspection rounds and a preventive and predictive maintenance program (see Answer QC-7).

QC-135

The electric arc furnace will be connected to a dust collector. Should it generate gases that are too hot, cause high pressures or other unplanned events that may prevent the use of the dust collector for better protection of this equipment, the Proponent needs to specify the measures planned to avoid any release of emissions from the furnace into the atmosphere.

Answer QC-135

See Answer QC-114.

QC-136

The Proponent needs to provide the temperature of gases at the entrance of the electric arc furnace dust collector.

Answer QC-136

At the exit of the EAF, the gas temperature is 800°C. The gas temperature at the entrance of the dust collector will vary depending on the cycle. When the EAF opens for the metal's casting, which lasts 20 minutes, the temperature is 39°C. When the metal melts in the furnace, the gas temperature at the entrance of the dust collector is 82°C. The temperature at the exit of the dust collector was set at 71°C taking into account the duration of each cycle (see Answer QC-114 for more details on the cooling system).

QC-137

In the smelting building, the Proponent needs to indicate whether equipment such as skylights or roof fans could lead to diffuse emissions to the atmosphere during the different operations (slag and pig iron casting, doors opening, skimming, etc.).

Answer QC-137

There will be no skimming. Slag and pig casting operations occur under the fume hood and emissions will be captured and treated by the EAF dust collector.

The ventilation of the smelting and casting building will not be forced. There will certainly be skylights placed at various locations to allow air renewal according to applied codes and regulations. Diffuse emissions by skylights were not considered in the calculation of emissions as they are considered negligible as a whole, mainly because of the EAF canopy and pig caster hoods which collect the emissions at the source. In addition, these building openings will be sampled in accordance with Article 148 of the CAR and NAIC will install platforms to enable safe access.

QC-138

In terms of atmospheric emissions, the Proponent needs to indicate whether it will assess those from various skylights.

If not, the Proponent needs to commit to sampling diffuse emissions to be issued at the various skylights or air vents, according to MDDELCC recommendations.

Answer QC-138

See Answer QC-137.

QC-139

The Proponent needs to indicate whether measures such as maintaining negative pressure were analyzed and planned at the smelting building to avoid any diffuse emission to the atmosphere.

Answer QC-139

Maintaining negative pressure inside the building would lead to a very high flow rate considering the volume of the building. The fume hoods at the source of the EAF and casting machine will allow the treatment of emissions generated by activities taking place inside the building.

QC-140 Preheating Furnace

In the fifth paragraph of Section 3.8.1, it is stated that emissions of nitrogen oxides from the preheating furnace are covered by Article 65 of the CAR. Under Article 55 of the CAR, “fuel burning equipment” means any indirect heat transfer equipment that uses fuel for heating purposes, for an industrial process or for electricity production”

In Section D1.1.1, Appendix D, it is stated that the temperature of a mixture of natural gas and process gas is increased by direct heating in the preheating furnace before it is fed to the reactor for the reduction of iron oxides in the pellets.

Following a request for clarification by MDDELCC, the Proponent has confirmed, in an email sent on August 25, 2016, that the preheating furnace is an indirect heat transfer device and, therefore, a piece of fuel burning equipment within the meaning of the CAR.

According to Section 3.3.2, the process gas fed into the preheating furnace comes from the dust collector of the CO_2 removal unit to which are added natural gas and H_2S from the conversion of dimethyldisulfide (DMDS). As far as it is concerned, the process gas used as fuel for the preheating furnace comes from the second quenching tower for gases coming from the reduction reactor. The Proponent needs to provide the composition of the process gas which fuels the pre-heating furnace and the composition of the process gas used as fuel in this furnace (see QC-127 and QC-128). Using these compositions, the Proponent needs to adequately consider contaminants that may be present in atmospheric emissions in order to complete the atmospheric dispersion study.

It should be noted that the use of the fuel process gas ensures that the regulatory requirements of Section V, Chapter VI, Title II of the CAR apply to the preheating furnace. Since this furnace is a piece of fuel burning equipment in the sense of the CAR, it is subjected to articles 88 to 91 of the CAR are and to articles 95 to 99 of the same regulation. It is therefore necessary to know the composition of the process gas in particular with respect to the presence of metals indicated in Appendix G of the CAR and total halogens.

Answer QC-140

The information sent by e-mail on August 25, 2016 is confirmed. Section D1.1.1 of Appendix D should have read as follows “*the temperature of a mixture of natural and process gases is increased by indirect heating in the preheating furnace before it is fed into the reactor for the reduction of iron oxides contained in the the pellets*”.

The composition of the process gas used as fuel or as feed to the PGH is considered confidential by the proponent. It is submitted under separate cover. The composition of the gas supplied confirms that the assumptions used in the impact study are adequate. Only the ammonia emissions had to be verified, they are found as traces in the process gas (see Answer QC-128 for more details).

Concerning total halogens, they were not considered in emission calculations because no raw material contains halogens. As for metals, they are exempt from the process gas (see answers QC-5 and QC-128).

Regarding the PGH, it is powered by a fuel mixture consisting of natural gas and process gas. The composition of the process gas is similar to the gaseous fossil fuel (propane, butane, LPG and refinery gas). The process gas is free from halogenated compounds and metals. According to the MDDELCC, the preheating furnace is said to be covered by Section V of Chapter VI of the CAR. This section deals especially with the use of solid fuels such as coal, coke, granules, tires, rubber residues, asphalt shingles as well as biogas and waste oil (reference CAR application guide, on page 191). We believe that the preheating furnace should be covered by Section III of Chapter VI of the CAR whose emission standards for nitrogen oxides are more stringent. The sampling results of the monitoring program for the first year of operation, which will target all contaminants planned under Section V, Chapter VI of the CAR and the analysis of the composition of the process gas will help have a better understanding of the CAR section applicable to preheating furnace operations.

Once validation is obtained, NAIC is committed to complying with applicable monitoring requirements, or those made in Section III, Chapter VI of the CAR or those in Section V of Chapter VI of the CAR.

It should be noted that Articles 88 and 89 (Section V) are more permissive on emissions of particles and nitrogen oxides. The design criteria remain unchanged and thus ensure emissions right below the permitted values.

QC-141 Principles Applicable for an Emission Point to which Emissions from Various Sources are Routed

Emission points (e.g. preheating furnace stack, agglomeration building stack, stack connected to the dust collector of the electric arc furnace) evacuate emissions generated by various sources. The following principles apply to these emission points:

- The standard ensuring the highest environmental protection takes precedence;
- Where standards expressed in concentration (e.g., 30 mg/Rm3) and a standard expressed in intensity (e.g., kg/h) may apply to the same emission point, both must be subject to a conformity check when sampling of the emission point.

Answer QC-141

Comment noted.

QC-142 Air Quality

In Section 7.2.1 it is stated that emissions considered for the atmospheric dispersion study completed for the project correspond to those presented in Chapter 3 (Section 3.8) and in more detail in Appendix D.

The Proponent must review these emissions in order to take into account the responses to the questions raised in this particular technical expertise concerning the composition of the process gas and applicable CAR requirements. Thus, additional contaminants could be submitted for consideration as part of the atmospheric dispersion study.

Answer QC-142

Emission rates of various parameters have been reviewed after new information from the designer of the technology or after necessary corrections were made. Metal concentrations were considered at the dust collectors. Emissions of volatile organic compounds associated with the combustion of natural gas (e.g., pentane, hexane, formaldehyde, toluene, benzene and dichlorobenzene) were also considered. Details on calculations assumptions are presented in Appendix D1 revised.

Therefore, the modeling has been redone and the results are presented again in the revised Appendix D2.

QC-143 Human Health and Odors

Section 7.3.3 could be reviewed, if necessary, to take into account the answers to the questions raised in this technical expertise, especially concerning the composition of the process gas and applicable CAR requirements. Additional contaminants could be considered as part of the atmospheric dispersion study.

At the odors level, the Proponent needs to give explanations concerning DMDS which releases ammonia odor.

Answer QC-143

The information in Section 7.3.3 remains relevant. Metal emissions are not likely to generate odors. In addition, to answer QC-169, VOCs were detailed. The latter are present in fuel emissions but result in very low or even negligible concentrations in ambient air.

DMDS may release ammonia odors. However, it will be contained in a stainless steel tank whose loading frequency will be at most once a year. Besides, an error occurred in Table 3.1. Delivery frequency will be once a year, not once a month.

An accidental release of DMDS was considered in the context of the technological risk analysis; see Chapter 8 of the impact study.

In addition, ammonia emissions will not be a source of odors because the modeled maximum ambient ammonia concentrations over a period of 4 minutes (0.03 µg/m^3) are 0.01% of the MDDELCC's ambient air standard of 350 µg/m^3. This criterion is ten times lower than the odor threshold listed by the US National Research Council of 3.5 mg/m^3 (5 ppm).

QC-144 Atmospheric Emissions Monitoring Program

the preheating furnace in Section 9.2.1, the Proponent needs to review the elements of the program to monitor emissions in the preheating furnace in order to take into account the fact that the use of process gases as fuel means the requirements of Section V, Chapter VI, Title II of the CAR apply to the preheating furnace. Articles 95 to 99 of this regulation apply to the latter.

Answer QC-144

As mentioned in Answer QC-140, NAIC's opinion differs from that of the MDDELCC's with regard to the applicability of the CAR and consequently to elements of the environmental monitoring program. Following clarifications in this Addendum, this aspect deserves to be discussed further, especially in the context of the resquests for authorization certificates.

NAIC is obviously committed to complying with the monitoring requirements according to the CAR section that will be deemed applicable.

To confirm the absence of metals and halogenated compounds, NAIC will sample, in addition to the parameters to be measured continuously (oxygen, carbon monoxide and nitrogen oxides), emissions of total particles, $PM_{2.5}$, SO2, H_2S, metals indicated in Appendix G of the CAR and total halogens.

QC-145 Auxiliary Boiler

It is reported that the power supply varies from 0.8 to 4.0 MW depending on its operating mode.

The Proponent needs to specify what the nominal heat capacity (MW) of the auxiliary boiler is.

It should be noted that the heat capacity specified in Section 3.4.1 is 3.7 MW, while in Table D1.6, Appendix D, the nominal heat capacity indicated at maximum load is 4.45 MW PCS.

Answer QC-145

The boiler's nominal heat capacity is 4.45 MW as specified in QC-122.

QC-146 Sludge and Briquette Dryers

It is stated in Section 9.2.1 that the sludge and briquette dryers are pieces of fuel burning equipment.

The Proponent needs to provide the necessary information to confirm that these dryers are pieces of fuel burning equipment as stated in Article 55 of the CAR (indirect heat transfer device).

Answer QC-146

Both dryers are combustion devices; the flame is not in direct contact with the material to dry.

QC-147

According to the *Clean Air Regulations* (art. 74), for a combustion device of more than 15 MW, NOx must be also sampled at source every three years. This parameter was not been considered in Section 9.2.1 (page 3, section 9 of the main report) "Atmospheric emissions" and should be added.

Answer QC-147

The heat capacity of the boiler is 4.5 MW and thus superior to the 3 MW threshold specified in Article 74 of the CAR. The monitoring program will be adjusted for NOx and the sampling will be conducted every three years.

QC-148

To conduct atmospheric emissions characterization campaigns, physical facilities are required. Since sampling is recurrent, the Proponent needs to provide for the establishment of sampling ports for different emission sources and the facilities required in order to have access to these sampling ports. The Proponent needs to specify what is to be done in this regard.

Answer QC-148

As mentioned in the first paragraph of Section 9.2.1, sampling at the atmospheric emission points will meet the requirements of the specifications of Book 4 "Sampling of Atmospheric Emissions," for all emission points, except A3 (flare), A10 (emergency generator) and A11 (trucking). It is agreed that the sampling ports will be accessible and positioned in order to comply with the guide (e.g., two ports at 90°, port location, etc.). In addition, an access point will be created to sample the skylights of the melting and casting building.

QC-149 Burners of the Auxiliary Boiler, Sludge and Briquette Dryers, Preheating Furnace and Thermal Oxidation Unit

The Proponent needs to state whether the burners of the auxiliary boiler, sludge and briquette dryers, preheating furnace and thermal oxidation unit will be sources of the type of "low nitrogen oxide emission".

Answer QC-149

The burners of the auxiliary boiler, sludge and briquette dryers, preheating furnace and thermal oxidation unit will be "low NOx emissions" burner-type.

QC-150 Canadian Multi-sector Air Pollutants Regulations

At various places in Appendix D, reference is made to the Canadian Multi-sector Air Pollutants Regulations. As mentioned previously, the MDDELCC delivers no opinion regarding the requirements related to this settlement as a federal responsibility.

Answer QC-150

Comment noted.

QC-151 Appendix D

The Proponent needs to specify the meaning of the Sm^3/h unit indicated in Tables D1.3, D1.5, D1.6, D1.10, D1.13 and D1.14 for gas consumption.

The Proponent needs to also indicate the relevant conditions to the term “normalized” or “N”. In addition, it must consider that the reference conditions “R” refer to a temperature of 25 ^oC and a pressure level of 101.3 kPa, as specified in Article 3 of the CAR

For these Tables, a sample calculation for determining the SO_2 emission factor must be presented. According to Note (3) of these Tables, it would be based on an average sulphur content in natural gas of 5.7 mg/Nm^3.

Answer QC-151

The “Rm^3/h” reference conditions expressed are 25 Celsius, 0% humidity and a pressure level of 101.3 kPa.

The “Nm^3/h” standardized conditions specified are 0 Celsius and a pressure level of 101.3 kPa.

The “Sm^3/h” standard conditions expressed are 15 Celsius and a pressure level of 101.3 kPa.

Examples of calculations for the sulfur balance are presented in the review of Appendix D1 for each of the relevant sources.

QC-152 Appendix D

It is mentioned in the first paragraph of Section D1.1.1 that the temperature of the reduction gas is increased by direct heating in a preheating furnace. As indicated by the Proponent in an email sent on August 25, 2016, the preheating furnace is an indirect heat exchange device. The Proponent needs to make the appropriate correction.

It is indicated that Table D1.2 presents the typical chemical composition of the flue gas in the preheating furnace and gas characteristics at the stack, at a maximum load. Yet Table D1.2 is entitled “Composition of gas burned in the preheating furnace” and values in volume/volume are presented there. The Proponent needs to provide the necessary information to understand Table D1.2. Is the indication “Process Gas” referring to the process gas used as fuel in the preheating furnace? If that is the case, the reference (e.g., data from an existing furnace) of the composition of the process gas must be provided.

The Proponent needs to also provide details on how the composition of the process gas used as fuel was used to the estimate emission rates presented in Table D1.3. If other contaminants different from those indicated in this table are present in the process gas, the relevance of including them in the framework of the atmospheric dispersion study must be assessed by the Proponent.

Answer QC-152

It is indeed indirect heating (see Answer QC-140), Appendix D1 has been reviewed.

The composition of the process gas was provided by the project designer and derives from calculations and models developed from the data of similar facilities operated by the project designer. The process gas does refer to the process gas from the reduction reaction and reused as fuel in preheating furnace. Adjustments were made to the text of Appendix D1. The Table heading should instead read: *Composition of gases fed to the Gas Preheater*. The composition of the process gas used as heating fuel or feed at the preheating furnace is considered confidential by the Proponent and is sent under separate cover.

We confirm that there are no other contaminants to be considered for the atmospheric dispersion modeling.

For the hourly emissions of NOx, CO, PM, VOC and TOC, the successful emission factor (g/GJ) is multiplied by 254 GJ/h (heat input to the furnace).

SO_2 - sulfur balance considering that the process gas contains 12.8 ppmv of H_2S while natural gas contains 2 ppmv of H_2S and 4 ppmv CH_3SH. The ratios of natural gas and process gas are provided under separate cover.

For CO_2 – This is a carbon balance from the compositions of Table D1.2 and a mixture according to the process and natural gas ratios (proportions provided under separate cover).

For CH_4 and N_2O; use of the CO_2 emission rate multiplied by the ratio of the RDOCECA CH_4 emission factors (or N_2O) and CO_2 for natural gas.

QC-153 Appendix D

The Proponent needs to provide the necessary information to understand Table D1.4 in Section D1.1.2. It should specify if “Residual Gas” refers to the gas released from the CO_2 removal unit and sent to the H_2S thermal oxidation unit (incineration). If that is the case, the reference (for example, data from an existing CO_2 removal unit) for the composition of this gas must be provided. If other contaminants than those indicated in Table D1.5 are present in this gas, the relevance of including them in the framework of the atmospheric dispersion study must be assessed by the Proponent.

Only natural gas emission factors are used for the estimate of atmospheric emissions from the thermal oxidizer. The Proponent needs to prove that no gas compounds entering the thermal oxidizer will impact atmospheric the emissions generated by this unit. It should be noted that the thermal oxidation unit converts H_2S into SO_2.

The Proponent needs to explain why a 33.5 m high stack is shown in Table D1.5 while atmospheric emissions from the thermal oxidation unit are routed to the stack in the preheating furnace.

Answer QC-153

The tail gases from the CO_2 removal unit are those fed to the thermal oxidation unit. The composition was provided by the project designer and derives from calculations and models developed from data from similar facilities operated by the project designer. Adjustments were made to the text in Appendix D1. All references to diameters or gas velocities for emission sources that are not emission points to the atmosphere have also been removed from the Table.

The composition of the tail gases from the CO_2 removal unit and fed to the thermal oxidation unit was indicated in Table D1.4 of Appendix D1. The composition of natural gas was also indicated as well as the ratio of the two gases. The S composition of residual gas is taken into account in the SO_2 calculation, even for greenhouse gases (CO_2, CH_4, N_2O).

The natural gas emission factors were used to calculate the emissions of CO, PMt and TOC presented in Table D1.5. These factors are based on the energy (g contaminant/GJ) of the gas mixture. About 90% of this energy comes from natural gas, except for specific organic compounds (pentane, hexane, formaldehyde, benzene, toluene, dichlorobenzene) for which only the heat input of natural gas (0.76 MW) has been considered since the waste gas has no heat input.

The height of the stack should not have been included in this Table. This was corrected in the reviewed version in Appendix D1.

QC-154 Appendix D

The Proponent needs to explain, in Section D1.2, how the 200 hours per year for start-up and shutdown events were determined because:

- Based on what is stated in Section 3.3.2.3, the reduction process start-up lasts 24 hours and charging the auxiliary boiler is increased at the beginning of start-up;
- As shown in Section 3.3.2.4, the reduction process shutdown lasts about 22 hours;
- As shown in Section D1.3 in Appendix D, “a total of four events (start-up/shutdown) were considered by the project designers”.

If we consider four 24-h events and that the auxiliary boiler is at maximum load for the entire duration of these events, the number of hours during which the auxiliary boiler is used at its maximum load is 96 hours.

Answer QC-154

The above comments are accurate.

To calculate emissions from the auxiliary boiler, we considered four shutdown and four start-up events for a total of 200 hours. To be more exact, we should have taken 48 hours multiplied by 4 for a total of 196 hours. The approximate number of 200 hours is valid for the number of hours of operation of the auxiliary boiler at full load.

During shutdown and start-up, process gases are not continuously sent to the flare. For start-up events, process gases are sent to the flare for a period ranging from 1.5 to 2 hours and, from about the twelfth hour.

For shutdowns, process gases are routed to the flare for a period of about 2 hours, and from about the sixth hour.

So we considered four shutdown and start-up events, i.e. 16 hours of flaring.

QC-155 Appendix D

In Section D1.3, the Proponent needs to provide the composition of the gas burned in the flare, i.e.:

- Gas from the reduction process during its start-up and shutdown;
- Gases from the vent of the treatment of the washing water;
- Gas from the vent of the cooling water treatment unit.

An example of mass balance calculation to determine the emission factors for H_2S and SO_2 to needs to be presented. Based on what is stated in the last paragraph of Section D1.3, these rates were estimated using mass balance assuming a 100% conversion of H_2S into SO_2. In addition, Index 3 of the table shows that the emission factor is based on a 5.7 mg/Nm^3 average sulfur content in natural gas.

The sum of the natural gas supply rates specified in the second paragraph of Section D1.3 (136.3 Nm^3/h) does not match the gas consumption level shown in Table D1.7 (144 Nm^3/h). The Proponent needs to provide appropriate clarifications.

Answer QC-155

The composition of the flared gases is provided under separate cover as it is deemed confidential by NAIC. It should be noted that it was estimated that the composition of the gas from the reduction process during start-up and shutdown is equivalent to the composition of the process gas used as fuel, i.e. the richest mixture. For more details on this issue, refer to Answer QC-120.

The mass balance used to determine H_2S and SO_2 emission factors are presented in Appendix D1 for each of the relevant sources.

The value in Table D1.7 has been changed to 135 Nm^3/h and includes all continuously burned gas (natural pilot gas and gas vents).

The heating power value was also corrected.

QC-156 Appendix D

In the first paragraph of Section D1.4, it is indicated that the following substances escape from the stack of the dust collector in the melting and casting building:

- Flue gases from the electric arc furnace;
- Dust from the melting and casting building captured by the hoods;
- Combustion gas from the ladle preheaters.

Figure 3.2 shows that emissions from buffer silos are sent to the dust collector of the melting and casting building (EAF dust collector). The Proponent needs to explain why these emissions were not considered in the estimate of atmospheric emissions discharged at the stack of the melting and casting building.

Answer QC-156

Emissions from the buffer silos are composed of nitrogen and, potentially, DRI dust. Nitrogen is not a contaminant. It is not mixed with hot gases and remains in nitrogen form. The dust will be collected by the dust collector.

QC-157 Smelting and Casting Building

It would have been appropriate if the information provided in the first two paragraphs of Section D1.4.1 on the purification of emissions from the electric arc furnace was indicated in Section 3 (Project *Description*) and in Section 3.8 more specifically.

In the first paragraph of subsection D1.4.1, it is indicated that "fumes generated during the smelting are extracted through a fourth opening in the furnace roof (three are present for electrodes) via a flexible suction pipe cooled with water in a sedimentation chamber ("drop-out box").

The Proponent needs to specify whether atmospheric emissions from the three openings for the electrodes are captured and purified.

It is also indicated in this first paragraph that the "configuration of the sedimentation chamber makes it possible to remove gas from coarse particles and the addition of air to the hot gas (800ºC) completes the CO combustion. The assumption used to estimate emissions is that 98% of the carbon monoxide is oxidized into CO_2 before being directed to the dust collector".

The Proponent needs to provide the reference for this assumption and indicate whether it is based on data from a similar existing system or on the chemical reaction.

Answer QC-157

A simplified diagram showing the various sources of emissions collected at the dust collector is presented at the end of this section (Figure 3.9).

Atmospheric emissions from the three openings for electrodes are captured and treated.

A fresh air volume (more than twice the volume of gas generated by the arc furnace) is injected in the flexible duct to facilitate complete combustion of CO into CO_2. The temperature of the gases coming out of the EAF is about 800°C. CO and O_2 analyzers are present in the sedimentation chamber and, if necessary, air can be injected back into the sedimentation chamber. The rate of CO conversion into CO_2 is based on the oxidation reaction and as well on the experience of the designer and supplier of the HYL-TENOVA technology.

It is confirmed that two roof hoods suck the atmospheric emissions generated by the smelting and casting process, i.e. one located above the furnace, and one located above the casting sector.

The supplier's warranty is 10 mg/Nm^3 for particles. NAIC is committed to respecting the emission rate at the stack of the EAF baghouse.

QC-158 Smelting and Casting Building

Based on information provided in the second paragraph, two roof hoods suck the atmospheric emissions generated by the smelting and casting process, i.e. one located above the furnace and one located above the casting sector. The Proponent needs to confirm this understanding. It would be appropriate that a diagram of the emissions capture system in this area is presented by including the sedimentation chamber and the dust collector.

Answer QC-158

Figure 3.9 at the end of this addendum shows clearly the two hoods in question and the sedimentation chamber linked to the dust collector.

QC-159 Smelting and Casting Building

In the last paragraph of Section D1.4.1, it is stated that the preferred approach to estimating particulate emissions has been to use the warranty of the equipment provider, i.e. an emission rate of 10 mg/Nm^3 at the exit of the dust collector.

The emission limit value for particulates stipulated in the CAR for these activities is 30 mg/m^{3}R (see Article 10 of the CAR).

Since the atmospheric dispersion study recommends the use of the conservative scenario to assess the impact of a project’s atmospheric emissions on air quality, it would be more appropriate if the limit value for particulate emissions stipulated by the CAR (30 mg/m^{3}R) is used as an emission factor. However, if the Proponent maintains the use of 10 mg/m^{3}R to estimate particulate emissions, it will have to commit to respecting this value instead of 30 mg/m^{3}R.

Answer QC-159

NAIC is committed to respecting the value of 10 mg/Nm^3 at the dust collector stack of the melting and casting building (EAF).

QC-160 Appendix D

In section D1.5 for emission points A5 (transfer building), A6 (storage building) and A7 (transfer building), the warranty provided by the dust collector suppliers was chosen as a factor for estimating particulates emissions, i.e. 10 mg/Nm^3.

The limit value for particulates emissions stipulated in the CAR for these activities is mg/Nm^3 (see Article 10 of the CAR).

Since the atmospheric dispersion study recommends the use of the conservative scenario to assess the impact of a project’s atmospheric emissions on air quality, it would be more appropriate if the limit value for particulate emissions stipulated by the CAR (30 mg/m^{3}R) is used as an emission factor for emission points A5, A6 and A7. However, if the Proponent maintains the use of 10 mg/m^{3}R to estimate particulate emissions, it will have to commit to respecting this value instead of 30 mg/m^{3}R.

Answer QC-160

The dispersion of atmospheric emissions was assessed for the two conditions, i.e. a concentration of 10 mg/Nm^3 and a concentration of 30 mg/Rm^3 for emission rates of the dust collectors associated with stacks A5, A6, A7 and A8. The results of the dispersion show that the criteria and standards are met for all contaminants evaluated at receptors outside the industrial zone, for both conditions.

NAIC is committed to respecting the value of 30 mg/Rm^3 at emission points A5, A6, A7 and A8.

QC-161 Appendix D

The Proponent needs to confirm that the emissions generated by the various activities carried out in the agglomeration unit will not be routed to the dust collector of the melting and casting building (EAF dust collector) as shown in Figure 3.2. The Proponent needs to confirm that they will be released through a special stack at this unit, as shown in Section D1.6.

Answer QC-161

The emissions generated in the agglomeration unit will be evacuated by a stack specific to this unit as shown in Section D1.6.

QC-162 Dust Collectors of the Agglomeration Building

In sub-section D1.6.3 for the three dust collectors located inside the agglomeration building, the guarantee of the dust collectors' supplier was chosen as a factor for in the estimate of particulate emissions, i.e. 10 mg/Nm3.

The emission limit value for particulates emission stipulated in the CAR for these activities is 30 mg/m^{3}R (see Article 10 of the CAR).

Since the atmospheric dispersion study recommends the use of the conservative scenario to assess the impact of a project's atmospheric emissions on air quality, it would be more appropriate if the limit value for particulate emissions stipulated by the CAR (30 mg/m^{3}R) is used as an emission factor for these three dust collectors. However, if the Proponent maintains the use of 10 mg/m^{3}R to estimate particulate emissions, it will have to commit to respecting this value instead of 30 mg/m^{3}R

Answer QC-162

See Answer QC-160.

QC-163 Appendix D

In Section D1.7 it is indicated that ammonia will be the main contaminant emitted into the atmosphere through the acid scrubber .

The Proponent needs to specify what other contaminants will be emitted by this scrubber and their emission rates.

Answer QC-163

In Section D1.7 it should have been written that only ammonia and water vapor would come out of the acid scrubber.

QC-164 Appendix D

In Section D1.8, the Proponent needs to give an example of mass balance calculation used to determine the SO_2 emission factor. Based on Index 2 of Table D1.17, it is based on the fuel's 15 ppm sulfur content.

Answer QC-164

The results of the SO_2 calculation for each relevant source were included in the review of Appendix D1.

QC-165 Appendix D

In Section D1.9, it is stated that the EPA (EPA Average In-use Emissions from Heavy-Duty Trucks) emission factors are the ones used to calculate NOx, CO, SO_2, PM, TOC and VOC emissions.

The Proponent needs to specify whether it is the general emission factors (Table 1 of the EPA document) or the emission factors of a specific category of trucks (Table 2 of the EPA document) that were considered. It should be noted that no emission factor for SO_2 is provided in the EPA document

The Proponent needs to give an example of mass balance calculation used to determine the SO_2 emission factor. Based on Index 3 in Table D1.18, it is based on the fuel's 15 mg/kg sulfur content.

Answer QC-165

Section D1.9 was reviewed to clarify the source of the emission factors and the calculation of the SO_2mass balance. The following text appears in the reviewed Appendix D.

The emission factors used to calculate NOx, CO, PM, TOC and total VOC emissions are those of the EPA (EPA Average In-Use Emissions from Heavy-Duty Trucks, Table 2, Class VIIIa representative of long-haul semi-trailer trucks). SO_2 emissions were calculated on the basis of complete sulfur oxidation in low-sulfur diesel fuel.

Diesel: 0.87 kg/l density; maximum sulfur content of 15 ppm (0.015 gS/kg diesel) based on the Canadian standard.

Emission factor: 0.015 gS/kg x 0.87 kg/l x (64 g SO_2/gS 32) x 0.352 l/km = 0.009 g SO_2/km.

The average diesel consumption rate of a heavy vehicle (35.2 l/100 km) was drawn from the publication of Canada Resources, Canada Vehicle Survey, September 2010.

QC-166 Appendix D

In Section D1.10.1, the Proponent needs to explain why an annual quantity of 671 500 t of raw material is used to estimate emissions related to off-site trucking operations, while a quantity of 830 000 t of iron pellets is mentioned in Section D1.10.2 in relation to the estimate of fugitive emissions related to the unloading and loading of pellets at the dock.

Besides, an example of mass balance calculation to be used to determine the SO_2 emission factor must be presented. Based on Index 2 in Table D1.19, it is based on the fuel's 15 mg/kg average sulfur content.

Answer QC-166

The calculations have been reviewed to reflect the maximum capacity of 830 000 t. Section D1.10.2 has been corrected. The mass balances for SO_2 are presented in Appendix D1 for each relevant source.

ATMOSPHERIC MODELING

QC-167 Scenario 3

The Proponent should give further clarification about its choice of initial dimensions (σy and σz) the two volumic sources associated with the handling of iron pellets at the dock during transshipment. Broadly speaking, the volumic source must match the characteristics of the actual emission as closely as possible. For example, when unloading a ship on the temporary stack, the width of the conveyor or of lance should be regarded as lateral dimension. In addition, the vertical dimension should correspond to the actual distance traveled by the material. For loading, the lateral dimension usually corresponds to the width of the loader's shovel or width of the truck's bed. Thereafter, the appropriate factors (2.15 or 4.3) are used to establish the initial dimensions (σy and σz). The dimensions included in the model are much larger. The Proponent must provide the necessary explanations or do the scenario 3 modeling again while considering appropriate volumic sources.

Answer QC-167

The initial vertical dispersion coefficients (σ_z) of the volumic and surface sources were reassessed while taking into account the MDDELCC's comments. For initial horizontal dispersion coefficients (σ_y), it is necessary to consider that the unloading shovel moves on the surface of the pile when bulk carriers are being unloaded (duration: 5-6 hours). The same is true when trucks are being loaded (duration: about 72 hours). In addition, standards for particles in ambient air are based on a 24-hour period. For these reasons, it is more realistic to consider the lateral dimension of the stack rather than the width of the shovel to estimate the initial horizontal dispersion coefficients (σ_y). SNC-Lavalin has also conducted a sensitivity test using both methods: beyond the industrial area or 300 m exclusion zone on the water body (see Question QC-170), the results of both approaches are virtually identical. In other words, with respect to distances for the application of air quality standards, atmospheric dispersion largely dominates initial dispersion.

QC-168 Scenario 3

Still regarding Scenario 3 which deals with cumulative impacts, the modeling must also include emissions from ship power generators when they are moored at the port during transshipment activities. Finally, emissions due to trucking operations between the quay and the plant were calculated based on the assumption that the road will be paved. Since emissions are much higher when the road is not paved, the Proponent needs to commit to paving the road where required. Otherwise, the modeling should be performed by considering the most conservative assumption, i.e. the use of a unpaved road.

Answer QC-168

Emissions from auxiliary power generators of ships moored at the port during transboarding activities were added to the simulations. Since this is an occasional activity, a worst case scenario was selected, i.e. the use of auxiliary generators operating at 90% capacity (approximately 2000 kW), which corresponds to the required load self-unloading conveyors. The assumptions used are presented in Appendix *D1.10.3 Emissions from Bulk Carriers*.

The existing road is already paved. Therefore, the assumptions used to estimate emissions are appropriate.

QC-169

The modeling was performed for total particulates (PST), fine particles ($PM_{2.5}$), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO) and ammonia (NH_3). However, it is stated in the Impact Assessment that the plant will emit about 19.1 tons and TOCs per year and 13.2 tons of VOCs per year. The Proponent should give further explanations what the main TOCs and TOCs emitted are. Depending on the amount and nature of contaminants emitted, it is possible that some TOCs and TOCs have to be added to the modeling. In addition, the modeling does not include metals contained in emitted particulates. Since the plant's dust emissions mainly come from the handling of iron pellets, the chemical composition of the pellets could be a starting point for the calculation of the emissions of metals associated with the plant site. Regarding road building activities, the Proponent needs to estimate emissions of metals based on the roads' coating materials.

Answer QC-169

TOC emissions consist mainly of ethane, butane, pentane and hexane with traces of formaldehyde, benzene, toluene and p-dichlorobenzene. There are no criteria or ambient air standards for ethane and butane. The other parameters have been added to the emissions calculated at each emission point (Appendix D1) and to the results of the atmospheric dispersion model (Appendix D2). The ambient concentrations calculated are 1% below the MDDELCC's ambient air standards or criteria. These emissions are not significant.

Emissions of metals and metal compounds were assessed by considering that the composition of the total particulate matters would be the same as that of the materials supplied to the processes concerned. Appendix D1.11 presents calculation details for each of the emission points. The results of the atmospheric dispersion study are presented for two cases: the case of an emission of 10 mg/Nm^3 at all dust collectors and (Table D2.12) and the worst-case scenario of an emission of 30 mg/Rm^3 (Table D2-13) for dust collectors associated to stacks A5 to A8 which corresponds to the MDDELCC's emission standard for these emission points.

Regarding trucking activities between the port and the proposed plant site, the MDDELCC's is not accurate because the existing road is already paved. Regarding unpaved roads on the plant site, it is currently impossible to estimate metal emissions since the type of covering material is not known. However, considering the short distances covered on the site, the distance between the internal roads and the edge of the industrial area, and the experience acquired in mining projects, it appears that the contribution of the internal roads to metal concentrations in ambient air would be marginal.

QC-170

An analysis of the figures showing iso-concentration curves for Scenario 3 shows that the concentrations modeled above the Saguenay River were not used to establish compliance with the standards and quality criteria for ambient air, which does not meet the MDDELCC's requirements. The MDDELCC requests that standards and criteria be respected at a distance of 300 meters from the facilities of a project, for the portion located on public lands. Therefore, the modeling should include an area along the bank and the port's facilities at a distance of 300 meters from the boundaries of the land section of the port zone. The standards and quality criteria for ambient air must be met outside this zone.

Answer QC-170

The 300 m exclusion zone on the water body from the boundaries of the land section of the port zone was taken into consideration in the new interpretation of the Appendix D.2 results.

QC-171

The initial concentrations used by the consultant comply with the MDDELCC's requirements. However, the initial concentration of total particulates (PST) is conservative and could lead to exceedances. A more realistic initial concentration should be used as appropriate. Based on MDDELCC's evaluation, an initial concentration of 40 µg/m3 would be more representative since there is little or no dust-generating activities in the area.

Answer QC-171

A new value of 40 µg/m^3 was selected as a representative initial concentration for the PM_T since there are little or no dust-generating activities in the area.

QC-172

The Proponent needs to commit to implementing a quality ambient air monitoring program that must be implemented before the commissioning of the plant to ensure compliance with the standards and quality criteria for ambient air. This program needs to include the installation of one or more sampling stations located on the basis of the modeling's results. The terms and conditions of the monitoring program (monitored contaminants, sampling frequency, sampling and analysis methods, etc.) should be presented for validation in a sample cost estimate.

Answer QC-172

Taking into consideration the ambient air concentrations anticipated near the plant and sensitive receivers, it does not seem justified to carry out such monitoring. We should recall that the modeling activities were performed using conservative assumptions concerning the number of hours of operation. We should also recall that simulations made with emission rates 3 times higher than expected for emissions points A5, A6, A7 and A8 show that particulate matter concentrations (PMT and $PM_{2.5}$) are allegedly still considerably lower than the standards. In addition, for the projected emissions of PM, the maximum contribution of the project to the PM levels in ambient air along the industrial zone is believed to be about 12% of the standards. Only the modeling results for the maximum annual ambient concentrations of crystalline silica demonstrate some potential exceedance of the annual criterion - considering the initial concentration - close to the industrial area, in an environment where there are no sensitive receivers. This modeling result is, however, obtained for a 30 mg/Rm³ concentration PM in the emissions generated by the dust collectors while the maximum predicted concentrations are below 10 mg/Nm^3.

TECHNOLOGICAL RISK

QC-173

On page 8-11, it is mentioned that the technology used in this project is recent and that there has been no major accidents at the plants using it. However, the process plans for the use of potentially explosive gases (methane, hydrogen) and oxygen. The Proponent needs to indicate whether there is a risk of explosion in the reactor. Should this be the case, the Proponent should present such that scenario and assess its consequences.

Answer QC-173

New information has made it possible to accurately indicate the composition of the process gas and its operating conditions. Among other things, the process gas contains more hydrogen than initially anticipated.

The accidental leak scenario was therefore reassessed based on new average conditions of temperature, pressure and gas composition. Section 8.5.3.3 should be replaced by the following paragraphs:

«*The leak rate was set at the maximum flow rate of the process gas in the circuit. In such situations, the circuit would depressurize very quickly, causing a rapid decline of the leak rate.*

The process gas flows in a closed circuit which mainly passes in the reactor, the quenched tower, the CO_2 *removal unit and the preheating furnace. All these equipment are located outside in the reduction area.*

Explosion

An accidental leak of this gas without immediate ignition could form a flammable gas cloud and cause an explosion if this cloud is present in congested/confined area with concentrations between the flammability limits.

The project's engineering study is not advanced enough to accurately determine the volume of potential explosive areas. An upper bound approach was therefore used by considering that the entire mass of the flammable cloud between the flammability limits contributes to the explosion. The Baker-Strehlow model was used with a high reactivity to the flammable gas and an average density for potential obstacles in the explosion zone. The results are summarized in the new table below (QC-173) and illustrated on the new map 8.3 presented at the end of this section.

Table QC-173 Maximum Effects Radius for a Major Process 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)*
120 m	*156 m*	*317 m*	*104 m*	*117 m*	*317 m*

* The consequences depend on weather conditions. Results are reported for the most severe conditions.

Jet Fire

An immediate ignition of the process gas leak would result in the formation of a jet fire. The results are summarized in the revised version of Table 8.17 of the main report.

Table 8.17 Rev01 Maximum Effects Radius for a Major Process 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)***
63 m	*74 m*	*82 m*	*59 m*	*68 m*	*74 m*

* The consequences depend hardly on weather conditions. Results are reported for the most severe conditions.

CO Toxicity

In case of no ignition of the leak and of a formation of a toxic cloud due to the presence of CO, the consequences would reach the distances shown in reviewed Table 8.16 of the main report.

Table 8.16 Rev01 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*	*50 m*	*65 m*	*71 m*
Wind: 6 m/s *Stability: D*	*59 m*	*97 m*	*129 m*

(1) Criterion for a 10-minute exposure

Figure 3.2 Rev01 Pig Iron Production Facility Simplified Process Flow Diagram

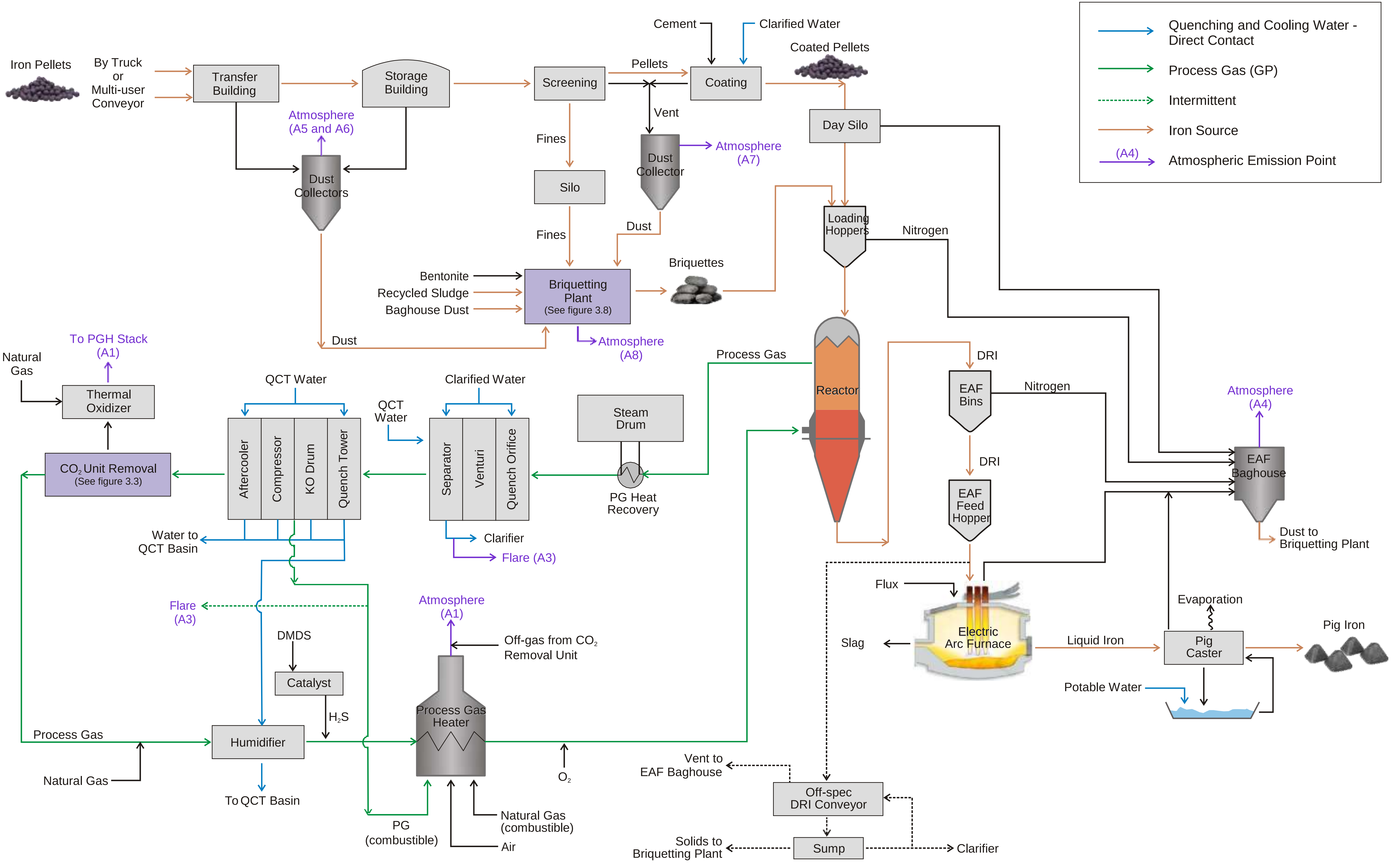


Figure 3.3 Rev01 Simplified Diagram: CO_2 Removal Unit

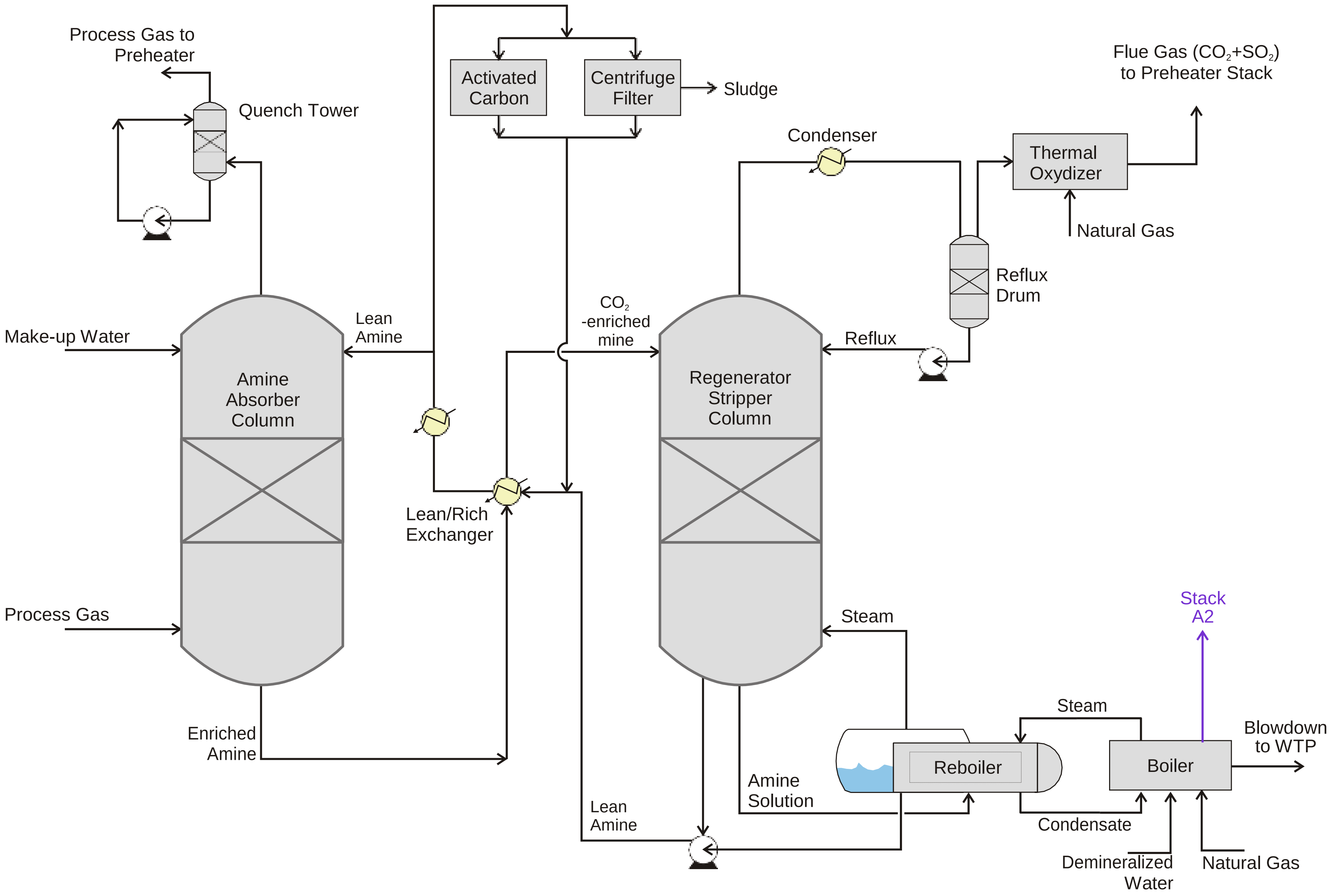


Figure 3.5 Rev01 Simplified Diagram : Industrial Wastewater Treatment

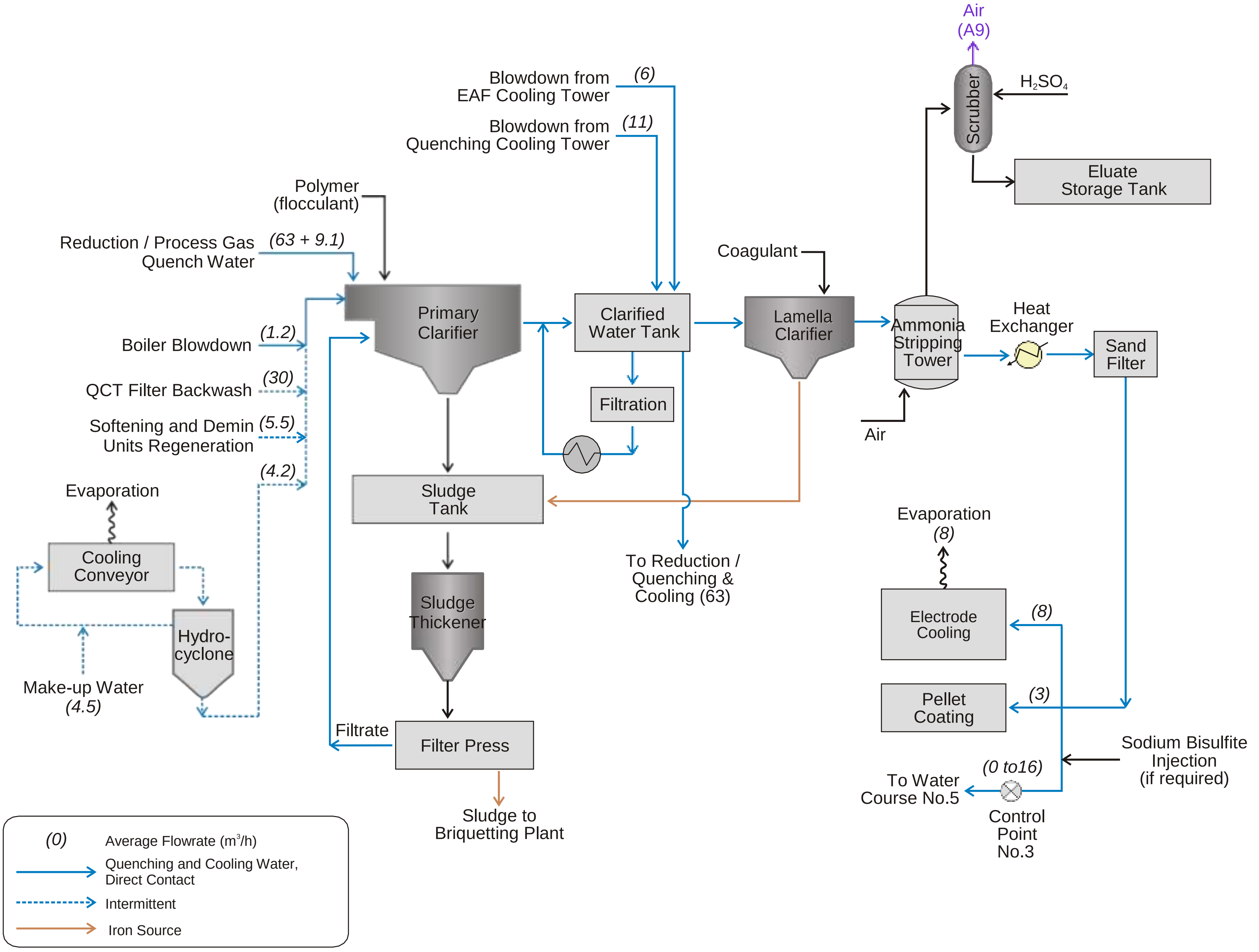
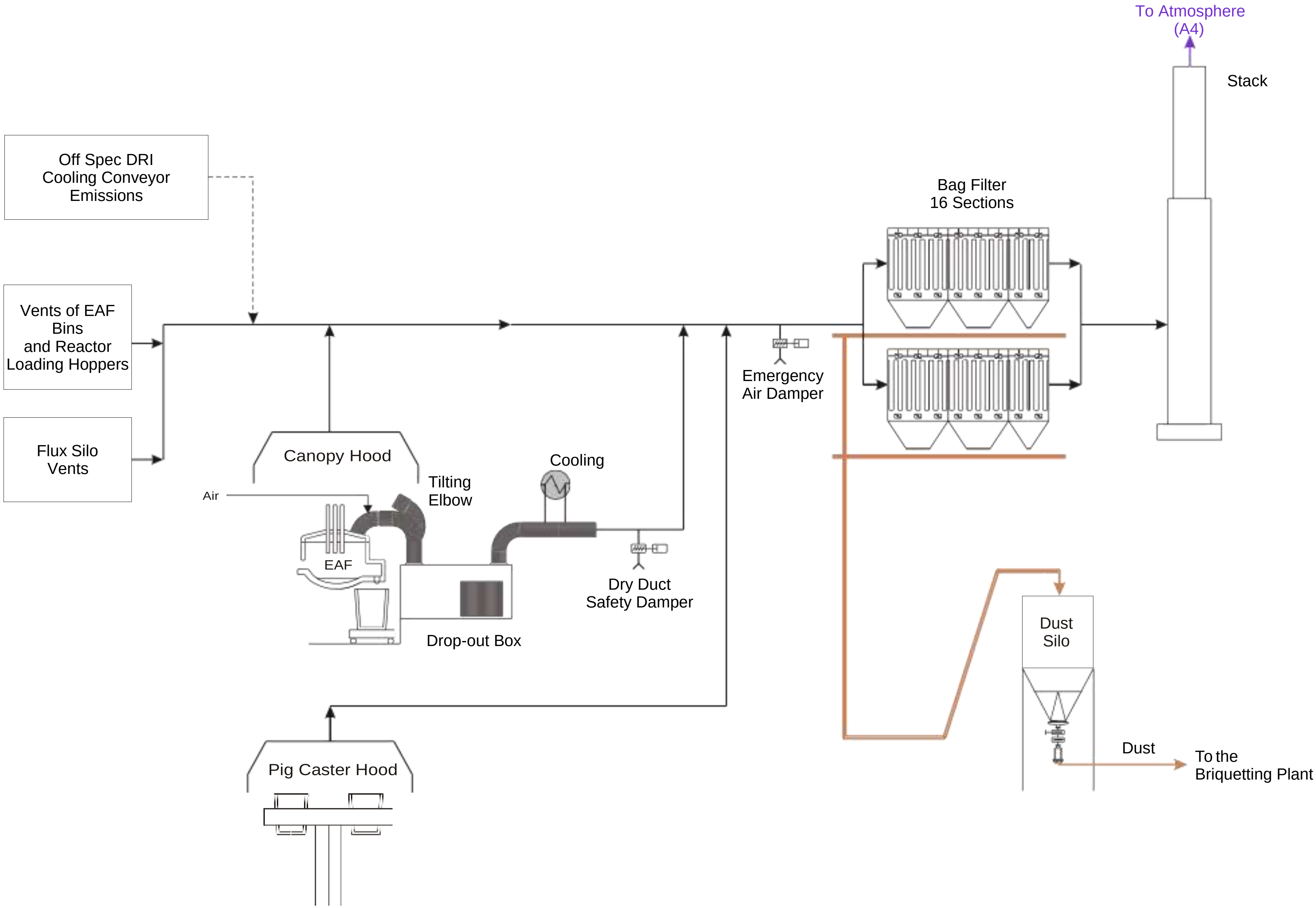
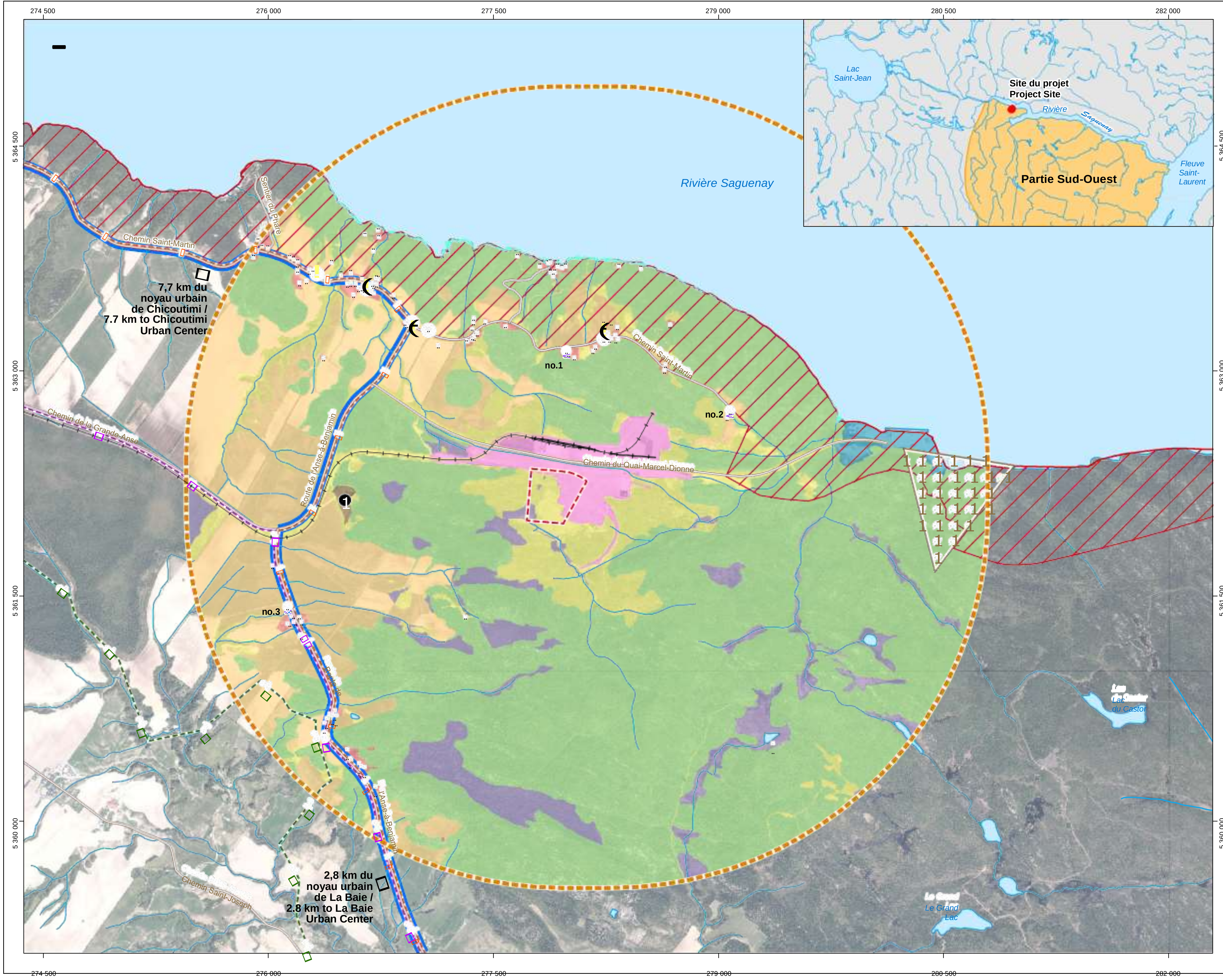


Figure 3.9 Addenda A - Simplified Diagram: Smelting and Casting Building Gas Treatment





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

NORTH ATLANTIC IRON CORPORATION

Usine de production de fonte en gueuse - Saguenay /
Pig Iron Production Plant - Saguenay

Carte 4.5 Rev01 / Map 4.5 Rev01

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

Projection MTM, fuseau 7, NAD83

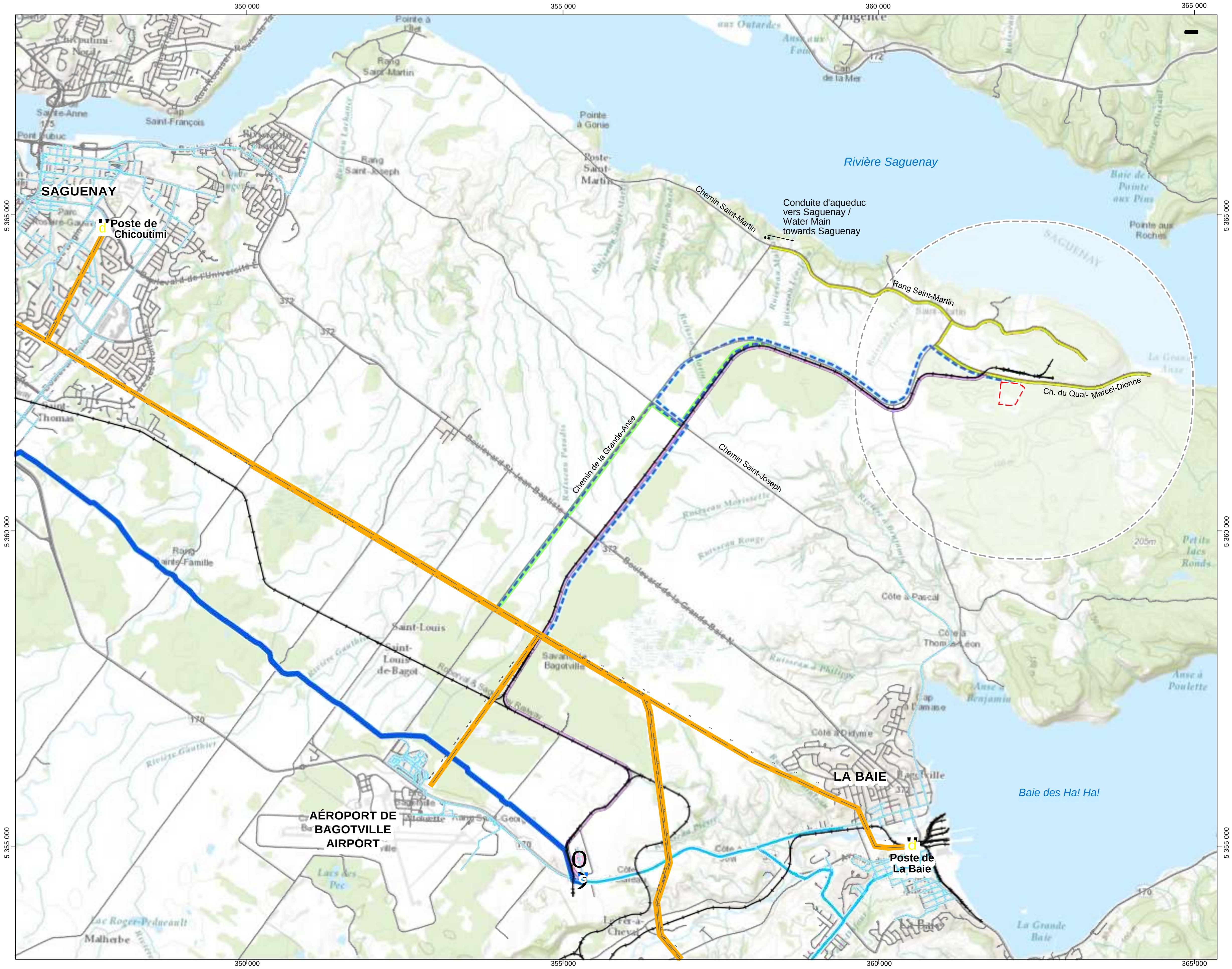
0 0,25 0,5 km

1/25 000

00	2016/10/19	Final / Final	L. Bathalon	C. Martineau
00	2016/04/08	Préliminaire / Preliminary	L. Bathalon	C. Martineau
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\addendaA\snc634451_ei_c4-5_milieu_humain_f00rev01.mxd



Composantes du projet
Project Components

🟥 Empreinte du projet / Project footprint
▨ Zone d'étude / Study area

Infrastructures existantes
Existing Infrastructure

Réservoir St-Anicet / St-Anicet Reservoir
Aqueduc alimentant le port de Saguenay / Port Saguenay Water Main
Poste de livraison / Delivery Station
Gaz Métro - Transport / Transmission
Gaz Métro - Alimentation / Supply
Gaz Métro - Distribution
Chemin de fer / Railroad
Ligne de transport d'énergie électrique/ Electricity Transmission Line

Infrastructures proposées
Proposed Infrastructure

Aqueduc proposé / Proposed Water Main

Gaz Métro - Tracés préliminaires à l'étude /
Gaz Métro - Preliminary Routes Under Study

Option servitude de la voie ferrée / Option Railroad Right-of-Way
Option *chemin de la Grande-Anse*

Note :
Gaz Métro n'a pas terminé l'analyse de la faisabilité technique des options au sud de la ligne de transport électrique jusqu'au poste de livraison /
Gaz Metro has not yet completed the technical feasibility analysis of the options to the south of the electricity transmission line up to the delivery station.

Nouvelle ligne de transport d'énergie électrique de 9 à 22 km selon le point de raccordement au réseau existant *(non illustré)* /

New electrcity transmission line from 9 to 22 km in length depending on connexion point to existing network (not shown)

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

Carte / Map 4.7 - Addenda A
Infrastructures nécessaires pour le projet NAIC
Required Infrastructure for the NAIC Project

Sources :
World Topographic Map, ESRI
Réseau de gaz naturel, Gaz Metro, 2012
Réseau électrique et réseau ferroviaire, CANVEC 1:50 000, MRN Québec

Projet / Project : 634451

0 0,6 1,2 km

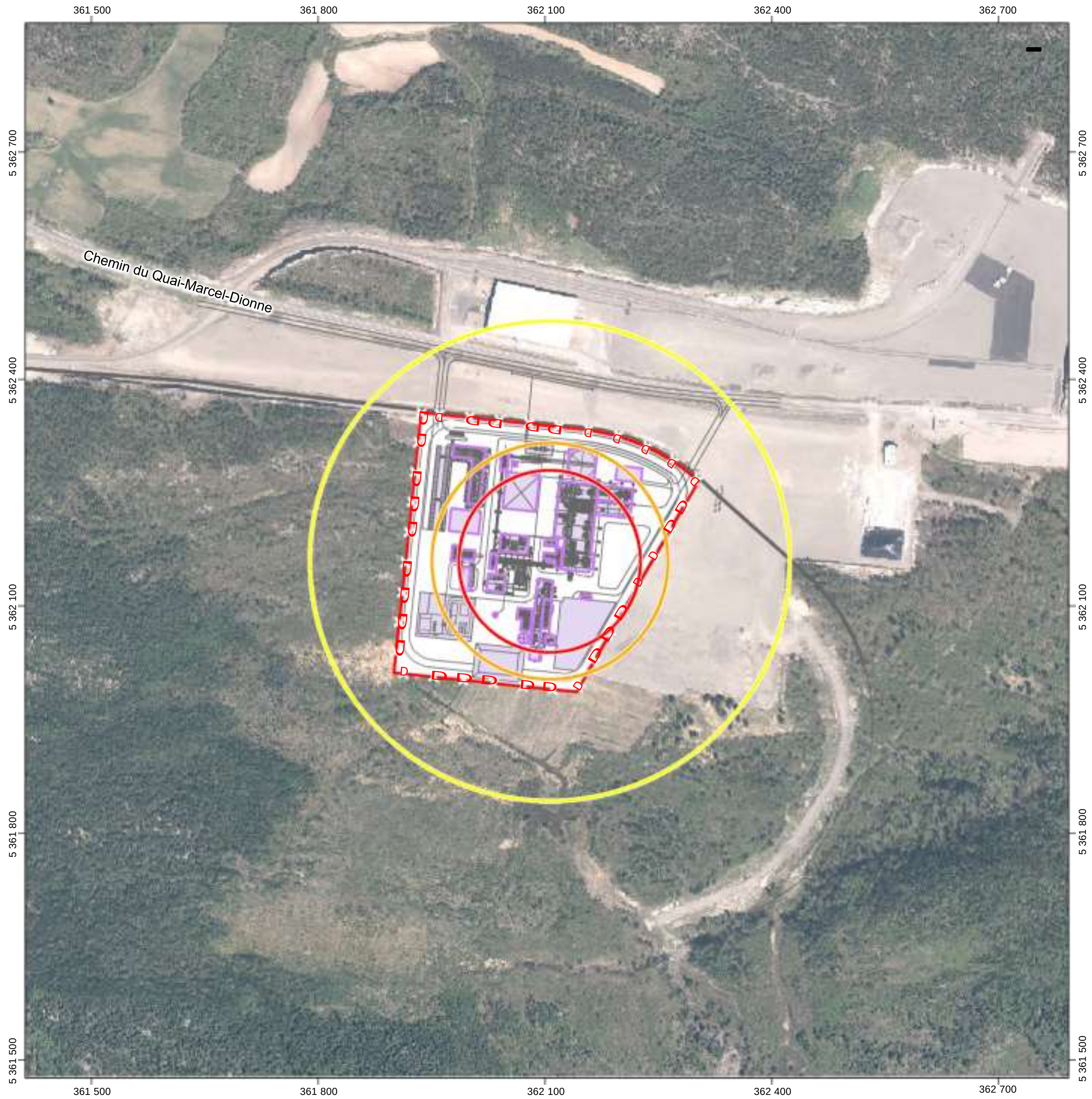
Projection MTM, fuseau 7, NAD83

1/60 000

00	2016/10/13	Préliminaire / Preliminary	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\addendaA\snc634451_addA_c4-7_services_publics_tab_161014.mxd



Composantes du projet
Project Components

🟥 Aire de projet / Project Area

Distances maximales des effets /
Maximum Distances of Impact

Effets sur la vie / Effects on Life
13 KPa - 120 m

Effets sur la santé / Health Effect
6,9 KPa - 156 m

Effets sur la santé / Health Effect
2,0 KPa - 317 m

NAIC

SNC·LAVALIN

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

Carte / Map 8.3 - Addenda A

Distances maximales des effets pour
le scénario d'explosion du gaz de procédé /
Maximum Distances of Impact
for the Process Gas Explosion Scenario

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 75 150 m

1/7 500

00	2016/10/19	Finale/ Final	L. Bathalon	C. Côté
Rév. Rev.	aaaa/mm/jj yyyy/mm/dd	Description/ Description	Préparé/ Prepared	Vérifié/ Verified

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3. Errata

Tables des matières

À la page titre, il manque les mots «et de la lutte contre» au nom du ministère de l'Environnement, du développement durable et de la lutte contre les changements climatiques.

Unités et symboles

- dBA devrait se lire Décibel pondération A

Références

Ajouter :

HATCH. Septembre 2014. Study to Identify BATEA for the Management and Control of Effluent Quality from Mines. MEND Report 3.50.1. http://mend-nedem.org/wp-content/uploads/MEND3.50.1BATEAAppAD.pdf

Chapitre 3

Le terme dololime utilisé doit être remplacé par dolomite calcinée.

À la quatrième puce de la page 28 du chapitre 3, il faudrait lire «présence de douches».

Chapitre 7, section 7.2.1.5, page 5

Un point devrait apparaître à la place d'un point-virgule à fin de la deuxième puce de l'itération.

Chapitre 7, section 7.2.1, page 10

- Il ne devrait pas y avoir de parenthèse à la fin de la dernière phrase de la page 9.
- La première puce de l'itération débutant par : Le tableau 7.1 présente….ne devrait pas faire partie de l'itération mais être placé comme un paragraphe en soi.

Chapitre 7, section 7.2.1, page 11

À la troisième puce du troisième paragraphe, point de transfert doit être au pluriel : Points de transfert

Chapitre 7, section 7.3.2.4, page 26

À la fin de l'encadré, les chiffres 0,63 apparaissent par erreur. Ces chiffres ne doivent pas figurer à la fin de l'encadrer.

Chapitre 9, section 9.3.3, page 9

À l'énumération des paramètres à analyser, il faut remplacer hydrocarbures aromatiques polycycliques (HAM) par hydrocarbures monocycliques (HAM).

Annexe D1, page D1.2, section D1.1.1

Au premier paragraphe, il faut remplacer le mot «direct» par «indirect».

La température du gaz de réduction, un mélange de gaz naturel et de gaz de procédés, est augmentée par chauffage indirect dans un four de préchauffe avant qu'il ne soit alimenté au réacteur pour la réduction des oxydes de fer des boulettes. La chaleur est produite par la combustion d'un mélange de gaz naturel et de gaz de procédés.

Annexe F3

La numérotation de l'annexe F3 doit être revue comme suit :

A.8 Évaluation de la vulnérabilité de la formation hydrogéologique

devient

F3 Évaluation de la vulnérabilité de la formation hydrogéologique

INTRODUCTION DE LA METHODE DRASTIC

devient

F3.1 introduction de la méthode drastic

Détermination des unités hydrostratigraphiques

devient

F3.2 détermination des unités hydrostratigraphiques

A.8 Calcul de l'indice DRASTIC

devient

F3.3 Calcul de l'indice DRASTIC

Tableau A.2.1 Calcul de l'indice de vulnérabilité DRASTIC pour l'aquifère rocheux

devient

Tableau F3.1 Calcul de l'indice de vulnérabilité DRASTIC pour l'aquifère rocheux

À la carte F1, la valeur du forage MW-07-16 doit être de 139,7.

Annexe K1

La fiche dolomite doit être remplacée par la fiche dolomite calcinée.

Annexe K3

La numérotation de l'annexe est erronée et les sections et sous-sections devraient être numérotées comme suit :

K3.1 Introduction

K3.1.1 Objectifs

K3.1.2 Portée du plan d'intervention d'urgence

K3.2 Définition des niveaux d'urgence

K3.3 Organisation et rôles des intervenants

K3.3.1 Intervenants internes

K3.3.2 Intervenants externes

K3.3.3 Premier témoin

K3.3.4 Centre d'urgence 911

K3.3.5 Service de sécurité incendie

K3.3.6 La sûreté du québec de la mrc de chicoutimi et la police de la ville de saguenay

K3.3.7 Agence de la santé et des services sociaux de saguenay-lac-saint-jean et la direction de santé publique

K3.3.8 Ministère du développement durable, de l'environnement et la lutte contre les changements climatiques (mddelcc)

K3.3.9 Environnement du canada

K3.3.10 Sécurité civile

K3.4 Plan d'action lors d'une situation d'urgence

K3.4.1 Fuites ou déversements

K3.4.2 Incendies

K3.4.3 Accident de travail

K3.4.4 Catastrophes naturelles

K3.4.5 Scénario d'intervention minute par minute

K3.4.6 Alerte à la population

K3.5 Plan d’évacuation et points de rassemblement

K3.6 Opérations de restauration

K3.7 Mesures préventives et équipements d'intervention

K3.8 Plans des installations

K3.9 Formation

K3.10 Mise à jour du plan

4. References

BAZOGE, A., D. LACHANCE ET C. VILLENEUVE. 2014. Identification et délimitation des milieux humides du Québec méridional. Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques, Direction de l'écologie et de la conservation et Direction des politiques de l'eau, 64 pages + annexes.

U.S. DEPARTMENT OF AGRICULTURE (USDA), 2009. Stream Visual Assessment Protocol, Version 2 (SVAP2) National Biology Handbook, Aquatic and Terrestrial Habitat Resources, Conservation Planning, Subpart B, Part 614

WSP / GCNN. 2016. Terminal maritime en rive nord du Saguenay. Étude d'impact environnemental. Rapport produit pour l'Administration portuaire du Saguenay. Multiple pages + annexes.

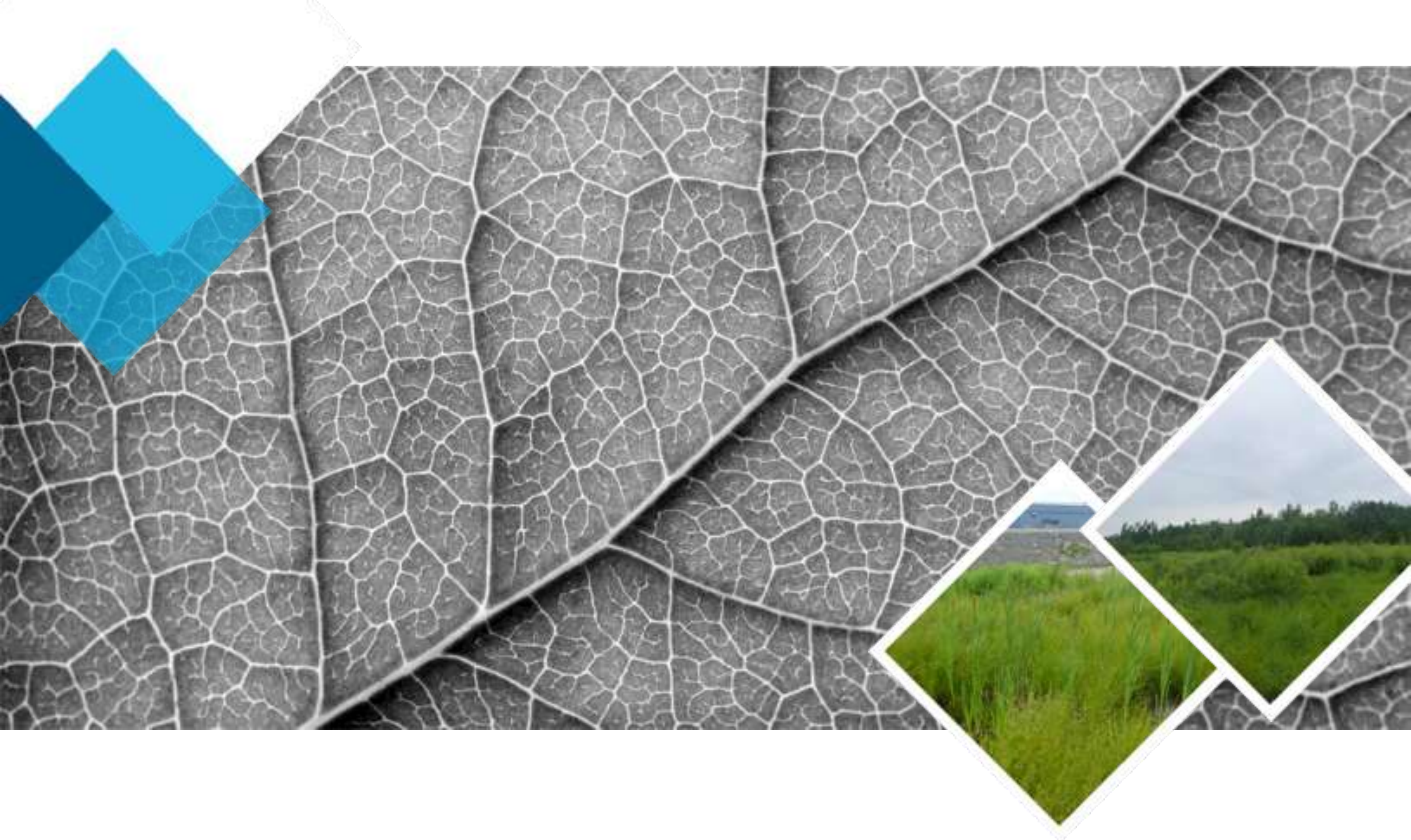
Annexe AddA-A

Milieux Humides, cours d’eau et espèces floristiques vulnérables ou menacées

Données brutes des inventaires biologiques

Rapport d'analyse des milieux humides impactés – Usine de production de fonte en gueuse – Saguenay

Administration portuaire de Saguenay



Environnement et géosciences

19 | 10 | 2016

Rapport > Rev. 00
Ref. Interne 634451

Rapport d'analyse des milieux humides impactés – Usine de production de fonte en gueuse – Saguenay

Administration portuaire de Saguenay

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N/Dossier n°: 634451 2016-10
Rapport préliminaire 00

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AVIS AU LECTEUR

Le présent rapport a été préparé, et les travaux qui y sont mentionnés ont été réalisés par SNC-Lavalin GEM Québec inc., (SNC-Lavalin), exclusivement à l’intention l’Administration portuaire de Saguenay (le Client), qui fut partie prenante à l’élaboration de l’énoncé des travaux et en comprend les limites. La méthodologie, les conclusions, les recommandations et les résultats cités au présent rapport sont fondés uniquement sur l’énoncé des travaux et assujettis aux exigences en matière de temps et de budget, telles que décrites dans l’offre de services et/ou dans le contrat en vertu duquel le présent rapport a été émis. L’utilisation de ce rapport, le recours à ce dernier ou toute décision fondée sur son contenu par un tiers est la responsabilité exclusive de ce dernier. SNC-Lavalin n’est aucunement responsable de tout dommage subi par un tiers du fait de l’utilisation de ce rapport ou de toute décision fondée sur son contenu.

Les conclusions, les recommandations et les résultats cités au présent rapport (i) ont été élaborés conformément au niveau de compétence normalement démontré par des professionnels exerçant des activités dans des conditions similaires de ce secteur, et (ii) sont déterminés selon le meilleur jugement de SNC-Lavalin en tenant compte de l’information disponible au moment de la préparation du présent rapport. Les services professionnels fournis au Client et les conclusions, les recommandations et les résultats cités au présent rapport ne font l’objet d’aucune autre garantie, explicite ou implicite. Les conclusions et les résultats cités au présent rapport sont valides uniquement à la date du rapport et peuvent être fondés, en partie, sur de l’information fournie par des tiers. En cas d’information inexacte, de la découverte de nouveaux renseignements ou de changements aux paramètres du projet, des modifications au présent rapport pourraient s’avérer nécessaires.

Le présent rapport doit être considéré dans son ensemble, et ses sections ou ses parties ne doivent pas être vues ou comprises hors contexte. Si des différences venaient à se glisser entre la version préliminaire (ébauche) et la version définitive de ce rapport, cette dernière prévaudrait. Rien dans ce rapport n’est mentionné avec l’intention de fournir ou de constituer un avis juridique.

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1 Introduction

1.1 Mise en contexte

L'administration portuaire de Saguenay (APS) souhaite entreprendre la 3ème phase de développement du Parc industriel maritime intermodal (PIMI) adjacent au port de Grande-Anse. Le développement de ce secteur répond à des stratégies de développement locale et provinciale, notamment la consolidation des activités du Parc industriel maritime intermodal (PIMI) et plus globalement d'une zone industrialo-portuaire comme le préconise la Stratégie maritime du Gouvernement du Québec.

Dans le cadre de cette 3ème phase de développement, une évaluation environnementale fédérale, en vertu de la *Loi canadienne sur l'évaluation environnementale* sera réalisée. L'ampleur du développement de la 3ème phase n'étant pas définie au moment de la réalisation du présent document, cette étude a été effectuée afin de mieux définir les milieux humides impactés sur une partie du site, afin de permettre l'implantation de l'usine de fonte en gueuse qui sera opérée par la Société de Fer de l'Atlantique Nord (NAIC).

Ainsi, ce rapport d'analyse des milieux humides MH13 et MH4 dont la localisation chevauche la superficie de remblayage prévue pour l'aménagement de la plateforme d'accueil de l'usine de NAIC, a été réalisé pour évaluer les pertes au niveau de la superficie de ces milieux et de leur valeur écologique. Le territoire qui accueillera la plateforme remblayée correspond à la superficie de l'empreinte du projet présentée dans l'étude d'impact sur l'environnement pour la construction et l'opération de l'usine de NAIC, déposée au ministère du Développement durable de l'Environnement et de la Lutte contre les changements climatiques (SNC-Lavalin, 2016).

1.2 Description des milieux humides d'origines

La zone d'étude de ce rapport d'analyse correspond à la zone d'empreinte du projet présentée dans l'étude d'impact. Deux milieux humides sont présents dans la zone d'étude et seront détruits en totalité (MH13), ou partiellement (MH4).

Le premier milieu humide (MH13) était, à l'origine, un marécage arboré de type sapinière à frêne noir ou a bouleau jaune de drainage imparfait à mauvais (GroupeHémisphères, 2012;). La strate arborescente est dominée par le sapin baumier (*Abies balsamea*) accompagné de l'érable à épis (*Acer spicatum*) et de l'if du Canada (*Taxus canadensis*) sur sphaignes et mousses. Ce marécage est situé dans une dépression topographique et ne possède aucun lien hydrographique. Ainsi, son rôle écologique est de moindre importance. Ce marécage a été modifié depuis l'étude réalisée en 2012 réduisant substantiellement sa superficie. Il sera complètement détruit pour la réalisation du présent projet.

Le second milieu humide (MH4) correspond à un complexe de milieux humides constitué d'un marécage arboré et d'une tourbière (GroupeHémisphères, 2012). La superficie de la portion de marécage arboré de MH4 est similaire à MH13 tandis que la portion de tourbière est constituée de pessière noire ou de sapinière à frêne noire, à drainage mauvais, dont l'épaisseur de matière organique dépasse les 30 cm. Ce complexe de milieux humides possède un lien hydrologique avec le cours d’eau #5. Son rôle écologique est de régulariser le débit de l’eau, limitant les risques d’inondation et augmentant par le fait même la qualité de l’eau par ses capacités de filtration. Seule une petite portion (0,54 ha) du marécage arboré sera impactée par le projet.

La superficie où sera implantée l’usine a été positionnée de manière à minimiser l’empiètement sur les milieux naturels tels que des peuplements forestiers ou des milieux humides. Effectivement, l’empreinte du projet est situé au cœur de ce qui était jadis un ancien champ en culture et d’anciennes friches herbacées (GroupeHémisphères, 2012). Une petite portion de pessière noire ou blanche de même que les deux milieux humides identifiés seront toutefois impactés. Par contre, bien que MH13 soit voué à être détruit, l’impact sur le milieu MH4 sera minimisé et de moindre ampleur puisque seule une petite portion située à l’extrémité nord-est du milieu humide sera perturbée par le projet.

2 Méthodologie

L’analyse des pertes de milieu humide sur la superficie de ces derniers de même que sur leur valeur écologique a été réalisée en se basant sur le rapport de caractérisation des milieux humides réalisé par le Groupe Hémisphères (2012) et sur les superficies mises à jour lors des analyses réalisées dans le cadre de l’étude d’impact sur l’environnement (SNC-Lavalin, 2016).

2.1 Espèce floristique à statut particulier et habitat potentiel

L’analyse pour la détermination des habitats potentiels pouvant abriter des espèces floristiques menacées, vulnérables ou susceptibles d’être ainsi désignées (EFMVS) avait été effectuée par le GroupeHémisphère (2012) selon une méthode qu’ils ont élaborée. Les résultats démontraient qu’aucun habitat potentiel n’était présent dans la zone d’étude. Afin de vérifier cette composante avec les outils couramment utilisés, cette analyse sera effectuée de nouveau en suivant la méthodologie du *Guide de reconnaissance des habitats forestiers des plantes menacées ou vulnérables – Côte-Nord et Saguenay-Lac-Saint-Jea*n (Dignard et coll., 2009).

Concernant les EFMVS, les demandes, effectuées au Centre de données sur le patrimoine naturel du Québec (CDPNQ) dans le cadre de la réalisation de l’étude d’impact sur l’environnement, ne rapportent aucune occurrence d’EFMVS dans la zone d’étude de l’étude d’impact, consistant à un rayon de 2,5 km autour de l’empreinte du projet (SNC-Lavalin, 2016).

2.2 Analyse des pertes de milieux humides

2.2.1 Superficie des milieux humides

La superficie des milieux humides utilisée pour l’évaluation des pertes et le calcul de la valeur écologique correspond aux superficies d’origine telles que définies dans le rapport du Groupe Hémisphère (2012) et qui ont été par la suite, réévaluées et mises à jour par photo-interprétation lors de la réalisation de l’étude d’impact sur l’environnement (SNC-Lavalin, 2016). Effectivement, puisque des travaux ont eu lieu dans le secteur suite au rapport de caractérisation qui a été produit par le GroupeHémisphère (2012), le type de milieux humides présent et les superficies des différentes composantes naturelles de la zone d’étude ont donc été modifiés.

2.2.2 Valeur écologique des milieux humides

Puisque l’évaluation des milieux humides, à l’aide des situations 1, 2 et 3 n’est plus appliquée par le MDDELCC, l’analyse de la valeur écologique des milieux humides a été réalisée selon la méthode élaborée par SNC-Lavalin inc. qui s'inspire de celle proposée par Joly et coll. (2008). Cette méthode a été bonifiée et améliorée depuis 2009, suite à des discussions avec certains représentants du MDDELCC. Afin d’évaluer la valeur écologique globale d’un milieu, la méthode proposée comporte les étapes suivantes :

› Attribution d’un pointage (1 à 3) pour 17 critères;

- Pondération du pointage en fonction de l’importance du critère (jusqu’à 3 fois);
- Attribution d’une note sur 102 pour la valeur écologique globale. Ce total est converti par la suite en pourcentage et ajusté selon une courbe de distribution normale.

Ainsi, la valeur écologique globale d’un milieu humide, lui est attribuée en fonction de la répartition suivante :

- Valeur faible : 39 % et moins
- Valeur moyenne : entre 40 % et 59 %
- Valeur élevée : 60 % et plus

La méthodologie, incluant la liste des 17 critères évalués, la grille d’analyse de la valeur écologique, l’attribution du pointage et la pondération, est présentée à l’annexe A.

3 Résultats

3.1 Analyse des habitats potentiels des EFMVS

Suite à l’analyse pour la détermination des habitats forestiers potentiels des EFMVS, aucun habitat potentiel ne s’est révélé être présent dans la zone d’étude. D’ailleurs, la zone d’étude a déjà subi des travaux et est désormais considérée comme un endroit perturbé, où la majorité de la superficie du territoire est constituée de sol nu et d’anciens champs agricoles (photos 1 et 2, juillet 2016).

3.2 Analyse des pertes de milieux humides

3.2.1 Superficie impactée et type de milieux humides

Tel que mentionné, la majorité du milieu humide MH13 d’origine a subi d’importantes perturbations scindant le milieu en deux milieux humides résiduels, ci-nommé MH13a et MH13b dans le présent rapport (carte 1). De plus, les deux milieux résiduels étant situés à un peu plus de 30 m de distance, ils ne constituent pas de mosaïque et seront traités comme deux milieux distincts. Ces milieux humides, dont la superficie combinée s’élève à 0,1 ha, seront entièrement détruits pour la réalisation du projet.

Tout d’abord, mentionnons que les perturbations, apportées au milieu humide MH13a, ont modifiées le type de milieu qui était à l’origine un marécage arboré (GroupeHémisphères, 2012). Le type de milieu résultant correspond aujourd’hui à un marais à quenouilles (*Typha latifolia*), à joncs, dont *Juncus effusus,* et à scirpe à ceinture noire (*Scirpus atrocinctus*; photo 3). MH13a a une superficie de 0,04 ha (photo 3)

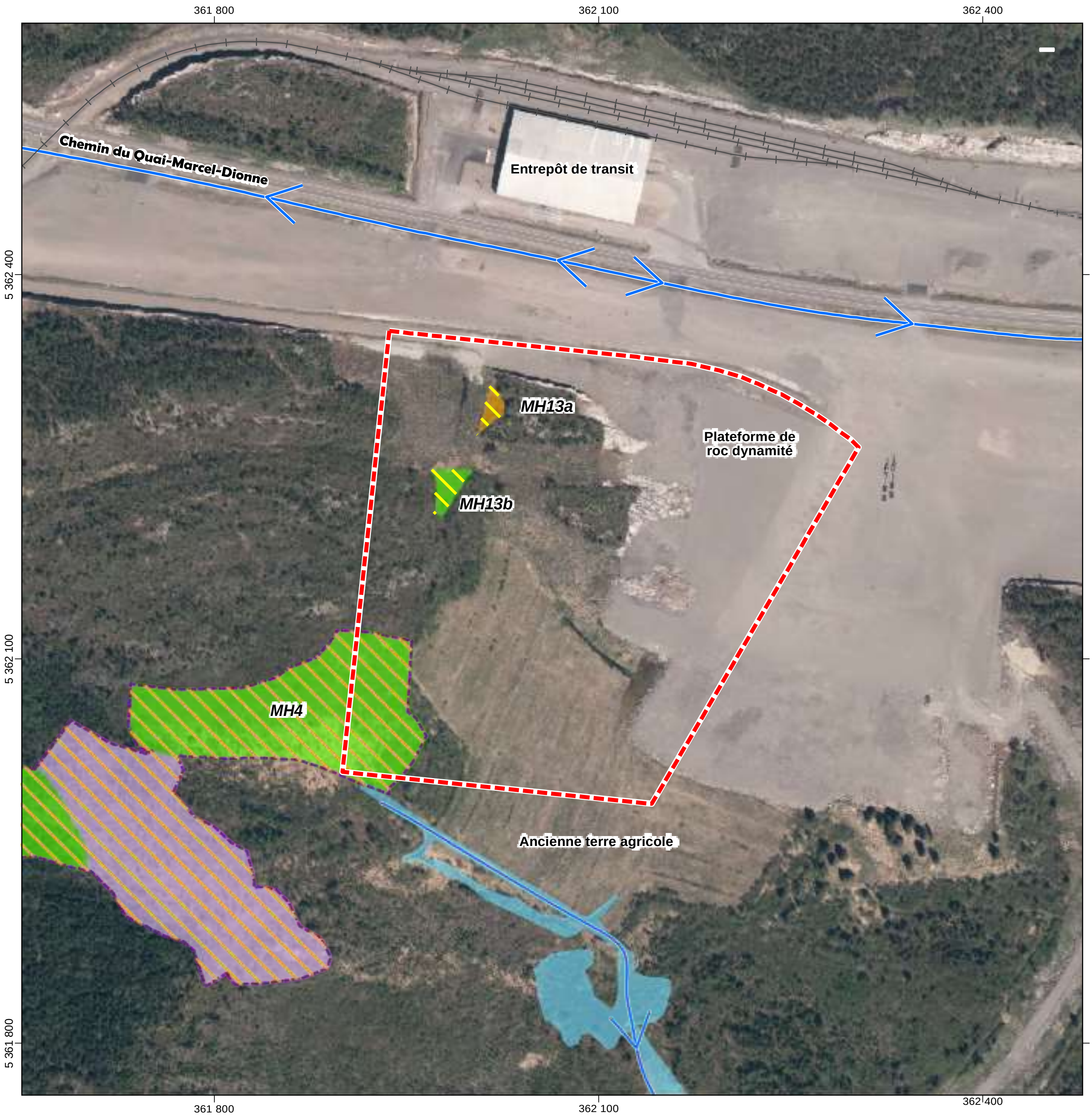
Le milieu MH13b, quant à lui, a également subit une réduction de sa superficie d’origine, mais est demeuré un marécage arboré. MH13b a une superficie de 0,06 ha.

Enfin, le milieu humide MH4 n’a pas subit de perturbation depuis la réalisation de l’étude du GroupeHémisphères (2012). D’une superficie totale de 4,42 ha, il correspond à un complexe de milieux humides constitué d’une tourbière boisée et d’un marécage arboré. Tel que mentionné précédemment, seule une petite portion du marécage arboré sera détruite pour la réalisation du projet, soit une superficie de 0,54 ha ce qui correspond à 12 % du milieu humide.

La description des milieux MH13b et MH4 peut être consultée dans les fiches de caractérisation présentée au rapport du GroupeHémisphères datant de 2012.

Photo 1. Portion dénudée de la zone d'étude

Photo 2. Portion constituée d'anciens champs agricoles, au nord de MH4



Composantes du projet

🟥 Aire de projet

Milieux humides

▭ Complexe de milieux humides

🟧 Marais

🟩 Marécage arboré

🟪 Tourbière

🟦 Eau peu profonde

Valeur écologique

▨ Moyenne

▨ Faible

→ Ruisseau ou fossé de drainage

NAIC

SNC·LAVALIN

NORTH ATLANTIC IRON CORPORATION

Usine de production de fonte en gueuse - Saguenay

Carte 1

Milieux humides

Sources :

Ville de Saguenay, imagerie 2015

PRÉLIMINAIRE

Projet : 634451

Projection MTM, fuseau 7, NAD83

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Photo 3. Marais à quenouilles (MH13a)

3.2.2 Valeur écologique des milieux humides

Le tableau 1 présente le résultat du pointage obtenu pour l'évaluation de la valeur écologique des milieux humides identifiés dans la zone d'étude, tandis que le tableau 2 présente les principales caractéristiques de ces milieux de même que leur valeur écologique.

La valeur écologique du marais (MH13a) et du marécage arboré (MH13b) est qualifié de faible, soit de 22 % pour chacun des milieux. Ces faibles valeurs sont principalement attribuables au fait que ces milieux ont été très perturbés de même que leur environnement immédiat, qu'il s'agit d'un ancien milieu qui a été fragmenté, qu'aucune espèce à statut particulier n'y ont été observée et que leur richesse relative et spécifique y est plutôt pauvres à moyennes. De plus, aucun lien hydrologique n'est présent. En raison de la forte altération de ces milieux, leur rôle écologique est de moindre importance.

La valeur écologique de MH4 est jugée moyenne, soit de 56 %. Cette valeur est attribuable à la présence du lien hydrologique via le cours d'eau #5, au fait que le milieu et son environnement sont peu perturbés, que le milieu n'est pas fragmenté et du fait que le milieu fait partie d'un complexe de milieux humides. Puisque la superficie qui sera détruite est de moindre envergure, l'impact sur ses fonctions écologiques est jugé faible.

De plus, il est bon de mentionner qu’aucune espèce exotique envahissante n’a été rapportée pour chacun de ces milieux lors des visites effectuées sur le terrain. Également, aucun des milieux humides impactés n’obtient une valeur écologique élevée.

Tableau 1 Pointage obtenu pour les milieux humides aux différents critères de la méthode d'évaluation de la valeur écologique (annexe A)

MH/ Critères	Type de milieu humide	Superficie	Hydroconnectivité	Connectivité avec les milieux naturels environnants	Perturbation	Présence d’espèces à statut particulier	Richesse relative	Unicité de l’habitat (échelle du bassin versant)	Rareté relative	Richesse spécifique	Capacité de filtration	Occupation des terres hautes	Fragmentation	Espèces exotiques envahissantes	Projet de conservation	Forme du milieu humide	Activité récréative
MH13a	9	1	2	3	3	3	2	1	2	1	6	2	2	6	2	3	1
MH13b	3	1	2	3	6	3	4	2	4	2	3	2	2	6	2	3	1
MH4	9	2	4	6	9	3	4	2	4	3	6	4	6	6	2	1	1

Tableau 2 Valeur écologique des milieux humides identifiés et superficie impactée

Milieu humide	Type	Superficie (ha)		Lien hydrologique	Présence d’espèces désignées	Valeur écologique
		Totale	Zone d’étude			
MH13a	Marais	0,04	0,04	Non	Non	Faible (25 %)
MH13b	Marécage arboré	0,06	0,06	Non	Non	Faible (22 %)
MH4	Complexe marécage arboré/tourbière	4,42	0,54	Oui, cours d’eau #5	Non	Moyenne (56 %)

4 Conclusion

Dans le cadre de la 3ème phase de développement du Parc industriel maritime intermodal (PIMI) adjacent au port de Grande-Anse à Ville Saguenay, une évaluation environnementale, en vertu de la *Loi sur l'évaluation environnementale*, sera réalisée. La superficie qui sera sujette à être développée en vue de l'implantation de futures infrastructures n'étant pas définie au moment de la réalisation du présent document, cette étude d'analyse des milieux humides a été effectuée sur l'empreinte connue d'un projet de construction et d'opération d'une usine de fonte en gueuse. Cette étude sur les milieux humides touchés a pour objectif de permettre l'implantation de cette usine, opérée par la Société de Fer de l'Atlantique Nord (NAIC).

Le milieu humide MH13 est maintenant scindé en deux milieux humides distincts, soit un marais à quenouilles (MH13a) et un marécage arboré (MH13b). Le milieu MH4 est, quant à lui, demeuré intact, et correspond à un complexe de milieux humides constitué d'une tourbière boisée et d'un marécage arboré.

Aucun des milieux humides présents dans la zone d'étude ne possède une valeur écologique élevée. Les milieux humides MH13a et MH13b ont une valeur écologique faible, et seront entièrement détruits (superficie de 0,1 ha) pour la réalisation du projet. Le milieu MH4 possède une valeur écologique moyenne et seulement 0,54 ha, soit 12 % du milieu humide total, sera détruit.

Aucun habitat potentiel pouvant abriter des EFMVS n'a été identifié dans la zone d'étude. Il en est de même pour les occurrences d'EFMVS, dont aucune n'a été rapportée par le CDPNQ.

La définition de la valeur écologique des milieux humides perdus sera considérée par l'APS dans son programme de compensation.

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Annexe A

Méthodologie pour le calcul de la valeur écologique des milieux humides

DÉTERMINATION DE LA VALEUR ÉCOLOGIQUE DES MILIEUX HUMIDES – APPROCHE DÉVELOPPÉE PAR SNC-LAVALIN INC., DIVISION ENVIRONNEMENT

La méthode qui a été élaborée pour évaluer la valeur écologique des milieux humides s'inspire de celle proposée par Joly et coll. (2008). Afin d'évaluer la valeur écologique globale d'un milieu, la méthode proposée comporte les étapes suivantes :

- attribution d'un pointage (1 à 3) pour 17 critères;
- pondération du pointage en fonction de son importance (1, 2 ou 3 x le pointage);
- attribution d'une note sur 102 pour la valeur écologique globale. Ce total est converti par la suite en pourcentage et ajusté selon une courbe de distribution normale.

Le tableau 1 présente les critères, leur pondération et le système de notation.

Les critères suivants sont considérés :

1. Type de milieu humide : considère la présence d'un ou plusieurs types de milieu humide. Ce critère évalue la valeur d'un milieu humide en fonction de son rôle et de sa composition. Comprend les types suivants :
    - tourbière ombrotrophe
    - tourbière minérotrophe
    - herbier aquatique
    - marécage arboré
    - marécage arbustif
    - marais d'eau douce (inclut les prairies humides)
    - marais salé
    - eau peu profonde
    - mosaïque ou complexe de milieux humides (Bazoges et coll., 2014)

    Ce critère est utilisé à la fois pour la valeur écologique et la valeur hydrologique pour tenir compte qu'un même type de milieu humide peut jouer un rôle différent selon le point de vue.
    ** Pour ce qui est de la mosaïque, chaque partie doit être considérée séparément et faire l'objet d'une analyse séparée (une colonne dans le tableau). Les points 2 (superficie), 3 (hydroconnectivité), 4 (connectivité), 12 (occupation des terres hautes), 13 (fragmentation) et 16 (forme) doivent cependant être considérés globalement et une seule caractéristique doit être attribuée à l'ensemble des parties de la mosaïque.*

2. Superficie : surface occupée par le milieu humide. La note attribuée augmente avec la superficie. Il est reconnu en biogéographie que les milieux plus grands ont généralement une plus grande valeur.
    ** Notez que dans le cas d'une mosaïque ou d'un complexe, la superficie considérée est celle de l'ensemble de ses parties. Calculée par la cartographie.*

3. Hydroconnectivité : représente le lien hydrologique avec le réseau hydrographique en tenant compte de la valeur du cours d'eau. Un milieu qui comporte une connectivité avec

le réseau hydrologique obtient une plus grande valeur, notamment en raison de l'influence qu'il peut avoir sur les milieux riverains et l'habitat du poisson en aval.

** Notez que dans le cas d'une mosaïque ou d'un complexe, l'hydroconnectivité considérée est celle de l'ensemble de ses parties.*

4. Connectivité avec les milieux naturels environnants : ce critère évalue la résilience du milieu humide ainsi que l'effet de corridor et de mosaïque. Il correspond au pourcentage de milieux naturels dans une zone tampon de 200 m autour du milieu humide. La distance de 200 m représente la zone tampon minimale autour des milieux humides et riverains pour les amphibiens et les reptiles selon Semlitsch et Bodie (2003). Ce critère est utilisé pour la valeur écologique et pour la valeur hydrologique, dans ce dernier cas pour tenir compte du rôle des milieux adjacents sur l'intégrité hydrologique d'un milieu humide.

   ** Notez que dans le cas d'une mosaïque ou d'un complexe, la connectivité considérée est celle de l'ensemble de ses parties. Calculée par la cartographie.*

5. Perturbations : évalue l'intégrité d'un milieu humide par la sévérité (type et étendue) des perturbations localisées à l'intérieur du milieu humide. Ce critère est utilisé pour la valeur écologique et la valeur de conservation. Ce critère nous semble spécialement important compte tenu de la pression que subissent les milieux humides au sud du Québec.

6. Présence d'espèces à statut particulier : évalue la présence et le nombre d'espèces floristiques et fauniques menacées ou vulnérables ou susceptibles d'être ainsi désignées incluant les espèces floristiques vulnérables à la récolte commerciale.

7. Richesse relative : évalue la richesse d'un milieu comme habitat en fonction du nombre de strates verticales ou horizontales.

8. Unicité de l'habitat : considère la présence de peuplements de grande valeur et généralement peu représentés, soit les peuplements climaciques.

9. Rareté relative : évalue la rareté d'un type de milieu humide à l'échelle du bassin versant. Les données de cartographie des milieux humides de Canards illimités sont utilisées pour faire cette évaluation.

   ** Calculée par la cartographie. Corresponds au pourcentage du type de milieu humide évalué sur l'ensemble du bassin versant. Par exemple, un marécage arbustif représente 10% des marécages du bassin versant de telle rivière. Selon les ratios, ce type de milieu humide est rare ou commun.*

10. Richesse spécifique : Évalue la richesse d'un milieu en fonction des classes de richesse relatives telles que définies dans les guides de reconnaissance des types écologiques (Blouin et coll., 2008). Ces classes de richesse relatives sont fonction du type d'humus, du pH, de la présence ou de l'absence de seepage, de la longueur de la pente arrière et de la diversité floristique.

    ** S'évalue avec le pourcentage de présence de certaines espèces indicatrices. Pour cette raison, les relevés de végétation seront pris en pourcentage et non en classe de pourcentage (ex : 20% de graminées, 35 % de sphaignes, etc.). Les clés des guides de reconnaissance des types écologiques seront alors utilisées pour déterminer la richesse.*

11. Capacité de filtration : évalue la capacité d'un milieu humide de filtrer les eaux selon le type de milieu et sa position dans le réseau hydrique. Les fossés sont ici considérés comme liens hydrologiques.

12. Occupation des terres hautes : évalue les menaces existantes ou potentielles en fonction du pourcentage du périmètre du milieu humide occupé par des milieux naturels.

    ** Notez que dans le cas d'une mosaïque ou d'un complexe, l'occupation des terres hautes considérée est celle de l'ensemble de ses parties. Calculée par la cartographie.*

13. Fragmentation : évalue l'intégrité d'un milieu humide selon le pourcentage de la superficie originale du milieu humide qu'occupe le plus gros fragment.

    ** Notez que dans le cas d'une mosaïque ou d'un complexe, la fragmentation considérée est celle de l'ensemble de ses parties. Calculée par la cartographie ou par le biologiste. Utilisé dans le cas des mosaïques. Si aucun milieu n'est regroupé (mosaïque), le pourcentage est de 100 %.*

14. Espèces exotiques envahissantes : évalue l'intégrité d'un milieu humide et les menaces existantes et potentielles par la présence d'espèces exotiques envahissantes telles que définies par le RSPEE (2011) et White et coll. (1993). La présence de phragmite entraîne automatiquement la plus basse note.

15. Projets de conservation : considère le statut de conservation du milieu humide, actuel ou projeté. Le fait qu'un milieu humide soit pressenti comme milieu compensatoire n'est pas pris en compte.

16. Forme du milieu humide : évalue la résilience ou la fragilité d'un milieu humide, i.e. un plus grand rapport périmètre/superficie (formule : $(P/S) \times (\sqrt{(S/\pi)})$) augmente les chances d'effet de bordure (perturbation). Par contre, il peut augmenter la diversité d'habitats.

    ** Notez que dans le cas d'une mosaïque, la forme du milieu humide considérée est celle de l'ensemble de ses parties. Calculée par la cartographie.*

17. Activités récréatives : évalue l'utilisation d'un milieu par la population aux fins récréatives.

La valeur écologique globale d'un milieu humide lui est attribuée en fonction de la répartition suivante :

Valeur faible :	39% et moins
Valeur moyenne :	entre 40% et 59%
Valeur élevée :	60% et plus

** Pour une mosaïque ou un complexe, la valeur attribuée à celle-ci est la plus haute note obtenue par l'une de ses parties.*

Les limites entre les classes ont été déterminées sur la base de l'examen d'une population de 17 milieux humides de nature variée. Ces limites pourront être sujettes à changement et le MDDELCC sera notifié de toute modification quant à ces limites ou à tout autre élément de la méthodologie.

Tableau 1. Grille d’évaluation de la valeur écologique des milieux humides

Critère	*Valeur*	*Importance / pondération*	*Critère / Pointage*	*1*	*2*	*3*	*Total*
1	Valeur écologique et hydrologique	3	**Type de milieu humide**	Marécage arboré et tourbière ombrotrophe	Eau peu profonde, tourbière minérotrophe, herbier aquatique et marécage arbustif	Mosaïque, complexe de milieux humides et marais d'eau douce et d'eau salée	
2	Valeur écologique	1	**Superficie**	Moins de 0,5 ha	0,5 à 5 ha	Plus de 5 ha	
3	Valeur écologique	2	**Hydroconnectivité**	Absence	Fossé et cours d'eau intermittent	Cours d'eau permanent	
4	Valeur écologique et hydrologique	3	**Connectivité avec les milieux naturels environnants**	Moins de 33 % de la zone tampon est composée de milieux naturels	Entre 33 et 66 % de la zone tampon est composée de milieux naturels	Plus de 66 % de la zone tampon est composée de milieux naturels	
5	Valeur écologique et de conservation	3	**Perturbations**	Site très perturbé par les activités humaines (ex : friche, coupe totale)	Site moyennement perturbé (ex : coupe partielle)	Site naturel non perturbé	
6	Valeur de biodiversité	3	**Présence d'espèces à statut particulier**	Absence	Présence potentielle d'espèces à statut particulier et présence confirmée d'espèces vulnérables à la récolte	Présence confirmée d'au moins une espèce menacée, vulnérable ou susceptible d'être désignée	
7	Valeur de biodiversité	2	**Richesse relative**	Comprend de 1 à 2 strates verticales ou horizontales	Comprend 3 ou 4 strates verticales ou horizontales	Comprend de 5 strates verticales ou horizontales ou plus	
8	Valeur de biodiversité	1	**Unicité de l'habitat à l'échelle du bassin versant**	Stade successionnel jeune	Peuplement en transition	Peuplement au stade climacique	
9	Valeur de biodiversité	2	**Rareté relative**	Représente moins de 10 % de ce type de milieu humide	Représente entre 10 et 25 % de ce type de milieu humide	Représente plus de 25 % de ce type de milieu humide	
10	Valeur de biodiversité	1	**Richesse spécifique**	Pauvre	Moyenne	Élevée ou très élevée	
11	Valeur hydrologique	3	**Capacité de filtration**	Milieu humide isolé	Milieu humide sous l'influence d'un cours d'eau/avec ruissellement	Milieu humide riverain	
12	Valeur de conservation	2	**Occupation des terres hautes**	Moins de 33 % du périmètre est naturel	Entre 33 et 66 % du périmètre est naturel	Plus de 66 % du périmètre est naturel	
13	Valeur de conservation	2	**Fragmentation**	Le plus gros fragment occupe moins de 33 % de la superficie totale	Le plus gros fragment occupe entre 33 et 66 % de la superficie totale	Le plus gros fragment occupe plus de 66 % de la superficie totale	
14	Valeur de conservation	2	**Espèces exotiques envahissantes**	Forte présence d'espèces indésirables ou présence de phragmite	Présence occasionnelle d'espèces indésirables	Absence d'espèces indésirables	
15	Valeur de conservation	2	**Projets de conservation**	Aucun projet connu	Projet en cours mais non-encore approuvé	Fait l'objet d'un projet de conservation	
16	Valeur de conservation	1	**Forme du milieu humide**	Plus de 4	Entre 3 et 4	Moins de 3	
17	Valeur de conservation	1	**Activités récréatives**	Aucun indice d'utilisation par l'homme	Quelques indices d'utilisation par l'homme	Plusieurs indices d'utilisation par l'homme	
Valeur écologique globale							
			Total sur 102				
			Total en pourcentage				

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TABLEAU 2 - Caracteristiques des tron9ons echantillonnes a Saguenay

Type d'Gcoulemant

Substrat

du lit du COUB d'eau

V6g•tation riveralne en % de recouvrvment

vegetation aquatiqua en¾da recouvromant

limon

Umon

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A	inter.	lent.	520	30	10	130	20	0	0	0	argite	sable	clalre	2,1	abruple	50	20	30	0	0	0	120	0	2 a 6	Faible	N
B	inler.	'°L iam	100	30	5	150	25	1	3	0	sable,	limon	claire	1	abrupte	70	30	0	0	0	0	60	0	7	Faible	N
C	inter.	lot EV	200	40	15	120	35	> 10	> 10	1	sable															

claire	1	abruple	100	0	0	5	0	0	270	0	**8** a 11	Nul	N	**N**

grav1er

D	Inlet .	lol. lam.	40	10	3	Perte du cour"S d'eeu dans le sol					organ1que	sable	claire	0.2	douce	0	0	100	0	0	0	0	0	12	Nul	N	N
A	inter.	lol. EV	100	50	15	80	30	• **5**	•5	1 +	sable,	gravier	cleire	0.7	abruple	100	0	0	0	0	0	**0**	0	13, 14	Nul	**N**	**N**
B	inler.	lent. & lot. lam	175	Succession de bassins reli6s par un r6seeu lanlOl sous terre, lanlOt en surface							organique	nla	nla	0,1	deuce	0	0	100	0	0	0	0	0	15 a 19	Nul	N	**N**

ensemenc4!1s

RD:50

dans le lil (80DJ.)

0

du aux barrages

timon bloc el argile RG 1.0

limon RG: 0,8 a 8

I-euage RG: 0,3

- 10

n l a	claire	0.7	moderee	0	0	0	**s.o**	0	0	20, 21	Deux lacs arlificiels

D	Inter .	lent.	30	30	5	Porte du couc:> d"cau da ns re :s:0 1	Of'gan1que	n/a	claire	0,3	mod6r6e	0	0	100	0	0	0	0	**0**	**22, 23**	Nul	**N**	**N**

A	inler.	lol. lam.	90	**30**	3	**150**	**13**	0	**0**	0	erg e

claire	1.7	abruple	30	70	0	0	**80**	0	0	0	25	Faible	F	F

3	**B**	inter.	lol. lem,	110	30	**5**	**150**	15	**0**	**0**	0	organique	argile	claire	1,7	abruple	**R0:80**	RG:50	RG:50	0	0	**0**	**0**	0	**26**	Faible	***N***	F
	C	Inter	lot. lam,	140	20	3	110	13	**0**	**0**	**2**	arganique	argile	claire	1,7	abruple	RO: 100	RG :50	RG:50	0	0	0	0	0	**24,** 27	Nul	N	N
4	**A**	inter.	lot. EV	320	50	5	150	**15**	>5	3	1 +	limon	sable	cleire	1,5	abruple	250 m avel = 70 % herbac6es, 30 % arbusles 70 m amont = 100 % arbusles			0	0	0	215	0	**28,** 29	Nul	N	N
	A	perm ,	lol. lam.	275	Tronyon 8 dimensions variebles dUi.\ la presence de 8 barrages de castors (H (m) =[0,7: 1,7)), et 8 8tengs (diam lre (m) = [5: 15])						9 +	argile	organique	claire	RG:1,5a6 RD :<6	variable	30	35	35	0	0	0	156	0	30 a 33	Nul	N	N

lent	225	200	50	dlJ aux barrages	0	0	0

n/a	0 turbide 34 36	Nul 1,2	N abruple	N	80	20	0	0	0	0	0	

C	inter.	lenl.	100	20	2	Sousn1veau aquet		0	0	0	orgamque	n/a	lurbide	0,5	moderee	30	70	0	Beaucoup d'herbe	0	0	37	Nul	N	N
D	inter.	lanL	40	100	s.o.	70	0,12	2	0	2															

A	fnler .	kJt EV	100	90	1 5	150	35	>10	,1	1 +	sable,	caillou,r;, gravier,	ciaire	RD ; < B	variable	0	0	100	0	0	0	325	0	.41 c\43	Nul	N	N
B	inter.	lot. lam.	345	90	15	150	35	>15	•5	pis	sable,	gravler	claire	RD: 0,8	variable	0	0	100	0	0	0	46	0	44 a45	Nul	N	N
C	inler,	lot. lam.	360	40	<5	50	15	> 10	0	0	argile	gravier	claire	RD: 1,5 RG :0,9	abruple	RG: 10 RO :50	RG : 10 RD : 40	RG :80 RO: 10	0	0	0	0	0	38 a 40	Nul	N	N
A	inter.	IOI. lam .	190	120	15	160	25	> 20	> 20	pis a	limon,	gravier	claire	RD: 1,2	douce	3	92	5	0	0	0	101	0	46 a 52	Nul	N	N
A	perm,	lot. EV	85	150	15	210	23		5	1 +	sable galel	gravier, argile, cailloux	ciaire	0,5	douce	0	30	70	0	0	0	332	0	53, 54	Nul	N	N

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ANNEXE IV

DONNEES BRUTES DE L'INVENTAIRE DES COURS D'EAU

Cours d'eau	**Tron on**	**Segment**	**Longueur du segment (m)**	**Largeur du cours d'eau (littoral) (m)**	**Superficie du littoral (m2)**	**Superficie de la bande riveraine (m2)**	**Principales caracteristiques du tron on**
6 *	CE100	CE100.1	59,1	5,7	336,78		Ce tronc;:on a ecoulement permanent presente une pente abrupte (+30%) sur une courte portion de la rive gauche. La hauteur de talus y est a peu pres de 6m. Le cours d'eau devient intermittent vers l'amont avant de disparaitre. La vegetation riveraine etait arborescente et dominee par le peuplier baumier *(Popu/us balsamifera)* et le frene rouge *(Fraxinus pennsylvanica),* tandis que la vegetation du littoral etait dominee par des herbacees comme le carex crepu *(Carex crinita)* et le calamagrostide du Canada *(Calamagrostis canadensis).*
		CE100.2	87,5	3,4	297,46		
		CE100.3	29,2	3,7	107,88		
		CE100.4	21,3	1,2	25,53		
		total	**197,0**		**767,65**	**15 870,13**	
	CE101	CE101.1	**s.o.**	resurqence	**s.o.**		Ce tronc;:on a ecoulement permanent est tout de meme intermittent a sa naissance. Les rives a pente generalement douce presentent une portion abrupte (+30%) en rive gauche vers l'amont. La hauteur de talus pour cette section est de 6 m. La vegetation du littoral etait largement dominee par le carex crepu *(Carex crinita)* accompagne de frene rouge *(Fraxinus pennsylvanica),* de pyrole a feuille d'asaret *(Pyrola asarifolia)* et d'impatiente du Cap *(Impatiens capensis).* La vegetation riveraine etait tres semblable avec quelques especes de plus (Gadellier lacustre *(Ribes lacustre),* frene noir *(Fraxinus nigra)* et trientale boreale *(trientalis borealis))*
		CE101.2	41,1	1,9	78,12		
		CE101.3	**42,1**	5,5	**231,42**		
		CE101.4	18,7	**3,5**	**65,34**		
		total	**101,9**		**374,88**	**7 200,52**	
7	CE103	CE103.1	85,7	2,5	214,37		Ce tronc;:on presente un ecoulement intermittent puisque l'eau passe sous le sol par endroits. Le tronc;:on caracterise prend naissance dans un ponceau sous le remblai de gravier. Ce tronc;:on ne presente ni pente abrupte, ni talus de plus de 5 m. La vegetation du littoral presentait un faible recouvrement et etait dominee par l'impatiente du Cap *(Impatiens capensis),* tandis que la vegetation riveraine etait arbustive et dominee par le gadellier *(Ribes* sp.), du sapin baumier *(Abies balsamea)* et du noisetier a long bee *(Cory/us cornuta)*
		CE103.2	58,0	9,6	556,94		
		total	**143,8**		**771,32**	**3 326,81**	
1	CE105	CE105.1	132,0	1,5	197,99		Ce trom;on a ecoulement permanent ne presente pas de rives abruptes, ni de talus de plus de 5 m. II prend naissance dans une resurgence a l'oree d'un champ agricole qu'il traverse ensuite. La vegetation du littoral ainsi que la vegetation riveraine etaient dominees par le calamagrostide du Canada *(Calamagrostis canadensis)* accompagne d'eupatoire maculee *(Eupatorium maculatum)* sur le littoral et de framboisier d'Europe *(Rubus idaeus),* de cerisier de Virginie *(Prunus virginiana)* et de peuplier baumier *(Popu/us balsamifera)* sur la rive.
		CE105.2	383,7	1,5	575,54		
		CE105.3	**64,7**	0,9	58,26		
		CE105.4	**69,6**	**0 ,9**	**62,68**		
		CE105.5	51,5	1,2	61,81		
		CE105.6	117,8	**0,8**	**94,22**		
		total	**819,3**		**1 050,50**	**16 640,37**	

Cours d'eau	Tron on	Segment	Longueur du segment (m)	Largeur du cours d'eau (littoral) (m)	S1.1perfii;ie dIJ littoral (m2)	Supei:ficie de la bande riveraine (m2)	Principales caracteristiques du tron1,on
10 *	CE106	CE106.1	s.o .	resurqence	s.o.		Cetronc;:on prend naissance dans une zone de resurgence suivie d'une zone d'ecoulement anastamose intermittent. L'ecoulement devient ensuite permanent. Les rives presentent une section plus abrupte (+30%) en rive droite avec une hauteur de Talus de 7m a cet endroit. Ce tronc;:on traverse une ancienne coupe forestiere. La vegetation riveraine etait dominee par le peuplier faux-tremble *(Populus tremuloides)* et le framboisier d'Europe *(Rubus idaeus),* tandis que la vegetation du littoral etait dominee par l'aulne rugueux (A/nus *incana* ssp. *rugosa)* et la glycerie melicaire *(Glyceria melicaria).*
		CE106.2	39,5	0,3	11,86		
		CE106.3	41,4	0,5	20,69		
		total	**80,9**		**32,55**	**880,11**	
8 *	CE107	CE107.1	175,5	2,3	403,55		Ce tronc;:on a ecoulement permanent presente des rives trop abruptes (+30%) et encombrees (debris de coupe) sur une hauteur de plus de 10 m pour y acceder de fac;:on securitaire. Ce tronc;:on fait partie des zones impactees par les barrages de castors. La vegetation riveraine est tres perturbee, a la fois par les coupes recentes et par les castors. La vegetation n'a pu etre inventoriee convenablement pour des raisons de securite, mais l'aulne rugueux *(A/nus incana* ssp. *rugosa)* et le peuplier faux-tremble *(Populus tremuloides)* semblaient dominer.
		CE107.2	95,7	2,3	220,00		
		CE107.3	92,3	2,3	212,32		
		total	**363,4**		**835,86**	**11 013,48**	
9	CE108	CE108.1	**48,7**	1,5	**73,0 4**		Ce tronc;:on a ecoulement permanent traverse une zone de regeneration parsemee de chablis. Les pentes des rives sont douces (-30%). Ce tronc;:on est perturbe par un reseau de barrages de castors. La vegetation du littoral etait dominee par l'aulne rugueux (A/nus *incana* ssp. *rugosa)* et la ronce pubescente *(Rubus pubescens),* tandis que la vegetation riveraine etait dominee par le peuplier faux-tremble *(Populus tremuloides),* l'erable rouge *(Acer rubrum)* et l'erable a epis *(Acer spicatum).*
		total	**48,7**		**73,04**	**1 263,76**	
2	CE109	CE109.1	s.o .	resurgences	s.o.		Ce tronc;:on a ecoulement permanent prend naissance dans une zone d'ecoulement diffuse et intermittente dont la source est probablement un etang artificiel en amont. Les pentes des rives sont douces (-30%). La vegetation du littoral etait dominee par la glycerie melicaire *(Glyceria melicaria)* et l'aulne rugueux *(A/nus incana* ssp. *rugosa),* tandis que la vegetation riveraine etait largement dominee par le sapin baumier *(Abies balsamea)* accompagne de peuplier faux-tremble *(Populus tremuloides).*
		CE109.2	16,8	0,9	15,16		
		CE109.3	29,9	0,5	14,94		
		CE109.4	55,4	1,2	66,46		
		CE109.5	s.o.	intermittent	s.o.		
		total	**102,1**		**96,56**	**2 136,15**	

Cours d'eau	Tron on	Segment	Longueur du segment (m)	Largeur du cours d'eau (littoral) (m)	Superficie du littoral (m2)	Superficie de la bande riveraine (m2)	Principales caracteristiques du tron on
	CE110	CE110.1	44,2	1,8	79,57		Ce tronc;:on a ecoulement permanent semble de nature anthropique. Les bandes de protection riveraines sont tres restreintes et n'atteignent meme pas le haut du talus de 1,5 m. De part et d'autre du cours d'eau, la vegetation prend la forme d'une jachere ou les herbacees sont tres diverfifiees (verge d'or rugueuse (*So/idago* rugosa), paturin (Poa sp), etc.)), tandis que la vegetation du littoral est dominee par le jonc epars *(Juncus* effusus) et la verge d'or graminifoliee *(Solidago graminifolia).*
		CE110.2	38,5	1,6	61,60		
		total	**82,7**		**141,17**	**1 560,66**	
3	CE111	CE111.1	**33,9**	**6,0**	203,13		Ce tronc;:on presente d'abord un ecoulement intermittent prenant naissance dans une aulnaie (zone de resurgence); le lit d'ecoulement rejoint ensuite la friche herbacee. Dans la portion traversant l'aulnaie, la vegetation des rives et du littoral etait arbustive avec une nette dominance de l'aulne rugueux *(A/nus incana* ssp. rugosa) accompagne de glycerie melicaire *(Glyceria melicaria)* et d'impatiente du Cap *(Impatiens* capensis). La partie dans la friche herbacee presentait tres peu de vegetation du littoral, tandis que la vegetation riveraine etait celle de la friche adjacent (Potentille tridentee *(Potentilla tridentata),* verge d'or graminifoliee (*Solidago graminifolia),* Aster ponceau *(Aster puniceus),* etc.)
		CE111.2	**36,9**	**0,3**	11,G7		
		CE111.3	46,1	1,7	**78,30**		
		CE111.4	**67,2**	1,3	87,35		
		CE111.5	**120,8**	2,4	**289,8 7**		
		total	**304,8**		**669,72**	**6 601,93**	
6*	**CE112**	CE112.1	**76,1**	**3,0**	**228,27**		Ce tronc;:on a ecoulement permanent commence au niveau du remblai de gravier du port et s'ecoule vers le nord perpendiculairement a la route. l'ecoulement y est regule par un petit barrage de castor. Le lit du cours d'eau s'approche assez de la route pour se joindre au fosse de drainage de celle-ci pour une section. Apres ce passage pres de la route, toute l'eau emprunte le lit d'ecoulement naturel du cours deau qui rejoint les tronc;:ons CE100 et CE101 un peu plus loin. La pente des rives est generalement de moins de 30% a !'exception de deux sections.r emierement,la rive droite au niveau de la section empruntant le fosse de la route presente une pente superieure a 30%, et ce, sur une hauteur approximative de 8 m. L'autre rive abrupte se trouve en rive gauche, vers la fin du tronc;:on et presente une pente de plus de 30% sur une hauteur de 4 m. La vegetation du littoral etait dominee par les herbacees comme la glycerie r elicaire *(G/yceria melicaria)* et l'impatiente du Cap *(Impatiens* capensis) mais presente egalement une bonne couverture d'aulne ruguJux *(A/nus incana* ssp. rugosa). Surles rives, la vegetation devenait arborescente et dominee par le sapin baumier *(Abies* ba/samea) et le peuplier baumier *(Popu/us balsamifera).* a !'exception de la rive droite le long de la section empruntant le fosse longeant la route. A cet endroit, la vegJtation etait coupee (incluant arbres et arbustes) et le tout etait rejete dans le fosse.
		CE112.2	**41,1**	**2,5**	**102,80**		
		CE112.3	**38,8**	**2,5**	**96,98**		
		CE112.4	**24,1**	**4,2**	101,03		
		CE112.5	**29,1**	**1,9**	**55,35**		
		CE112.6	37,0	**2,0**	**73,94**		
		CE112.7	**80,7**	**1,9**	**153,39**		
		CE112.8	**70,5**	**2,2**	**155,08**		
		CE112.9	**33,8**	7,1	**240,24**		
		CE112.10	**32,4**	**1,2**	**38,85**		
		CE112.11	**22,2**	**1,0**	**22,24**		
		CE112.12	**21,0**	**1,9**	**39,87**		
		CE112.13	**64,2**	**2,8**	**179,88**		
		CE112.14	**68,3**	**2,0**	**136,57**		
		CE112.15	**35,9**	**2,1**	**75,35**		
		total	**675,2**		**1 699,84**	**30 702,00**	

Cours **d'eau**	Tronc;Qn	Segment	Longueur du **segment** (fll)	Largeu r du cours d'eau **(littoral)** **(m)**	Superficie du littoral (m2)	Superficie de la b r,de **riveraine** (m2)	Principales caracteristique dutronc;on
5	CE113	CE113.1	14,8	1,5	22,18		Ce tronc;on a ecoulement permanent semble de nature anthropique. II s'agit probablement d'un ancien fosse de drainage de coupe. Plusieurs barrages de castor en aval provoquent de la retention d'eau et expliquent probablement la presence d'une zone de marecage arbustif. Autrement, la vegetation du littoral etait essentieliement herbacee et composee de calamagrostide du Canada *(Cafamagrostis* canadensis}, d'impatiente du Cap *(Impatiens* capensis} et de glycerie melicaire *(Gfyceria meficaria},* tandis que la vegetation riveraine etait dominee par le calamagrostide du Canada *(Cafamagrostis* canadensis} accompagne de frene noir *(Fraxinus nigra},* d'eupatoire maculee *(Eupatorium macufatum)* et de peuplier baumier *(Popufus bafsamifera}.*
		CE113.2	31,1	3,5	109,00		
		CE113.3	33,7	3,5	117,95		
		total	**79,6**		**249,1**	**1 996,65**	
Grand total			**2 999,44**		**6 762,21**	**99192,58**	

s.o. = sans objet

* Trorn;:ons presentant une pente de plus de 30 % sur au mains une partie d'une au des deux rives

Annexe AddA-B

Scories

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 * (Grenville)	A **	B	C				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**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**> 1**	*0,08*			
Capacité de neutralisation	**eq/kg**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**<3**	*0,4*			
Chrome hexavalent (Cr 6+)	**mg/kg**	**NA**	**NA**	**6**	**10**	**NA**	**NA**		*<0,4*			
Soufre	**%g/g**	**NA**	**0,4**	**2**	**2**		-	**< 0,2**	*<0,01*			
Matière assimilée à une matière dangereuse												
Biphényles polychlorés totaux	**mg/kg**	**NA**	**0,2**	**1**	**10**		**50**		*<0,01*			
Halogènes organiques totaux	**mg/kg**	**NA**					**1500**		*<200*			
Huiles et graisses (C10C50)	**mg/kg**	**NA**	**300**	**700**					*<100*			
Matière corrosive												
pH	**pH**	**NA**	**NA**	**NA**	**NA**		**>2; <12,5**		*10,2*			
Matière lixiviable												
Métaux - Lixiviation												
Arsenic	**mg/l**	**NA**	**NA**	**NA**	**NA**	**0,01**	**5**			*<0,004*		
Baryum	**mg/l**	**NA**	**NA**	**NA**	**NA**	**1**	**100**			*0,24*	*0,006*	*0,015*
Bore	**mg/l**	**NA**	**NA**	**NA**	**NA**	**5**	**500**			*0,1*		
Cadmium	**mg/l**	**NA**	**NA**	**NA**	**NA**	**0,005**	**0,5**			*<0,002*	*<0,001*	*<0,001*
Chrome	**mg/l**	**NA**	**NA**	**NA**	**NA**	**0,05**	**5**			*0,008*	*<0,007*	*0,008*
Cuivre	**mg/l**	**NA**	**NA**	**NA**	**NA**	**1**	**-**			*0,17*	*<0,003*	*0,009*
Fer	**mg/l**	**NA**	**NA**	**NA**	**NA**	**-**	**-**				*<0,1*	*<0,1*
Mercure	**mg/l**	**NA**	**NA**	**NA**	**NA**	**0,001**	**0,1**			*<0,01*	*<0,0005*	*<0,0005*
Nickel	**mg/l**	**NA**	**NA**	**NA**	**NA**	**-**	**-**			*0,011*	*<0,006*	*<0,006*
Plomb	**mg/l**	**NA**	**NA**	**NA**	**NA**	**0,01**	**5**			*<0,01*	*<0,001*	*<0,001*
Sélénium	**mg/l**	**NA**	**NA**	**NA**	**NA**	**0,01**	**1**			*<0,005*	*0,001*	*<0,001*
Uranium	**mg/l**	**NA**	**NA**	**NA**	**NA**	**0,02**	**2**			*<0,02*		
Zinc	**mg/l**	**NA**	**NA**	**NA**	**NA**	**-**	**-**			*<0,2*	*<0,005*	*<0,005*
Nitrates+nitrites	**mg/l**	**NA**	**NA**	**NA**	**NA**	**10**	**1000**			*<0,2*		
Nitrites	**mg/l**	**NA**	**NA**	**NA**	**NA**	**1**	**100**			*<0,2*		
Fluorures totaux	**mg/l**	**NA**				**1,5**	**150**			*<1*		
Matière toxique												
Biphényles polychlorés totaux	**mg/kg**	**NA**	**0,2**	**1**			**50**		*<0,01*			
Composés phénoliques (Phénols-4AAP)	**mg/l**									*<0,04*		
Cyanure d'hydrogène	**mg/kg**						**250**		*<1*			
Sulfure d'hydrogène	**mg/kg**						**500**		*3*			
Métaux Extractibles Totaux												
Argent	**mg/kg**	**2**	**0,5**	**20**	**40**				*<0,5*			
Arsenic	**mg/kg**	**10**	**5**	**30**	**50**				*<5*			
Baryum	**mg/kg**	**200**	**200**	**500**	**2000**				**220**			
Cadmium	**mg/kg**	**0,9**	**0,9**	**5**	**20**				*<0,5*			
Chrome	**mg/kg**	**45**	**45**	**250**	**800**				*14*			
Cobalt	**mg/kg**	**25**	**25**	**50**	**300**				*<2*			
Cuivre	**mg/kg**	**50**	**50**	**100**	**500**				**94**			
Fer	**mg/kg**	**-**	**-**	**-**	**-**				27000			
Étain	**mg/kg**	**5**	**5**	**50**	**300**				**6**			
Manganèse	**mg/kg**	**1000 (1445)**	**1000**	**1000**	**2200**				**2200(5)**			
Mercure	**mg/kg**	**0,6**	**0,2**	**2**	**10**				*<0,02*			

Paramètres	Unités	Critères génériques pour les sols(1)				Normes de potabilité²	Normes du RMD³	Valeur du Guide de valorisation	Résultats Scories NAIC			
		A * (Grenville)	A **	B	C				Autres tests selon RMD ou Guide de valorisation	Lixiviation RMD TCLP-1311	Lixiviation pluies acides⁴ TCLP - 1312	Lixiviation à l'eau⁴ 3 CTEU-9
Molybdène	**mg/kg**	**6**	**2**	**10**	**40**				*<1*			
Nickel	**mg/kg**	**30**	**30**	**100**	**500**				*2*			
Plomb	**mg/kg**	**50**	**30**	**500**	**1000**				*<5*			
Zinc	**mg/kg**	**120**	**120**	**500**	**1500**				*<10*			

(1) Critères génériques pour les sols du guide de Protection http://www.mddelcc.gouv.qc.ca/sol/terrains/guide-intervention/guide-intervention-protection-rehab.pdf consultés le 9 septembre 2016 utilisés pour comparaison selon le Guide de valorisation. Pour les teneurs de fond, Critère A, les valeurs révisées pour la province géologique de Grenville ont été utilisées. La deuxième colonne donne les valeurs de fond les plus faibles toutes provinces géologiques confondues.

(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

(5) résultat égal au critère C

(6) Les résultats sont inférieurs à 200; 25; 50 et 50 mg/kg respectivement exprimés en chlore; fluor; brome et iode extractible

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

Votre # de commande: 120020874
Votre # du projet: COMPLETE
Votre # Bordereau: N-A

Attention:Renée Rossignol

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Date du rapport: 2016/09/21
Rapport: R2193259
Version: 3 - Révisé

CERTIFICAT D'ANALYSE – RÉVISÉ

 # 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
Capacité de neutralisation (1)	1	2016/08/10	2016/08/10		
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 R3 m
Réactivité: cyanures d'hydrogène (2)*	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
Addition de paramètres pour les métaux	1	N/A	2016/07/15	n/a	n/a
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
Huiles et graisses totales lixiviés*	1	2016/07/15	2016/07/15	STL SOP-00175	MA. 415-HGT 2.0 R1 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 (2)*	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 (2)*	1	2016/07/15	2016/07/15	QUE SOP-00153	MA. 405 – C 1.1 r2 m
Halogènes organiques totaux (HOT) (3)	1	N/A	N/A		

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.

Votre # de commande: 120020874
Votre # du projet: COMPLETE
Votre # Bordereau: N-A

Attention:Renée Rossignol

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Date du rapport: 2016/09/21
Rapport: R2193259
Version: 3 - Révisé

CERTIFICAT D'ANALYSE – RÉVISÉ

 # DE DOSSIER MAXXAM: B644082
Reçu: 2016/07/07, 13:35
(1) Cette analyse a été effectuée par CEAEQ - Laval
(2) Cette analyse a été effectuée par Maxxam - Québec
(3) Cette analyse a été effectuée par Exova - PC

* Maxxam détient l'accréditation pour cette analyse selon le programme du MDDELCC.
*** Cette analyse ne fait pas partie du programme d'accréditation du MDDELCC.

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
==
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.

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

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							
Argent (Ag)	mg/kg	**2**	20	40	<0.5	0.5	1634596
Arsenic (As)	mg/kg	**6**	30	50	<5	5	1634596
Baryum (Ba)	mg/kg	**200**	500	2000	**220**	5	1634596
Cadmium (Cd)	mg/kg	**1.5**	5	20	<0.5	0.5	1634596
Chrome (Cr)	mg/kg	**85**	250	800	14	2	1634596
Cobalt (Co)	mg/kg	**15**	50	300	<2	2	1634596
Cuivre (Cu)	mg/kg	**40**	100	500	**94**	2	1634596
Etain (Sn)	mg/kg	**5**	50	300	**6**	4	1634596
Fer (Fe)	mg/kg	**-**	-	-	27000	10	1634596
Manganèse (Mn)	mg/kg	**770**	1000	2200	2200	2	1634596
Mercure (Hg)	mg/kg	**0.2**	2	10	<0.02	0.02	1634596
Molybdène (Mo)	mg/kg	**2**	10	40	<1	1	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

MÉTAUX LIXIVIÉS (SOLIDE)

ID Maxxam		CP9964		CP9965		
Date d'échantillonnage		2016/07/06		2016/07/06		
# Bordereau		N-A		N-A		
	Unités	**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						
Baryum (Ba)	mg/L	0.006	1635419	0.015	0.005	1638409
Cadmium (Cd)	mg/L	<0.001	1635419	<0.001	0.001	1638409
Chrome (Cr)	mg/L	<0.007	1635419	0.008	0.007	1638409
Cuivre (Cu)	mg/L	<0.003	1635419	0.009	0.003	1638409
Fer (Fe)	mg/L	<0.1	1635419	<0.1	0.1	1638409
Mercure (Hg)	mg/L	<0.0005	1635419	<0.0005	0.0005	1638409
Nickel (Ni)	mg/L	<0.006	1635419	<0.006	0.006	1638409
Plomb (Pb)	mg/L	<0.001	1635419	<0.001	0.001	1638409
Sélénium (Se)	mg/L	0.001	1635419	<0.001	0.001	1638409
Zinc (Zn)	mg/L	<0.005	1635419	<0.005	0.005	1638409

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

Dossier Maxxam: B644082
Date du rapport: 2016/09/21

Les Minéraux Harsco
Votre # du projet: COMPLETE
Votre # de commande: 120020874

MÉTAUX LIXIVIÉS (SOLIDE)

ID Maxxam		CQ0778		
Date d'échantillonnage		2016/07/06		
# Bordereau		N-A		
	Unités	**SCORIE-NAIC -TCLP 1311**	**LDR**	**Lot CQ**
% HUMIDITÉ	%	0	N/A	N/A
MÉTAUX				
Arsenic (As)	mg/L	<0.004	0.004	1635747
Baryum (Ba)	mg/L	0.24	0.005	1635747
Bore (B)	mg/L	0.1	0.1	1635747
Cadmium (Cd)	mg/L	<0.002	0.002	1635747
Chrome (Cr)	mg/L	0.008	0.007	1635747
Cuivre (Cu)	mg/L	0.17	0.02	1635747
Fer (Fe)	mg/L	110	2	1635747
Mercure (Hg)	mg/L	<0.01	0.01	1635747
Nickel (Ni)	mg/L	0.011	0.006	1635747
Plomb (Pb)	mg/L	<0.01	0.01	1635747
Sélénium (Se)	mg/L	<0.005	0.005	1635747
Uranium (U)	mg/L	<0.02	0.02	1635747
Zinc (Zn)	mg/L	<0.2	0.2	1635747

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

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
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

PARAMÈTRES CONVENTIONNELS-LIXIVIAT LABO (SOLIDE)

ID Maxxam		CQ0778		
Date d'échantillonnage		2016/07/06		
# Bordereau		N-A		
	Unités	**SCORIE-NAIC -TCLP 1311**	**LDR**	**Lot CQ**
% HUMIDITÉ	%	0	N/A	N/A
CONVENTIONNELS				
Fluorure (F)	mg/L	<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

HYDROCARBURES LOURDS-LIXIVIAT LABO (SOLIDE)

ID Maxxam		CQ0778		
Date d'échantillonnage		2016/07/06		
# Bordereau		N-A		
	Unités	**SCORIE-NAIC -TCLP 1311**	**LDR**	**Lot CQ**
% HUMIDITÉ	%	0	N/A	N/A
HUILES ET GRAISSES				
Huiles et graisses totales	mg/L	<3.0	3.0	1635768

LDR = Limite de détection rapportée
Lot CQ = Lot contrôle qualité
N/A = Non Applicable

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

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

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

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

REMARQUES GÉNÉRALES

Tous les résultats sont calculés sur une base sèche excepté lorsque non-applicable.

État des échantillons à l'arrivée: BON

Le rapport a été ré-émis en raison de l'ajout de métaux (Ag, As, Ba, Co, Sn, Mn et Mo) sur l'échantillon CP9963-01R tel que demandé par le client le 29 août 2016 par courriel.
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.

HYDROCARBURES LOURDS-LIXIVIAT LABO (SOLIDE)

Veuillez noter que les résultats n'ont été corrigés ni pour la récupération des échantillons de contrôle de qualité, ni pour le blanc de lixiviat.

Veuillez noter que le blanc fortifié et le blanc de méthode n'ont pas suivi les étapes de filtration 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

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	Arsenic (As)	2016/07/15		134	%
			Cadmium (Cd)	2016/07/15		112	%
			Chrome (Cr)	2016/07/15		114	%
			Cobalt (Co)	2016/07/15		117	%
			Cuivre (Cu)	2016/07/15		113	%
			Manganèse (Mn)	2016/07/15		107	%
			Mercure (Hg)	2016/07/15		101	%
			Molybdène (Mo)	2016/07/15		111	%
			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	Argent (Ag)	2016/07/15		95	%
			Arsenic (As)	2016/07/15		99	%
			Baryum (Ba)	2016/07/15		100	%
			Cadmium (Cd)	2016/07/15		96	%
			Chrome (Cr)	2016/07/15		99	%
			Cobalt (Co)	2016/07/15		97	%
			Cuivre (Cu)	2016/07/15		102	%
			Etain (Sn)	2016/07/15		100	%
			Fer (Fe)	2016/07/15		101	%
			Manganèse (Mn)	2016/07/15		98	%
			Mercure (Hg)	2016/07/15		102	%
			Molybdène (Mo)	2016/07/15		98	%
			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	Argent (Ag)	2016/07/15	<0.5		mg/kg
			Arsenic (As)	2016/07/15	<5		mg/kg
			Baryum (Ba)	2016/07/15	<5		mg/kg
			Cadmium (Cd)	2016/07/15	<0.5		mg/kg
			Chrome (Cr)	2016/07/15	<2		mg/kg
			Cobalt (Co)	2016/07/15	<2		mg/kg
			Cuivre (Cu)	2016/07/15	<2		mg/kg
			Etain (Sn)	2016/07/15	<4		mg/kg
			Fer (Fe)	2016/07/15	<10		mg/kg
			Manganèse (Mn)	2016/07/15	<2		mg/kg
			Mercure (Hg)	2016/07/15	<0.02		mg/kg
			Molybdène (Mo)	2016/07/15	<1		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

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
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
			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	Baryum (Ba)	2016/07/15	<0.005		mg/L
			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	Baryum (Ba)	2016/07/15		98	%
			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

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			Chrome (Cr)	2016/07/15	<0.007		mg/L
			Cuivre (Cu)	2016/07/15	<0.02		mg/L
			Fer (Fe)	2016/07/15	<2		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	%
			Fer (Fe)	2016/07/15		96	%
			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	%
1635768	SBH	BL. LIXIVIAT	Huiles et graisses totales	2016/07/15	<3.0		mg/L
1635768	SBH	Blanc fortifié	Huiles et graisses totales	2016/07/15		95	%
1635768	SBH	Blanc de méthode	Huiles et graisses totales	2016/07/15	<3.0		mg/L
1635850	CB8	MRC	Cyanures d'hydrogène	2016/07/15		101	%
1635850	CB8	Blanc de méthode	Cyanures d'hydrogène	2016/07/15	<1		mg/kg
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	Baryum (Ba)	2016/07/21	<0.005		mg/L
			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	Baryum (Ba)	2016/07/21		103	%
			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	%

RAPPORT ASSURANCE QUALITÉ (SUITE)

Lot AQ/CQ	Init	Type CQ	Groupe	Date Analysé	Valeur	Réc	Unités
			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

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:

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Tester, eta lonner, c onseiller.

Certificat dranalyses

Attention : Martine Lepage	
Client : Maxxam Analytique Inc.	
adresse : 889, Montee de Liesse St-Laurent, Quebec H4T 1P5	

No de certificat :	1 6-7 4 0753
Version :	1
Date de reception :	2016-08-04
Votre projet :	B644082
No. de commande :	----
No. de client :	00039 1

Resultats exprimes en base humide sauf indication contraire.

Identification					CP9963-0 1R/
Identificatio n (suite)					SCORIE-NAIC
Matrice					Solide
Date de prelevement					2016-07-06
Lieu du prelevement					NA
Preleve par					Client
No de laboratoire					3172619
Parametres		Unites	Date Preparation	 Analyse	Resultat(s)
HalogenesOrganiques Totaux					
- en chlore extractible	x	mg/kg	2016-08-04	2016-08-04	<200
- en fluor extractible		mg/kg	2016 -08 -04	2016 -08 -04	<25
- en brome extractible	x	mg/kg	2016-08-04	2016-08-04	<50
- en iode extractible		mg/kg	2016-08-04	2016-08-04	<50

Commentaires:

Methodes d'analyse: Annexe I
Controle de qualite : Annexe II
Cette version remplaceet annule toute version anterieure, le cas echeant.

Chimi ste :

Oana Pascuta
2014-102

2016-08-05

Note : Ces resul tats ne se rapportent qu'aux echantillons soumis pour analyse.

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Tester, etalonner, conseiller.

Certificat d'analyses

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Client: Maxxam Analytique Inc.
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St-Laurent, Quebec
H4T 1P5

No de certificat : 16-740753
Version: 1
Date de reception : 2016-08-04
Votre projet : B644082

No. de commande :
No. de client: 000391

Annexe I

Parametres	No. de methode ou reference	Instruments ou techniques
Halogenes Organiques Totaux		
- en chlore extractible	E-A-EN-EN-FL-PC-MD008	IC
- en fluor extractible		Electrode selective
- en brome extractible	E-A-EN-EN-FL-PC-MD008	IC
- en iode extractible		IC

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H4T 1P5

No de certificat : 16-740753
Version: 1
Date de reception : 2016-08-04
Votre projet : B644082

No. de commande :
No. de client: 000391

Annexe II

1aentificat1on		Blanc analyse	Duplicata d'echantillon			Materiaux de reference		
Parametres	Unites	Resultats	No de laboratoire	Resultats 1	Resultats 2	Valeurs	Ecarts	Obtenus
Halogenes Organiques Totaux								
- en chlore extractible	mg/kg	< 200	----	----	----	1000	800 - 1200	979
- en fluor extractible	mg/kg	< 25	----	----	----	----	----	----
- en brome extractible	mg/kg	< 50	----	----	----	500	400 - 600	452
- en iode extractible	mg/kg	< 50	----	----	----	----	----	----

NA : Non applicable

Note : Ces r8sultats ne se rapportent qu'aux 8chantillons soumis pour analyse.

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Centre d'expert/se
en analyse
envlronnementale

Direction de !'analyse chimique
850 boul. Vanier
Laval (Quebec) H7C 2M7
Tel.: 450 664-1750
Fax: 450 661-8512

Certificat d'analyse

Client:
Maxxam Analytique-Montreal
889, Montee de Liesse
Saint-Laurent (Quebec) H4T 1PS

Norn de projet: Maxxam Analytique inc. (MTL)
Responsable: Maxxam Analytics
Telephone: 514-448-9001
Code projet client:

Date de reception: 14 juillet 2016
Numero de dossier: L037615
Bon de commande: B644082
Code projet CEAEQ: 1199

Numero de l'echantillon: L037615-01

Preleveur:
Description de l'echantillon: CP9965-02R \ SCORIE-NAIC
Description de prelevement:
Point de prelevement:
Nature de l'echantillon: sol ou sediment

Date de prelevement: 6 juillet 2016

Capacite de neutralisation

Methode: MA. 110 - C. neu 1.0
Date d'analyse: 18 juillet 2016

	Resultat	Unite	**LDM**
Capacite de neutralisation	0,4	eq/kg	0,1

Les resultats ne se rapportent qu'il /'echantillon soumis ii /'analyse.

J'atteste avoir formellement constate ces faits

Certificat approuve le 9 aoCit 2016

Helene Supper

Helene Supper, chimiste
Contaminants inorganiques, Laval

Legende:

ABS: Absence	*ND: Non detecte*	*RNF: Resul/at non disponible*	*VR: Voir remarque*
DNQ: Resultat entre la LDM et la LQM	*ST: Sous-traitance*	*NOR: Detecte - Mais ne satisfait pas le rapport isotopique*	
INT: Interferences -Analyse impossible	*PR: Presence*	*TN/: Colonies trop nombreuses pour etre identinees*	

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Version 1 (1098349)

Annexe AddA-C

Objectifs environnementaux de rejets préliminaires (OER)

Tableau 1 : **Usine de fonte en gueuse a Saguenay**

Objectifs environnementaux de rejet preliminaires pour l'effluent des eaux de procede (15,8 m^3/h ou 379 m^3/d) ***PRELIMINAIRE***

23 sc tembrc 2016;

Contaminants	Usages	Critercs mg/L	Concentraflons allouees al'cffluent< >¹ ing/L	PerioJ:lcs .. d'application.
Conventionnels				
Dermn_de biochinique en oxygt\ne (5 jouri;)	CVAC	3,0	3,0	Annee
Matieres en suspension.	CVAC	17,0 (2)	17,0 *	Année
Phospjic,re t_llt.iil (tlllliL'.PL	CVAC	—	0,03 •	15 mai-14 oct.
Metaux				
Chrorre total	CVAC	0,011 (3)	0,011 *	Année
Cuivre	CVAC	0,0057 (4)	0,0057 *	Année
Fer	CVAC	1,3	1,3 *	Année
Zinc	CVAC	0,074 (4)	0,074 *	Annee
Substanc s otganiques				
Cyclohexylal11in _	CVAC	0,2 (5)	0,2 *	Annee
tvlorpholi1Je	CVAC	0,48	0,48 *	Annee
Autres para_'!lHres _				
A:zote ammniacal (estival)(mg/L-N)	CVAC	, .1.22 ,, (6)	1,22 •	l" juin-30 nov.
Azote arnnoniacal (hivemal)(N)	..CVAC	1,9. ,, (6)	J,9 •	ler dec-31 m1i
ch·, ; tesidue1 total -• - -:;f:: - i-:?	1s: VAC	0,0020	_0,002_0 ,, (7)	Annee
Chlorures	CVAC	230	230 •	Annee
Hydrocarbures _petrolie_rs (c,ftso).			i ( )_	Annee
Nitrates (mg!J,,:N)	CVAC	2,9	2,9 •	Annee
Nitrosamines	CVAC	a venir	a venir	Annee
pH			-- 6,S 11_9_ (10)	Annee
Sulfates	CVAC	500	500 i (II)•	Annee
Sulfrtes	CVAC	02?0.	0,20 •	Annee
T ll]l_eratu_ e	CVAC		(12)	Annee
Essais de toxicite				
Toxicite aigu(l	VAFe	1 UTa	I UTa (13)	Annee
Toxicite chronique	CVAC	I lffc	l UTc (14)	Annee

VAFe: Valcur aigui!finale a!'effluent

CVAC: Critere_de vi _aqu_atique chronigue

\+ Les concentrations allouees a!'effluent marquees d'un ast6risque doivent'eii ctfvisecs par i avantcl'etrc comparecs a la concentration attendu Atcfflucnt o ll a la moy 111\e dt! 4o cs.

(1) Pour !es differents contaminants, cctte concentration doit correspondre a la fraction totalc a ('exception des metaux pour lcsg_uels elle doit correspondrc A la fr_action extractiblc totale.

(2)-Le calcul du critere des inatieres en suspension (MES) correspond a une augmentation de 5 mg/L par rapport a la concentration naturellc. Ccllc-ci a etc evaluec a partir de la concentration medianc de 12 mg/L provcnant des donnees de la caracterisation initiate des cours d'eau reccpteurs (SNC-Lavalin, 2016).

(3) Bien qu'il existc un critcre de qualite pour des formcs spccifiques de ce contaminant, l'OER est etabli pour la; .forme totale. Une analyse des diffcrentes formes permet de preciser le risque lorsque la concentration mesuree a!'effluent est superieurc J 1'9E_}!..._

(4) Critcre calculfpour un milieu recept ur dont ladurctc e:ii de56,5 mgiLCaC()3 scion lcs donnecs de la caracterisation initi e d.es cows d'e<1_u recepteurs (SNC-Lavalin, 2016).

.Tableau 1 : Usine de fonte en gueuse a Saguenay

Objectifs environnementaux de rejet preliminaires pour l'effluent des eaux de procede (15,8 m^3/h ou 379 m^3/d) *PRE LIMINAIRE*

;.: 23 eptembre 2016

.. (5) Le crit re du cyclohexyla.mine est une evaluation j)reliminai_re realisee par le JvtI)pELCC (I. Guay, 2005).

"(6) L ; c-;iti s applicables 1 l'azote ammoniacaJ sont det rmines pour une tem¢riture de 20 °C en ete et de 7 . °C en hiver et pour une vaJeur mediane de pH de 7 selon !es donnees de la caracterisation initiale des cours ..d'eau rect,pJeurs.

i(7) Pour le chlore residue! total (CR'[), la concentration respecter a l'effluerit'c<?_[esp ,:fiJa la valeur la plus ; basse entre l'OER et la valeur aigue finale (VAFe). Dans A cas d'un rejet ccmtr i, l'OER est de 0,002 mg/L et la VAFe est de 0,031 mg!L. La concentration a respecte l' fflJJep.Jfserait dolfi de 0,00 2 mg/L. Cette valeur est superieure au seuil de detection de l'appareil pr yu luvrnteur, soit 0,001 mg/L.

. - - -- -··· - --··· ..-,_, . / J:. :--.-:.) --,: it ' ':¾=-- - -'/ - if!"

"(8) Ence qui concerne 1£ .hydrocarbure lf,i :rfeur dlversitlpetfn - @Jeffient de specifier une gamme de toxicite, c'est pour i on r ti n. {™ntyafil3Uf guide d'interventi<mi · qu'un OER. En considerant !'absence . de dilution, Ia va1j guide1 t£q;o; L sert orientertl ftniseen place des meilleures pratiques d'operation de meilleures if ehnologiei{u tilhit;se menti

"(9) Pour le suivi de j ntamin · - rJm utiliser des methodes analytiques ayant une limite de detection plus , petite ou egale !Wl/OER, Les parametres suivants ont une limite de detection plus elevee que l'OER : hydrocarbures petroliers C10-Cso 0,1 mg/L.

Pour ce parametre, I'absence de detection a la limite precisee precedemment sera interpretee comme le r.espect de l'OER.

f10) Cette exigence de pH, requise dans la majorite des reglements existants sur !es-rejets industriels, satisfai-t l'objectif de protection du milieu aquatique.

f11). Ce critere s'applique a des eaux dont la durete est inferieure a 100 mg/L CaCO3 et dont la concentration en ., chlorures est inferieure a 5_mg/L.

ti2) L'augmentation artificieOe de la temperature de l'eau ne doit pas causer le deplacement ou la modification des populati<>JlS, alterer Jes ne1_sensibles ou tuer le _o_rganjsmes vivant a proximite.

(I 3);L'unite toxique aigue (UTa) correspon_d a 100/CL50 (%v/v) (CL50 : concentration letale pour 50 % des organismes testes). Les essais de toxicite_demandes sont specifies a !'annexe I .

l14) L'u te toxique chronlque (UTc) cor/espond a I 00/CSEO (CSEO : oncentration sans effet observable) ou I 00/CI25 (CI25: concentration inhibitrice pour 25% des organismes testes). Les essais de toxicite demandes sont specifies a !'annexe I.

Les resultats de suivi doivent etre exprimes en concentration totale pour tousles contaminants, a l'exception des metaux pour lesquels ils doivent etre exprimes en metal extractible total. La forme extractible totale d'un metal est celle contenue dans un echantillon non filtre. Elle correspond a la somme du metal dissous et du metal lie aux particules, sans digestion du reseau silicate (CEAEQ, 2012).

5.5 Toxicite globale de I'effluent

Le controle de la toxicite des eaux usees a l'aide d'essais de toxicite permet d'integrer les effets cumulatifs de la presence simultanee de plusieurs contaminants, de meme que l' influence des substances toxiques non mesurees.

L'effluent des eaux de procede ne doit pas depassel'.Jme unite toxiaue poufl s essais de toxicite aigue (1 UTa) et une unite toxique pour les essais . to ci · 6111.ique (l UTc). Les essais de toxicite recommandes pour verifier l tq icite de l' flp'.J'lfi:s o" . ifej!es a!'annexe 1.
I fl r #:i!A ! ,J tP!! i!I

Dans une situation o4Jl n'y a plls qjt esf rtJj 4ihJtlolfr ge,J fluent dans le milieu recepteur, comme c'est le ca.fici, l'apsenee{Ue Joiiclfeliigpe]a,{fel11.ti ni n'assure pas, a elle seule, la protection des orgi1is es':ciquatig'µ } iil?Wsls tl} uh tejet continu. Le suivi de la toxicite chronique s'avere !,' "· - set1tie1 pO@] f rifier l''impact potentiel que peut presenter !'effluent final sur les organ· s i.uati'l;l¼es:du'ifnil1eu recepteur.
iL +1h,;;c

Appendix D

Atmospheric Emissions

Table of Contents

List of Tables

Each source of emission to the atmosphere as well as the hypotheses used for the calculations are presented in the sections below. *Emissions are estimated for a production of 110% of nominal capacity. The modifications of the text appear in italic while the modified values in the table of the ESIA appear in bold.*

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		1.70
N_2 + Ar		63.8
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
Éthane	**0,34**	**2,9**
Butane	**0,23**	**2,0**
n-pentane	**0.28**	**2.5**
n-hexane	**0.2**	**1.7**
Formaldehyde	**8.13×10^{-3}**	**0.1**
Benzene	**2.28×10^{-4}**	**< 0.1**
Toluene	**3.96×10^{-4}**	**< 0.1**
p-dichlorobenzene	**1.30×10^{-4}**	**< 0.1**
NH_3	**0.00**	**0.00**

Contaminants	Emission Rate	
	(kg/h)	(T/year)
CO_2	31,689	277,592
CH_4	0.28	2.45
N_2O	0.25	2.18
GHG CO_2eq	-	278,320

« N » : volume at standard conditions (0 °C, 101.3 kPa, humide base)
« R » : volume at MDDELCC at reference conditions (25 °C, 101.3 kPa, dry base)
« A » : volume at actual conditions (T °C, 101,3 kPa, humid base)

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 feed gas to the preheater and Table D1.3 shows the preheater emissions fluegas.

Table D1.2 Composition of Gases fed to the Gas Preheater

	Process Gas	Natural Gas
	v/v	v/v
H_2	confidential information provided under separate cover	-
CO		-
CO_2		0.64
CH_4		95.70
N_2		1.84
H_2O		-
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		4.0E-04
NH_3		-

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%. *CO_2 emissions were calculated by carbon footprint depending on the chemical composition of natural gas (Table D1.2) and process gas while assuming complete combustion. For* *two other greenhouse gases (CH_4 and N_2O), the emission parameters of the Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere (RMRCECA) for the combustion of natural industrial use were considered.*

Sulphur dioxide (SO_2) emissions based on complete oxidation of sulfur in the gas mixture (process gas + natural gas) were calculated using the following operating parameters and gas mixture caloric supply of 254.2 GJ/h (70.6 MW):

Process gas: hydrogen sulfide (H_2S) concentration of 13 ppmv (18.6 mg S/Nm^3)

Natural gas: H_2S and thiol concentrations of respectively 1.8 ppmv (2.64 mgS/Nm^3) et 8 mg/Nm^3 (3.03 mgS/Nm^3)

Emission factor: (18.6 mgS/Nm^3 x 2 914 Nm^3/h + 5.67 mgS/Nm^3 x 6,118 Nm^3/h) x (64 mg SO_2/32 mgS) / 254.2 GJ/h = 694 mg SO_2/GJ =~ 0,7 g SO_2/GJ

The organic compounds emission factors were extracted from the AP-42 compilation of US EPA for burning natural gas in a boiler or equivalent (Section 1.4). As shown in table D1.1 and table D1.3, the TOC emissions consist of ethane, butane, pentane and hexane with traces of formaldehyde, benzene, toluene and dichlorobenzene. These emission factors were applied in the calculations of emission rate using the total heat input to the furnace, which comes from natural gas and process gas. For the rest of the presentation of emissions by sources and emission point, the emissions of ethane and butane are removed from the tables as though they are part of all TOC, they are not subject to ambient air standards MDDELCC, unlike the other listed compounds.

Table D1.3 Estimate of Atmospheric Emissions from the Gas Preheater

Parameters		Load
Power at supply point (MW HHV)		70.6
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		8.7
H_2O		18.2
O_2		1.70
N_2+Ar		71.3
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)	0.18
PMt = $PM_{2.5}$	3.2 (2)	0.81
TOC	4.6 (2)	1.18
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**
VOCs	2.3 (2)	0.59
Éthane	**1,3 (2)**	**0,33**
Butane	**0,9 (2)**	**0,23**
n-pentane	**1,1 (2)**	**0,28**
n-hexane	**0,8 (2)**	**0,19**
Formaldehyde	**$3,2 \times 10^{-2}$ (2)**	**0,01**
Benzene	**$9,0 \times 10^{-4}$ (2)**	**< 0,01**
Toluene	**$1,4 \times 10^{-3}$ (2)**	**< 0,01**
p-dichlorobenzene	**$5,0 \times 10^{-4}$ (2)**	**< 0,01**
CO_2	55,189 (4)	14,027
CH_4	0.97 (5)	0.28
N_2O	0.86 (6)	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/MMpi³: CO: 84, PM: 1.9, TOC:11, VOCs:5.5).
(3) Based on an average sulfur content of 5.7 mg/Nm³ in natural gas.
(4) Representative emission factor for carbon balance in natural gas and process gas while considering a complete combustion.
(5) RMRCECA emission factors (natural gas/industrial use).
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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 off gas from the CO_2 removal unit to b*e 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 fed to the Sulfur Oxidizer

	Off Gas	Natural Gas
	10,230 Nm^3/h	71,5 Nm^3/h
	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
NH_3	**1.4E-03**	**-**

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 (AP-42). *All the assumptions are presented in the table footnotes. The emissions were calculated based on the total heat value of natural gas and off gas, which is 0.84 MW at supply point, with the exception of specific organic compounds (pentane, hexane, formaldehyde, benzene, toluene, dichlorobenzene) for which only the caloric content of natural gas (0.76 MW) was considered.*

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+Ar		12.4
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
n-pentane	**1,1**	**< 0.01**
n-hexane	**0,8**	**< 0.01**
Formaldehyde	**3.2E-2**	**< 0.01**
Benzene	**9.0E-4**	**< 0.01**
Toluene	**1.4E-3**	**< 0.01**
Dichlorobenzene	**5.0E-4**	**< 0.01**
CO_2	5 844 220	17,662
CH_4	0.966 (5)	0.003
N_2O	0.861 (5)	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/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 and 243 mg/Nm³(170 ppmv) in the off gas

(4) Representative emission factor for carbon footprint on the natural gas and process gas while considering a complete combustion.

(5) RMRCECA emission factors (natural gas/industrial use).

Sulphur dioxide (SO_2) emissions based on complete oxidation of sulfur in the gas mixture (process gas + natural gas) were calculated using the following operating parameters and gas mixture caloric supply of 3.02 GJ/h (0.84 MW):

Process gas: flowrate of 10,230 Nm^3/h; heat value of 0.04 MJ/Nm^3 under residual H_2, CO and CH_4; H_2S concentration of 170 ppmv (243.4 mgS/Nm^3); H_2S concentration of 170 ppmv (243.4 mgS/Nm^3)

<u>Natural gas</u>: flowrate of 71.5 Nm^3/h ; heat value of 38.3 MJ/Nm^3; H_2S and thiol concentrations of respectively 1.8 ppmv (2.64 mgS/Nm^3) and 8 mg/Nm^3 (3.03 mgS/Nm^3)

Emission factor: (243,4 mgS/Nm^3 x 10 230 Nm^3/h + 5,67 mgS/Nm^3 x 71,5 Nm^3/h) x (64 mg SO_2/32 mgS) / 3,02 GJ/h = 1,648,000 mg SO_2/GJ = 1,648 g SO_2/GJ

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 mass balance approach was considered for the following operating parameters.*

<u>Natural Gas</u>: heat value of 38.3 MJ/Nm^3; H_2S et thiol concentrations of respectively 1.8 ppmv (2.64 mgS/Nm^3) and 8 mg/Nm^3 (3.03 mgS/Nm^3)

Emission factor: 5,67 mgS/Nm^3 x (64 mg SO_2/32 mgS) / 38,3 MJ/Nm^3 = 0,3 mg SO_2/MJ = 0,3 g SO_2/GJ

RMRCECA emissions factors were used to calculate GHG emissions from combustion.

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 Auxiliary 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
Natural Gas consumption (kg/h)	**62.4**	**312.2**
Natural Gas consumption (Sm^3/h)	88.2	441.0
Natural 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+Ar	71.8	71.8
Gas velocity at the stack (m/s)	**2.5**	**12.5**
Stack diameter (m)	0.50	
Stack height (m)	10	

Contaminants	Emission Factors	Emission Rate		Emission Rate	
	(g/GJ)	(kg/h)	(t/a)	(kg/h)	(t/a)
NOx	18 (1)	0.06	**0.49**	0.29	0.06
CO	35.4 (2)	0.11	**0.96**	0.57	0.11
SO_2	0.3 (3)	0.001	**0.01**	0.005	< 0.01
PMt = $PM_{2.5}$	3.2 (2)	0.00	**0,09**	0.05	0.01
TOC	4.6 (2)	0.01	**0,13**	0.07	0.01
VOCs	2.3 (2)	0.01	**0,06**	0.04	0.01
n-pentane	**1,1 (2)**	**< 0.01**	**0.03**	**0.02**	**< 0.01**
n-hexane	**0,8 (2)**	**< 0.01**	**0.02**	**0.01**	**< 0.01**
Formaldehyde	**$3,2 \times 10^{-2}$ (2)**	**< 0.01**	**< 0.01**	**< 0.01**	**< 0.01**
Benzene	**$9,0 \times 10^{-4}$ (2)**	**< 0.01**	**< 0.01**	**< 0.01**	**< 0.01**
Toluene	**$1,4 \times 10^{-3}$ (2)**	**< 0.01**	**< 0.01**	**< 0.01**	**< 0.01**
Dichlorobenzene	**$5,0 \times 10^{-4}$ (2)**	**< 0.01**	**< 0.01**	**< 0.01**	**< 0.01**
CO_2	**49,010 (4)**	**157**	**1,344**	**785**	***157***
CH_4	0.966 (4)	< 0,01	**0,03**	0,02	***< 0,01***
N_2O	0.861 (4)	< 0,01	**0,02**	0,01	***< 0,01***
GHG CO_2eq	-		**-**	1 352	-

(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 $lb/MMpi^3$: 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) RMRCECA emission factors (natural gas/industrial use).

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 (WS-531F)
- Gasses from the quenching and cooling water vent (WS-430F)

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 a total flue gas of 135* Nm^3/h*. The composition of the gas from the degasser vent is confidential and provided under separate cover.*

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.

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.

US-EPA AP42 emission factors for industrial flares (new version 2015) were used *for* NO_X*, CO, total VOC, TOC and particulate matter caused by the vented gas and process gas incineration.* CO_2 *emissions were calculated by carbon balance depending on the chemical composition of natural gas and process gas (Table D1.2) and assuming a 98% combustion efficiency. The combustion efficiency was also used for the* CH_4 *emission calculation. For* N_2O*, the RDOCECA emission factor for the combustion of natural gas (industrial use) was considered. As the AP-42 emission factors are not available for specific organic compounds (formaldehyde, benzene, etc.) issued by industrial flares, these emissions are not calculated for the incineration of vented and process gas. VOCs Emissions from table D1.7 come only from the burning of natural gas by the pilot. Given the high temperatures of the flare emissions, the impact on modeling results and ambient concentrations is negligible.*

SO_2 *emissions based on complete oxidation of sulfur in the gas mixture (vented gas + process gas + natural gas) were calculated for continuous emission and start-up/shutdown events. For continuous emission, vented gas does not contain sulfur. Only the SO2 generated by the sulfur in the pilot natural gas is calculated. The heat supply of the vented gas combined the flare pilot gas would reach 1.34 GJ/h.*

Gaz naturel: supply flowrate of 14.3 Nm^3/h, heat value of 38.3 MJ/Nm^3; H_2S et thiol concentrations of respectively 1.8 ppmv (2.64 mgS/Nm^3) and 8 mg/Nm^3 (3.03 mgS/Nm^3)

Emission factor: *5,67 mgS/Nm^3 x 14,3 Nm^3/h x (64 mg SO_2/32 mgS) / 1,34 GJ/h = 121 mg SO_2/GJ = 0,1 g SO_2/GJ*

As for the events of start-up and shut down, sulfur in the incinerated process gas is considered in the calculation of SO_2. The heat supply of the vent gases, the process gas and the pilot flare would raise to 101,9 GJ/h.

Gaz naturel: supply flowrate of 8,000 Nm^3/h; heat value of 12.7 MJ/Nm^3; H_2S concentrations of 13 ppmv (18.6 mgS/Nm^3)

Emission factor: (18.6 *mgS/Nm^3 x 8,000 Nm^3/h + 5,67 mg SO_2/Nm3 x 14,3 Nm3/h) x (64 mg/SO2/ 32 mgS) / 101,9 GJ/h = 2,922 mg SO_2/GJ = 2,9 g SO_2/GJ*

Table D1.7 Estimate of Atmospheric Emissions from the Flare

Parameters		Continuous Emissions		Events	
Annual use (h/year)		8760		16	
Incinerated gas consumption (kg/h)		144		4925	
Incinerated Gas consumption (Nm^3/h)		**135**		8000	
Calorific value of Incinerated Gas (MJ/Rm^3)		**9.9**		**12.7**	
Incinerated Gas consumption (GJ/h, HHV)		1.34		102	
Incinerated Gas velocity (m/s)		20		20	
Contaminants	**Emission Factors (g/GJ)**		**Emission Rate (kg/h)**		
		(kg/h)	**(t/a)**	**(kg/h)**	**(t/a)**
NO_X	29.2 (1),(2)	0.04	**0.34**	2.98	**0.05**
CO	133 (1), 35.4 (2)	0.12	**1.09**	13.6	**0.22**
SO_2	(continuous) 0,1 (3) (event) 2,9 (3)	< 0.01	**< 0.01**	**0,30**	**< 0.01**
PM	81.7 (1) 3.2 (2)	0.07	**0.58**	8.33	**0.13**
TOC	246 (1) 4.64 (2),	0.20	**1.72**	25.1	**0.40**
VOCs	245 2.32 (2),	0.19	**1.70**	25.0	**0.40**
n-pentane	**1,1 (2)**	**< 0.01**	**< 0.01**	**0**	**0**
n-hexane	**0,8 (2)**	**< 0.01**	**< 0.01**	**0**	**0**
Formaldehyde	**$3,2 \times 10^{-2}$ (2)**	**< 0.01**	**< 0.01**	**0**	**0**
Benzene	**$9,0 \times 10^{-4}$ (2)**	**< 0.01**	**< 0.01**	**0**	**0**
Toluene	**$1,4 \times 10^{-3}$ (2)**	**< 0.01**	**< 0.01**	**0**	**0**
Dichlorobenzene	**$5,0 \times 10^{-4}$ (2)**	**< 0.01**	**< 0.01**	**0**	**0**
CO_2	(continuous) 109,821 (4) (event) 52,532 (4)	146.7	**1285**	5355	**86**
CH_4	2.80 (5)	0.59	**5.16**	26.3	**0.42**
N_2O	0.57 (6)	< 0.01	**0.01**	0.05	**< 0.01**
GHG CO_2eq	-		**1,393**		**95**

(1) AP42 emission factors for industrial flares applicable to vented gas and process gas
(2) AP42 emission factors for natural gas combustion (pilote)
(3) Mean emission factor calculated based on the average sulfur content of 5.7 mg/Nm^3 in natural gas and 10 mg/Nm^3 in vented gas. For events, a sulfur content of 18.6 mg/Nm^3 in the process gas is considered.
(4) Based on the carbon/CO_2 vents gas and process gas balance with a 98% combustion efficiency. For natural gas burned by the pilot, a RDOCECA emission factor is used.
(5) Based on the balance sheet CH4 in the vent gas and process gas with a 98% combustion efficiency (2% of CH4 emitted to the atmosphere). For natural gas burned by the pilot, a RMRCECA emission factor is used.
(6) of emission factors RMRCECA (natural gas / industrial use).

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 (Nm³/h)		482,067
Dry reference volumetric flowrate (Rm³/h)		522,172
Temperature (°C)		71
Actual volumetric flowrate (Am³/h)		607,867
Typical composition (% volume)		
CO_2		0.54
H_2O		0.77
O_2		20.3
N_2+Ar		**75.3**
Stack diameter (m)		4.1
Gas velocity at the stack (m/s)		10.8
Stack height (m)		33.1
Contaminants		
NOx	6.14	53.8
CO	1.66	14.5
SO_2	0.01	0.05
PMt = $PM_{2.5}$	4.88	42.8
TOC	0.70	6.14
VOCs	0.65	5.73
n-pentane	**0.02**	**0.19**
n-hexane	**0.02**	**0.13**
Formaldehyde	**< 0.01**	**0.01**
Contaminants		
Benzene	**< 0.01**	**< 0.01**
Toluene	**< 0.01**	**< 0.01**
Dichlorobenzene	**< 0.01**	**< 0.01**
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

(1) Average operation on a full cycle of the electric arc furnace, which includes the fumes from the furnace (Table D1.9), the combustion gas from preheater burners ladles (Table D1.10), the vents of the hoppers and reactor feed silos and oven and fluxes, as well as the ambient air drawn through the hoods.

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_2 before 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 *(754 600 Nm^3/h vs. 433 400 Nm^3/h during the fusion*. 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/Nm^3 at the exit of the baghouse. This approach can be described as conservative since the expected performance is below 5 mg/Nm^3.

No emission rates were calculated for the other contaminants in the absence of specific emission factors. It is also expected that the sulfur and the specific organic compounds will be absent in the inputs to the EAF.

Table D1.9 Estimate of Atmospheric Emissions from the Electric Arc Furnace

Parameters	EAF
Production (T of metal per cycle)	120
Anode consumption (kg/h)	115
DRI consumption (kg/h)	69,850
Flue Gas	
Standardized volumetric flowrate (Nm^3/h)	6,033
Temperature (°C)	500
Actuel volumetric flowrate (Am^3/h)	17,084
Typical composition (% volume)	
CO_2	34.50
H_2O	0.46
O_2	0.0
N_2+Ar	65.1

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
n-pentane	**0**	**0**
n-hexane	**0**	**0**
Formaldehyde	**0**	**0**
Benzene	**0**	**0**
Toluene	**0**	**0**
Dichlorobenzene	**0**	**0**
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 AP42 emission factor for CO is reduced by 98% since the gas generated by the furnace is treated in post-combustion and drop-out box.
(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: Input (DRI: 5%; Graphite electrodes: 100%); Output: (Smelting: 3.9%; Slag: 0.07%); . The residual carbon balance (input - output) is found in the fumes from the furnace in form of CO_2

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 Nm^3/h. *These combustion gases will be captured by the ventilation hoods of the smelting and casting building and routed to the associated baghouse.*

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). *For* SO_2 *emission, a mass balance approach of sulfur in natural gas was considered for the following operating parameters.*

Natural gas: Heat valueof 38.3 MJ/Nm^3*;* H_2S *and thiols concentrations of 1.8 ppmv (2.64* mgS/Nm^3*) and 8* mg/Nm^3 *(3.03* mgS/Nm^3*), respectively*

Emission factor: $5.67\ mgS/Nm^3 \times (64\ mg\ SO_2/32\ mgS) / 38.3\ MJ/Nm^3 = 0{,}3\ mg\ SO_2/MJ = 0.3\ g\ SO_2/GJ$

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
Natural gas consumption (kg/h)		**394.3**
Natural gas consumption (Sm^3/h)		557.0
Natural gas consumption (GJ/h, HHV)		20.2
Flue gas (10% of excess air)		
Standardized volumetric flowrate (Nm^3/h)		6,056
Temperature (°C)		400
Actual volumetric flowrate (Am^3/h)		14,930
Typical composition (% volume)		
CO_2		8.74
H_2O		17.68
O_2		1.73
N_2+Ar		71.8
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)	0.01
PMt = $PM_{2.5}$	3.2 (2)	0.06
TOC	4.6 (2)	0.09
VOCs	2.3 (2)	0.05
n-pentane	1.1	0.02
n-hexane	0.8	0.02
Formaldehyde	3.2 x 10^{-2}	< 0.01
Benzene	9.0 x 10^{-4}	< 0.01
Toluene	1.4 x 10^{-3}	< 0.01
Dichlorobenzene	5.0 x 10^{-4}	< 0.01
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 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 into the atmosphere (Natural gas / industrial use).

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. *Other contaminants (VOCs) are not emitted by these dust collectors.*

Table D1.11 A5, A6 and A7-Estimate of Atmospheric Emissions from the Transfer, Storage and Screening Buildings

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+Ar	76.8		76.8		76.8	
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 $_{2.5}$ (1)	0.13	1.16	0.22	1.93	0.13	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 (A) of fines, dust, dried mud and bentonite handling zone;*
- *The baghouse (B) of the briquettes' mixer/compactor/dryer zone;*
- *The baghouse (C) of the briquette storage silos zone;*
- *The flue gas of the dryer of the sludge from the water treatment unit;*
- *The flue gas of 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

Evacuation gas from briquetting plant		Normal Load
Standardized volumetric flowrate (Nm^3/h)		**36,199**
Dry reference volumetric flowrate (Rm^3/h)		**38,205**
Temperature (°C)		**50**
Actual volumetric flowrate (Am^3/h)		**42,828**
Typical composition (% volume)		0
CO_2		**0.3**
H_2O		**3.3**
O_2		**19.7**
N_2+Ar		76.7
Stack diameter (m)		**1.0**
Gas velocity at the stack (m/s)		**15.1**
Stack height (m)		23.0
NO_x	0.06	0.56
CO	0.14	1.23
SO_2	< 0.01	0.01
PMt = $PM_{2.5}$	**0.36**	**3.18**
TOC	0.02	0.16
VOCs	0.01	0.08
n-pentane	**< 0.01**	**0.04**
n-hexane	**< 0.01**	**0.03**
Formaldehyde	**< 0.01**	**< 0.01**
Benzene	**< 0.01**	**< 0.01**
Toluene	**< 0.01**	**< 0.01**
Dichlorobenzene	**< 0.01**	**< 0.01**
NH_3	0	**0**
CO_2	0	**0**
CH_4	196.25	**1719**
N_2O	< 0.01	**0.03**
GHG CO_2eq	-	**1,732**

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 *while SO_2 emissions were calculated on the basis of complete oxidation of sulfur in natural gas.*

Emissions from dryer of the briquettes are shown in Table D1.13.

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
Natural gas consumption (kg/h)	**28.8**
Natural gas consumption (Sm^3/h)	40.6
Natural gas consumption (GJ/h, HHV)	1.5
Flue Gas (10% of Excess Air)	
Standardized volumetric flowrate (Nm^3/h)	442
Temperature (°C)	150
Actual volumetric flowrate (Am^3/h)	684
Typical composition (% volume)	
CO_2	8.74
H_2O	17.7
O_2	1.7
N_2+Ar	71.8

Contaminants	Emission Factors (g/GJ)	Emission Factors (kg/h)
NOx	16 (1)	0.02
CO	35.4 (2)	0.05
SO_2	0.3 (3)	< 0.01
PMt = $PM_{2.5}$	3.2 (3)	0.01
TOC	4.6 (2)	0.01
VOCs	2.3 (2)	< 0.01
n-pentane	**1.1 (2)**	**< 0.01**
n-hexane	**0.8 (2)**	**< 0.01**
Formaldehyde	**3.2×10^{-2} (2)**	**< 0.01**
Benzene	**9.0×10^{-4} (2)**	**< 0.01**
Toluene	**1.4×10^{-3} (2)**	**< 0.01**
Dichlorobenzene	**5.0×10^{-4} (2)**	**< 0.01**
CO_2	49,010 (2)	72
CH_4	0.966 (2)	0.01
N_2O	0.861 (2)	< 0.01

(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 into the atmosphere (natural gas/ industrial use).

Natural gas: Heat value of 38.3 MJ/Nm^3; H_2S and thiols concentrations of 1.8 ppmv (2.64 mgS/Nm^3) and 8 mg/Nm^3 (3.03 mgS/Nm^3), respectively

Emission factor: 5.67 mgS/Nm^3 x (64 mg SO_2/32 mgS) / 38.3 MJ/Nm^3 = 0,3 mg SO_2/MJ = 0.3 g SO_2/GJ.

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 of 66* Nm^3/h. 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 CO. PM. TOC. total VOC and specific organic compounds emissions 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 same emission factor presented in section D1.6.1 is used to estimate* SO_2 *emissions. The emissions of the sludge dryer are presented in Table D1.14.*

Table D1.14 Estimate of Atmospheric Emissions from the Sludge Dryer

Parameters		Normal operation
Power at supply point (MW HHV)		0.70
Higher heating value (HHV) of the gas (MJ/kg)		38.3
Natural gas consumption (kg/h)		**49.3**
Natural gas consumption (Sm^3/h)		69.6
Natural gas consumption (GJ/h, HHV)		2.5
Drying Gas		
Standardized volumetric flowrate (Nm^3/h)		757
Temperature (°C)		**150**
Actual volumetric flowrate (Am^3/h)		**1,173**
Typical composition (% volume)		
CO_2		8.74
H_2O		17.7
O_2		1.73
N_2+Ar		71.8
Contaminants	**Emission Factors (g/GJ)**	**Emission Rate (kg/h)**
NOx	16 (1)	0.04
CO	35.4 (1)	0.09
SO_2	0.3 (2)	< 0.01
PMt = $PM_{2.5}$	3.2 (3)	0.01
TOC	4.6 (2)	0.01
Total VOCs	2.3 (2)	0.01
n-pentane	**1.1 (2)**	**< 0.01**

Contaminants	Emission Factors (g/GJ)	Emission Rate (kg/h)
n-hexane	**0.8 (2)**	**< 0.01**
Formaldehyde	**3.2×10^{-2} (2)**	**< 0.01**
Benzene	**9.0×10^{-4} (2)**	**< 0.01**
Toluene	**1.4×10^{-3} (2)**	**< 0.01**
Dichlorobenzene	**5.0×10^{-4} (2)**	**< 0.01**
CO_2	49,010 (4)	124
CH_4	0.966 (4)	< 0.01
N_2O	0.861 (4)	< 0.01

(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 respecting mandatory reporting of certain emissions of contaminants into the atmosphere (natural gas/ industrial use)..

D1.6.3 Briquetting Building Baghouses

Several 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. *Other contaminants are not emitted at these dust collectors.*

Table D1.15 Estimate of Atmospheric Emissions from the Baghouses inside the Briquetting Building

Baghouse Gas	Baghouse (A) Material handiling zone	Baghouse (B) briquettes' mixer/compactor/dryer zone	Baghouse (C) briquette storage silos zone	Total
Standardized volumetric flowrate (Nm³/h)	**12,900**	**9200**	**12,900**	**35,000**
Temperature (°C)	32	32	32	32
Actual volumetric flowrate (Am³/h)	**14,412**	**10278**	**14412**	**39,103**
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+Ar	76.8	76.8	76.8	76.8
Contaminants	**Emission Rate**			
	(kg/h)	**(kg/h)**	**(kg/h)**	**(t/year)**
$PM_T = PM_{2.5}$	**0.129**	**0.092**	**0.129**	**0.305**

(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/Nm³)		5.0	
Stack Gas			
Standardized volumetric flowrate (Nm³/h)		33.0	
Dry reference volumetric flowrate (Rm³/h)		33.4	
Temperature (°C)		50	
Actual volumetric flowrate (Am³/h)		39	
Typical composition (% volume)			
CO_2		0.00	
H_2O		7.31	
O_2		19.41	
N_2+Ar		73.3	
Stack diameter (m)		0.1	
Gas velocity at the stack (m/s)		1.4	
Stack height (m)		11	
Contaminants	**Emission Factors (g/Nm³)**	**Emission Rate**	
		(kg/h)	**(T/a)**
NH_3	**0.005**	**0.0002**	**0.001**

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 NOx, CO, PM and TOC (total VOCs)* of an emergency generator of this capacity as indicated in the manufacturer's specifications, including contaminant emission factors. *Emissions of specific organic compounds, were estimated from AP-42 emission factors for diesel fuel combustion by internal combustion engines (Section 3.3). The annual emissions are estimated considering 87.6 hours of operation per year at full capacity, which corresponds to 1% of the time.*

SO_2 emissions were calculated on the basis of complete oxidation of sulfur in diesel.

Diesel: heat value of 38.3 MJ/l; density of 0.87 kg/l; maximum of 15 ppm sulfur (0.015 gS / kg diesel) as per Canadian standards

Emission factor: 0.015 gS/kg x 0.87 kg/l x (64 g SO_2/32 gS) / 38.3 MJ/l = 0.00068 g SO_2/MJ = 0.7 g SO_2/GJ

Table D1.17 Estimate of Atmospheric Emissions from the Emergency Generator

Parameters	Normal operation
Type of fuel	**Diesel with low sulfur content**
Fuel consumption (l/h)	656,8
Higher heating value (HHV) of the fuel (MJ/kg)	38,3
Fuel consumption (GJ/h, HHV)	25,2
Gaz de combustion	
Débit volumique normalisé (Nm³/h)	**12,212**
Débit volumique sec de référence (Rm³/h)	12,336
Température (°C)	491
Débit volumique actuel (Am³/h)	34,163
Composition typique (% volume)	
CO_2	7,6
H_2O	7,5
O_2	9,1
N_2 + Ar	75,9
Diamètre de la cheminée (m)	0,6
Vitesse des gaz à la cheminée (m/s)	33,6
Hauteur de la cheminée (m)	5,0

Contaminants	Emission factor		Emission rate	
	(g/GJ)		(kg/h)	(t/a)
NOx	708,7	(1)	17,83	*1,56*
CO	56,0	(1)	1,41	*0,12*
SO_2	0,7	(2)	0,02	*< 0,01*
PM	4,9	(1)	0,12	*0,01*
COT	13,3	(1)	0,34	*0,03*
COV totaux	13,3	(3)	0,34	*0,03*
n-pentane	**2,9**	**(4)**	**0,07**	**0,01**
n-hexane	**-**		**0**	**0**
Formaldehyde	**0,5**	**(4)**	**0,01**	**< 0,01**
Benzene	**0,4**	**(4)**	**0,01**	**< 0,01**
Toluene	**0,2**	**(4)**	**< 0,01**	**< 0,01**
Dichlorobenzene	**-**		**0**	**0**
CO_2	69 530	(5)	1 749	*153*
CH_4	3,5	(5)	0,09	*0,01*
N_2O	10,4	(5)	0,26	*0,02*
GES CO_2eq	-		-	

(1) Emission factors based on the manufacturer's data for a 2.5 MW engine.
(2) Fuel sulfur mass balance according to the Canadian standard (15 ppm/S).
(3) It is assumed that TOC is all VOCs.
(4) Emission factors from AP-42 for diesel combustion in internal combustion engines.
(5) Emission factors in RMRCECA from (diesel).

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, table 2, Class VIIIa *representing semi-trailer trucks for long haul)* 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. *SO_2 emissions were calculated on the basis of complete oxidation of sulfur in diesel fuel with low sulfur content.*

Diesel: density of 0.87 kg / l; maximum of 15 ppm sulfur (0.015 gS / kg diesel) as per Canadian standards

Emission factor: 0.015 gS/kg x 0.87 kg/l x (64 g SO_2/32 gS) x 0.352 l/km = 0.009 g SO_2/km

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.

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[1] AP-42 Table 11.9-3

Table D1.18 Estimate of Atmospheric Emissions due to Trucking Activities on the Plant Site

Parameters	Normal operation	
	Combustion	Fugitives de routes
Fuel type	Diesel	-
Fuel consumption (L/100km)	35.2	-
Total distance traveled (km-vehicule/h)	0.128	0.128
Fuel consumption (l/h)	0.045	-
Average mass of vehicule (t)	-	37.5
Maximum transportation rate (t/h)	-	14.7

Contaminants	Emission Factors (g/kmV)		Emission Rate			
			(kg/h)	(t/a)	(kg/h)	(t/a)
NOx	5.7	(1)	0.0007	0.006	0	0
CO	1.49	(1)	0.0002	0.002	0	0
SO_2	0.009	(3)	< 0.0001	< 0.001	0	0
PMt	0.14 **2,726**	(1) (2)	< 0.0001	< 0.001	0.35	3.044
PM_{10}	0.14 **727**	(1) (2)	< 0.0001	< 0.001	0.09	0.812
$PM_{2,5}$	0.13 **72**	(1) (2)	< 0.0001	< 0.001	0.01	0.080
COT	0.29	(1)	< 0.0001	< 0.001	0	0
COV totaux	0.28	(1)	< 0.0001	< 0.001	0	0
CO_2	937	(4)	0.1198	1.050	0	0
CH_4	0.05	(4)	< 0.0001	< 0.001	0	0
N_2O	0.39	(4)	< 0.0001	< 0.001	0	0

(1) Emission Factors AP-42 - Average In-Use Emissions from Heavy-Duty, table 2 for *VIIIa type*
(2) Emission factors for fugitive dust calculated using the protocol described in 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

Annually, about 830,000 t of raw materials will be transported to the plant and 518,000 tonnes of pig iron will be shipped. The raw material and the finished product will be transported through the port located at 2.4 km from the plant. In the event that the conveyor would not be available, the APS, which is responsible for loading/unloading and transportation from the port to the plant, hauls these materials on Chemin du quai Marcel Dionne. Considering the logistics of loading and unloading of ships, production and storage capacity as well as the average load of 25 t per truck, it was estimated that the pellet and pig iron would be truckloaded respectively at a pace of 400 t/h and 100 t/h.

Since the road is paved, it is reasonable to neglect fugitive dust emissions caused by moving trucks. Only air emissions resulting from the diesel engines combustion are considered. The truck fuel consumption is estimated at 35.2 l/100km and the EPA emission factors are used to determine the contaminant emissions. The GHGs were estimated following the protocol QC.27 of RMRCECA.

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) US EPA Emission factors for diesel fuel combustion by heavy vehicles - 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) RMRCECA Emission factors, 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**	

D1.10.3 Emissions of the ships

The dockside emissions from the ships were added to the inputs of the dispersion model. The iron pellets unloading activities will take place for approximately 6 hours every 12 days (at a rate of 5,500 t/h) for a total of about 30 loads per year. During dockside activities, only the auxiliary generator is used. It is assumed that the fuel is a marine diesel oil with sulfur content not exceeding 1%. Table D1.23 shows the characteristics for ships emissions.

The emission factors of conventional contaminants (NOx, CO, $PM_{2.5}$*,* SO_2 *and HC) are derived from the ICF International reference (2009) and have been prepared for backup generators using marine diesel oil (MDO) with a sulfur content of 1%.*

The VOC (benzene, toluene, formaldehyde) emissions were estimated assuming a distribution of emitted compounds in the HC as provided by AP-42 document for diesel engines. In the absence of available emission factors for pentane and hexane, emission factors of these parameters have been developed using their ratio in benzene from CARB emission factors for organic compounds emissions of diesel trucks. Estimated VOC emissions are negligible.

Table D1.23 Emission factor caractereisitics of the ships

Parametere	Value	Note	
Auxiliary generators	3 x 740 kW operating at 90% (total : 1,998 kW)	A self-unloading ship requires about 2,000 kW	
Fuel	MDO at 1% S	Marine diesel	
Emission (1)	g/kWh (1)	g/s	kg/h
NOx	13.9	7.72	27.77
CO	1.10	0.61	2.20
$PM_{2.5}$	0.45	0.25	0.90
SO_2	4.24	2.35	8.47
HC	0.40	0.22	0.80
COV emission		mg/s	g/h
Benzene (2)	0.027% of emitted HC	0.059	0.21
Toluene (2)	0.012% of emitted HC	0.026	0.09
Formaldehyde (2)	0.034% of emitted HC	0.075	0.27
Pentane (3)	1.68 times emitted benzene	0.099	0.36
Hexane (3)	0.43 times emitted benzene	0.026	0.09
Stack	0.6 m	One equivalent stack for 3 generators	
Gaz speed	30 m/s	Typical Data - Model Wartsila 4L20	
Gas temperature	335 ºC	Typical Data - Model Wartsila 4L20 (operated at 85%)	
Stack height	25 m	Estimation	

The emission rates presented in Table D1.23 are valid for maximum hourly concentrations estimation. As the pellets unloading operations will last only 6 hours a day, and the rest of the unloading day, the ship could remain docked with an estimated use of backup generators at 25%, the emission rate in g/s must be divided by two to account a representative average emission.

D1.11 Metals and metal compounds emission in dust

The total particulate matter (PM_T) emitted through the stack of the pig iron plant contain metals and metal compounds present in the material feeding processes (iron pellets, slag, DRI and bentonite) and the pig iron product.

The outgoing PMT from the chimney of the auxiliary boiler (A2) are metal-free because the combustion gases are not in direct contact with either the pellets and neither with the slag.

The PM_T emitted at the gas preheater stack (A1), the thermal oxidation unit (A1) and the flare (A3) does not contain metals. The dust contained in the process gas from the reduction furnace are removed by a series of equipment placed downstream of the reactor (see response QC-128 and QC-5 for details). The composition of the process gas used as fuel, the flare and thermal oxidation unit are provided in the tables in the previous sections as well as in a confidential document under separate cover.

The main stacks emitting metals in the atmosphere include:

A4 – Stack of the smelting and casting building baghouse (EAF baghouse);

A5 – Stack of transfer building baghouse;

A6 – Stack of the storage building baghouse;

A7 – Stack of and screening and coating building baghouse;

A8 – Stack of the briquetting unit baghouse.

Metal emissions evaluation is based on the assumption that the emitted dust will contain the same proportion of metal than those of the material fed to the different processes, either iron ore pellets for stacks A5, A6, A7, or the mixture of inputs fed for briquetting process (pellets, FRD, bentonite, mud) to the stack A8. Emissions of metal in smelting and casting building (stack A4) are estimated by assuming that the composition of metals in dust is the same as that of the metals contained in the FRD.

Emission rates of the metals in the PM_T at a specific stack are calculated by multiplying the percentage of each metal in the input by the emission rate (g/s) of total particles emititng from the assiciated stack.

D1.11.1 Composition of input metals and metal compounds

Metals and metal compounds compositions at the inputs materials of various plant processes are presented in Table D1.24. For calculation purposes, the values lower than the detection limit within the AM BMC pellets are assumed equivalent to the detection limit for metals emission rates from A5, A6 and A7 stacks.

Based on the to BRENNTAG specification sheet for bentonite (see Appendix K of the impact study), the crystalline silica content can vary from 1 to 10%. For the study, an average concentration of 5% SiO_2 was selected for bentonite.

Table D1.24 AM BMC Pellet Composition and FRD composition as estimated by NAIC

Component	AM BMC pellets(%) [1]	FSM AM BMC FRD Max (%) [2]
As	<0.0003	0.0004
Co	<0.002	0.0026
Cr	0.02	0.021
Cu	<0.001	0.0013
Hg	<0.0005	0.0007
Pb	<0.002	0.0026
Ni	<0.0015	0.002
P	0.01	0.01
SiO_2	3.5	4.59
V	0.01	0.01
Zn	0.01	0.01

[1] Arcelor Mittal pellets, Arcelor Mittal BMC iron pellets– see table 1 – Appendixe B

[2] The NAIC FRD Maximum composition, after FSM (Forks Speciality Metal) simulations based on the d'Arcelor Mittal Port-Cartier pellet composition (AM BMC) – see table 2 – Appendixe B

D1.11.2 A8 – Briquetting plant stack

The emitted PM_T from the stack of the briquetting plant comes from the five following sources:

- *Stack of the feeding silos of the briquetting machine ;*
- *Stack of the briquettes mixer/compacter baghouse;*
- *Stack of the briquette storage silos baghouse;*
- *Mud dryer from de water treatment unit; and the*
- *Briquettes dryer.*

As a result, they have a mixed composition related to the mixture of different inputs with different metal content.

D1.11.3 Total metals emssions by source

The metal emission rates at the various stacks of the pig iron plant are presented at Table D1.25 for dust emission at the baghouses *outlet. The calculations are based on the assumption that the metal dust composition is equivalent to the composition of metals contained within the material feeding the different processes.*

Table D1.25 Emission rate for the metals and metallic compounds at the stacks (10 mg/Nm^3 at the dust collector stack)

Emission rate kg/h- 10 mg PM_T/Nm^3					
Componant	Smelting and casting unit baghouse (A4)	Transfer building baghouse (A5)	Storage building baghouse (A6)	Screening and coating building baghouse (A7)	Briquetting plant stack (A8)
As	1,96E-05	3,96E-07	6,62E-07	3,96E-07	1,11E-06
Co	1,27E-04	2,64E-06	4,42E-06	2,64E-06	7,34E-06
Cr	1,03E-03	2,64E-05	4,42E-05	2,64E-05	6,99E-05
Cu	6,36E-05	1,32E-06	2,21E-06	1,32E-06	3,67E-06
Hg	3,43E-05	6,60E-07	1,10E-06	6,60E-07	1,87E-06
Pb	1,27E-04	2,64E-06	4,42E-06	2,64E-06	7,34E-06
Ni	9,79E-05	1,98E-06	3,31E-06	1,98E-06	5,54E-06
P	4,90E-04	1,32E-05	2,21E-05	1,32E-05	3,46E-05
SiO_2	2,25E-01	4,62E-03	7,73E-03	4,62E-03	1,29E-02
V	4,90E-04	1,32E-05	2,21E-05	1,32E-05	3,46E-05
Zn	4,90E-04	1,32E-05	2,21E-05	1,32E-05	3,46E-05
Emission rate (t/an)- 10 mg PM_T/Nm^3					
As	1.72E-04	3.47E-06	5.80E-06	3.47E-06	9.70E-06
Co	1.12E-03	2.31E-05	3.87E-05	2.31E-05	6.43E-05
Cr	9.01E-03	2.31E-04	3.87E-04	2.31E-04	6.13E-04
Cu	5.58E-04	1.16E-05	1.93E-05	1.16E-05	3.21E-05
Hg	3.00E-04	5.78E-06	9.67E-06	5.78E-06	1.64E-05
Pb	1.12E-03	2.31E-05	3.87E-05	2.31E-05	6.43E-05
Ni	8.58E-04	1.73E-05	2.90E-05	1.73E-05	4.85E-05
P	4.29E-03	1.16E-04	1.93E-04	1.16E-04	3.03E-04
SiO_2	1.97	4.05E-02	6.77E-02	4.05E-02	0.113
V	4.29E-03	1.16E-04	1.93E-04	1.16E-04	3.03E-04
Zn	4.29E-03	1.16E-04	1.93E-04	1.16E-04	3.03E-04
Input to processes	100% DIR	100% AM BMC pellets	100% AM BMC pellet	100% AM BMC pellet	9,4% Sludge (FSM max) 76,5% Fines (boulettes) 9,4% EAF dust (FSM max.) 4,75% Bentonite (MSDS)

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Annexe AddA-E

Qualité de l’eau de surface

Annexe E2- Rev01 - Tableaux des résultats de qualité de l'eau de surface

Paramètre	Unités	Limite de quantification de la méthode	CVAA Note 1	CVAC Note 2	Station #1 Note 21	Station #2 Note 22	Station #2 - Duplicata	Station #1	Station #2	Station #2 - Duplicata	Station #2	Station #2 - Duplicata	Station #2	Station #2 - Duplicata
Date de prélèvement					2016-06-06	2016-06-06	2016-06-06	2016-06-29	2016-06-29	2016-06-29	2016-07-27	2016-07-27	2016-09-01	2016-09-01
Organiques et physicochimiques														
Alcalinité totale ($CaCO_3$)	mg/L	0,02	**-**	**Note 10**	-	55	56	-	59	62	33	33	110	110
Azote ammoniacal (N-NH_3)	mg/L	0,02	**ND**	**ND**	-	0,22	0,21	-	nd	nd	nd	nd	0,39	0,35
Azote ammoniacal total (N) Note 3	mg/L	0,02	**21 et 19**	**1,9 et 1,2**	-	0,24	0,34	-	0,8	0,69	0,74	0,78	0,83	0,82
Carbone organique dissous	mg/L	0,2	**-**	**-**	-	16	17	-	23,9	24	28	27	20	20
Chlore résiduel total	mg/L	0,001	**-**	**0,002**	-	-	-	-	-	-	-	-	-	-
Conductivité (à 25°C)	mS/cm	0,001	**-**	**-**	-	0,12	0,12	-	0,12	0,12	0,067	0,067	0,24	0,23
Cyclohexylamine	mg/L		**-**	**0,2**	-	-	-	-	-	-	-	-	-	-
DBO_5	mg/L		**-**	**3**	-	-	-	-	-	-	-	-	-	-
Dureté ($CaCO_3$)	mg/L	1	**-**	**-**	-	56	57	-	63	62	34	31	110	110
Fluorures	mg/L	0,03	**4**	**0,20**	-	0,19	0,20	-	**0,23**	**0,22**	**0,18**	**0,19**	**0,22**	**0,23**
Hydrocarbures pétroliers C_{10}-C_{50}	mg/L	0,1	**2,8** Note 23	**0,2** Note 23	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Matières en suspension	mg/L	0,3	**Note 11**	**Note 12**	4,6	12	11	13	12	16	8,2	8,2	**46**	**37**
Morpholine	mg/L		**11**	**0,48**	-	-	-	-	-	-	-	-	-	-
Nitrosamines	mg/L		**0,39** Note 24	**0,017** Note 24	-	-	-	-	-	-	-	-	**-**	-
pH	pH	-	**Note 13**	**6,5 à 9,0** (Note 14)	-	6,98	7,13	-	6,82	6,83	7,02	7,24	7,90	7,96
Phosphore total	mg/L	0,002	**-**	**0,03**	-	**0,048**	**0,049**	-	**0,068**	**0,064**	**0,037**	**0,036**	**0,082**	**0,085**
Solides dissous totaux	mg/L	1	**-**	**-**	-	110	100	-	120	120	170	110	130	130
Turbidité	UTN	0,1	**Note 15**	**Note 16**	-	20	18	-	13	18	10	10	**42**	**49**
Oxygène dissous (terrain) Note 4	%	0	**-**	**54,90%**	67%	75%	75%	60%	91%	91%	91%	91%	80%	-
Température (terrain)	°C	-	**-**	**Note 17**	16,40	16,67	16,67	16,65	18,7	18,7	23,3	23,3	16,66	-
Anions														
Bromures	mg/L	0,1	**-**	**-**	-	nd	nd	-	nd	nd	nd	nd	nd	nd
Chlorures	mg/L	0,05	**860**	**230**	-	1,2	1,2	-	0,60	0,62	0,53	0,52	1,3	1,3
Nitrites Note 5 (N-NO_2-)	mg/L	0,01	**0,06**	**0,02**	-	-	-	-	-	-	nd	nd	nd	nd
Nitrates (N-NO_3-)	mg/L	0,01	**-**	**2,9**	-	-	-	-	-	-	0,14	0,02	0,05	0,02
Nitrites-nitrates Note 6	mg/L	0,02	**-**	**-**	-	0,04	0,05	-	0,03	0,03	0,06	0,05	0,04	0,06
Sulfates Note 7	mg/L	0,3	**500**	**500**	-	1,6	1,5	-	2,8	2,8	1,2	0,9	1,1	1,2
Sulfites	mg/L			**0,20**	-	-	-	-	-	-	-	-	-	-
Microbiologie														
Coliformes fécaux	UFC/100ml	2	**-**	**-**	-	31	34	-	26	25	100	80	95	100
Essais de toxicité														
Toxicité aiguë	UTa		**-**	**-**	-	-	-	-	-	-	-	-	-	-
Toxicité chronique	UTc		**-**	**-**	-	-	-	-	-	-	-	-	-	-
Métaux														
Aluminium	µg/L	0,5	**750** Note 18	**87** Note 19	-	**830**	**840**	-	**610**	**630**	**880**	**900**	**1500**	**1400**
Antimoine	µg/L	0,005	**1100**	**240**	-	0,042	0,043	-	0,053	0,058	0,062	0,059	0,052	0,049
Argent Note 8	µg/L	0,003	**0,831**	**0,100**	-	0,006	0,005	-	0,007	0,006	0,005	0,006	0,009	0,008
Arsenic	µg/L	0,09	**340**	**150**	-	0,41	0,43	-	0,56	0,57	0,57	0,58	0,73	0,72

Paramètre	Unités	Limite de quantification de la méthode	CVAA Note 1	CVAC Note 2	Station #1 Note 21	Station #2 Note 22	Station #2 - Duplicata	Station #1	Station #2	Station #2 - Duplicata	Station #2	Station #2 - Duplicata	Station #2	Station #2 - Duplicata
Baryum Note 8	µg/L	0,03	**719**	**252**	-	14	14	-	12	12	12	12	34	33
Béryllium Note 8	µg/L	0,01	**5,79**	**0,64**	-	0,03	0,03	-	0,03	0,03	0,04	0,03	0,04	0,04
Bore	µg/L	0,3	**28000**	**5000**	-	7,7	7,7	-	8,7	9	7,1	7,2	12	12
Cadmium Note 8	µg/L	0,006	**1,26**	**0,184**	-	0,019	0,02	-	0,017	0,016	0,028	0,025	0,026	0,024
Calcium	µg/L	0,02	**-**	**Note 20**	-	18000	18000	-	19000	19000	10000	9400	34000	34000
Chrome Note 9	µg/L	0,04	**16**	**11**	-	1,1	1,1	-	0,97	0,99	1,2	1,1	2,2	2,0
Cobalt	µg/L	0,008	**370**	**100**	-	0,9	0,88	-	0,66	0,67	1	1	2,1	2,0
Cuivre Note 8	µg/L	0,07	**8,6**	**6,0**	-	1,7	1,7	-	2	2	1,7	1,5	2,2	2,1
Fer	µg/L	0,5	**3400**	**1300**	-	1300	1200	-	1200	1200	**1400**	**1400**	**3100**	**2800**
Magnésium	µg/L	0,02	**-**	**-**	-	3000	3000	-	3500	3400	2100	2000	6600	6500
Manganèse Note 8	µg/L	0,03	**2639**	**1223**	-	200	200	-	110	110	98	100	530	530
Molybdène	µg/L	0,01	**29000**	**3200**	-	0,28	0,28	-	0,3	0,31	0,2	0,2	0,58	0,44
Nickel Note 8	µg/L	0,05	**302**	**34**	-	1,5	1,5	-	1,9	1,8	2,1	1,9	3,0	2,7
Plomb Note 8	µg/L	0,03	**42**	**1,64**	-	0,34	0,33	-	0,27	0,27	0,44	0,42	0,66	0,63
Potassium	µg/L	0,03	**-**	**-**	-	1600	1600	-	1700	1700	830	770	2500	2400
Sodium	µg/L	0,02	**-**	**-**	-	3900	3900	-	3900	3800	2900	2800	6400	6200
Vanadium	µg/L	0,1	**110**	**12**	-	2,6	2,5	-	2,4	2,4	2,4	2,4	4,7	4,5
Zinc Note 8	µg/L	0,7	**77**	**77**	-	5,0	5,0	-	3,7	3,3	10	14	6,7	6,8

Dureté moyenne	mg/L	65,375
Dureté médiane	mg/L	59,5
Chlorures médiane	mg/L	0,91
pH médiane	mg/l	7,075

Note 1 CVAA= critère de la protection de la vie aquatique (effet aigu)

Note 2 CVAC= critère de la protection de la vie aquatique (effet chronique)

Note 3 Azote ammoniacal : le CVAA, CVAC varient selon le pH (=7,0), la température (20°C été et 7°C hiver)

Note 4 Oxygène dissous : le CVAC, un pourcentage minimum, varie selon la température (=16,5°C) et le biote (eau froide)

Note 5 Nitrites : le CVAA, CVAC varient selon la concentration en chlorures (<2 mg/L)

Note 6 Les résultats des concentrations en nitrates et en nitrites ont été combinés avant juillet 2016. Le CVAA et le CVCC existent pour ces composés séparément.

Note 7 Sulfates : le CVAA, CVAC varient selon la dureté (<100 mg/L) et les chlorures (<2 mg/L)

Note 8 Métaux dont le CVAA et/ou le CVAC varient selon la dureté (médiane=59,5 mg/L)

Note 9 Les critères ont été présentés pour le chrome VI car aucun critère pour le chrome total n'existe.

Note 10 La sensibilité d'un milieu à l'acidification varie avec l'alcalinité; élevée (>10 mg/L); moyenne (10-20 mg/L); faible (>20 mg/L)

Note 11 Le critère de qualité est défini par une augmentation maximale de 25 mg/L par rapport à la concentration naturelle ou ambiante (non influencée par une source ponctuelle de matières en suspension, par une pluie importante ou par la fonte) selon le contexte.

Note 12 Le critère de qualité est défini par une augmentation maximale de 5 mg/L par rapport à la concentration naturelle ou ambiante (non influencée par une source ponctuelle de matières en suspension, par une pluie importante ou par la fonte) selon le contexte.

Note 13 Les espèces affectées pour des plages de pH variés sont présentées dans un tableau disponible sur le site du MDDELCC sur les critères de qualité de l'eau de surface.

Note 14 Un pH de 6,0 à 9,5 est exigé à l'effluent dans la directive sur les mines et la majorité des règlements du Ministère sur les rejets industriels. Cette exigence satisfait l'objectif de protection du milieu aquatique.

Note 15 Le critère de qualité est défini par une augmentation maximale de 8 uTN par rapport à la valeur naturelle ou ambiante (non influencée par une source ponctuelle de matières en suspension, par une pluie importante ou par la fonte) selon le contexte.

Note 16 Le critère de qualité est défini par une augmentation maximale de 2 uTN par rapport à la valeur naturelle ou ambiante (non influencée par une source ponctuelle de matières en suspension, par une pluie importante ou par la fonte) selon le contexte.

Note 17 Toute diminution ou augmentation artificielle de la température ne doit pas :

- modifier la température de l'eau sur tout un tronçon de rivière ou une portion de lac avec pour résultat le déplacement prévisible ou la modification des populations aquatiques présentes ou potentielles;
- altérer certaines zones sensibles localisées, telle une frayère;
- tuer les organismes vivants à proximité d'un rejet.

De plus, le milieu ne doit pas subir de changements brusques de température occasionnés, par exemple, par un arrêt subit d'un rejet thermique en saison froide.

Note 18 Il ne devrait pas y avoir d'effets toxiques à cette concentration si le pH se maintient entre 6,5 et 9,0.

Note 19 Ce critère de qualité a été défini pour des eaux de faible dureté (< 10 mg/L) et dont le pH est d'environ 6,5.

Note 20 La sensibilité d'un milieu à l'acidification varie avec la concentration en calcium : élevée (<4000 µg/L); moyenne (4000-8000 µg/L); faible (>8000 µg/L).

Note 21 Les deux stations d'échantillonnage #1 et #2 sélectionnées sont localisées sur la carte 4.3. La station #1 est à proximité du point de rejet de l'effluent sur le cours d'eau #5.

Note 22 Les deux stations d'échantillonnage #1 et #2 sélectionnées sont localisées sur la carte 4.3. La station #2 est à la confluence du cours d'eau #5 avec le cours d'eau #8.

Note 23 Ce critère de qualité a été défini pour le diesel.

Note 24 Ce critère de qualité a été défini pour le nitrosodiphénylamine, N-.

Note 25 nd = paramètre non détecté

Annexe AddA-F

Eaux souterraines

Tableau F3.1 Rev01 Calcul de l’indice de vulnérabilité DRASTIC pour l’aquifère rocheux

Zone 1 : Roc recouvert d’argile (de 2 m à plus de 5 m)

	Paramètres	Poids	Valeur considéré	Cote	Poids x cote
D	Profondeur de l'eau	5	La profondeur du toit de la nappe considérée se situe entre à 0,23 m au puits MW-10-16	10	50
R	Recharge annuelle	4	Selon les données météorologique mensuelle de l'année 2014 la recharge a été calculée à 14 cm/an (entre 10 et 18 cm / année)	6	24
A	Unité hydrostratigraphique	3	Gneiss et paragneiss gris foncé et granite rose (granite de La Baie)	3	9
S	Sol de surface	2	Argile silteuse	1	2
T	Pente	1	La plaine argileuse possède une pente de 0 à 2 %	10	10
I	Zone non saturée	5	Silt et argile	3	15
C	Conductivité hydraulique	3	Selon notre appréciation de degré de recharge des puits d'observation lors des travaux d'échantillonnage, la conductivité hydraulique du roc a été estimé à une valeur inférieur à 4 m/j ou 5x10-3 cm/sec	1	3
	Total -- Indice DRASTIC				**113**

Zone 2 : Roc affleurant ou recouvert d’un sol mince

	Paramètres	Poids	Valeur considéré	Cote	Poids x cote
D	Profondeur de l'eau	5	La profondeur du toit de la nappe considérée se situe entre à 2 m au puits MW-3A-16	9	45
R	Recharge annuelle	4	Selon les données météorologique mensuelle de l'année 2014 la recharge a été calculée à 14 cm/an (entre 10 et 18 cm / année)	6	24
A	Unité hydrostratigraphique	3	Gneiss et paragneiss gris foncé et granite rose (granite de La Baie)	3	9
S	Sol de surface	2	Sol mince sur roc	10	20
T	Pente	1	Les crête topographique rocheuse possède des pentes de l'ordre de 2 à 6%	9	9
I	Zone non saturée	5	Métamorphique ou ignée (granite ou gneiss)	8	40
C	Conductivité hydraulique	3	Selon notre appréciation de degré de recharge des puits d'observation lors des travaux d'échantillonnage, la conductivité hydraulique du roc a été estimé à une valeur inférieur à 4 m/j ou 5x10-3 cm/sec	1	3
	Total -- Indice DRASTIC				**150**

Tableau F3.2 Calcul de la recharge et bilan hydrologique

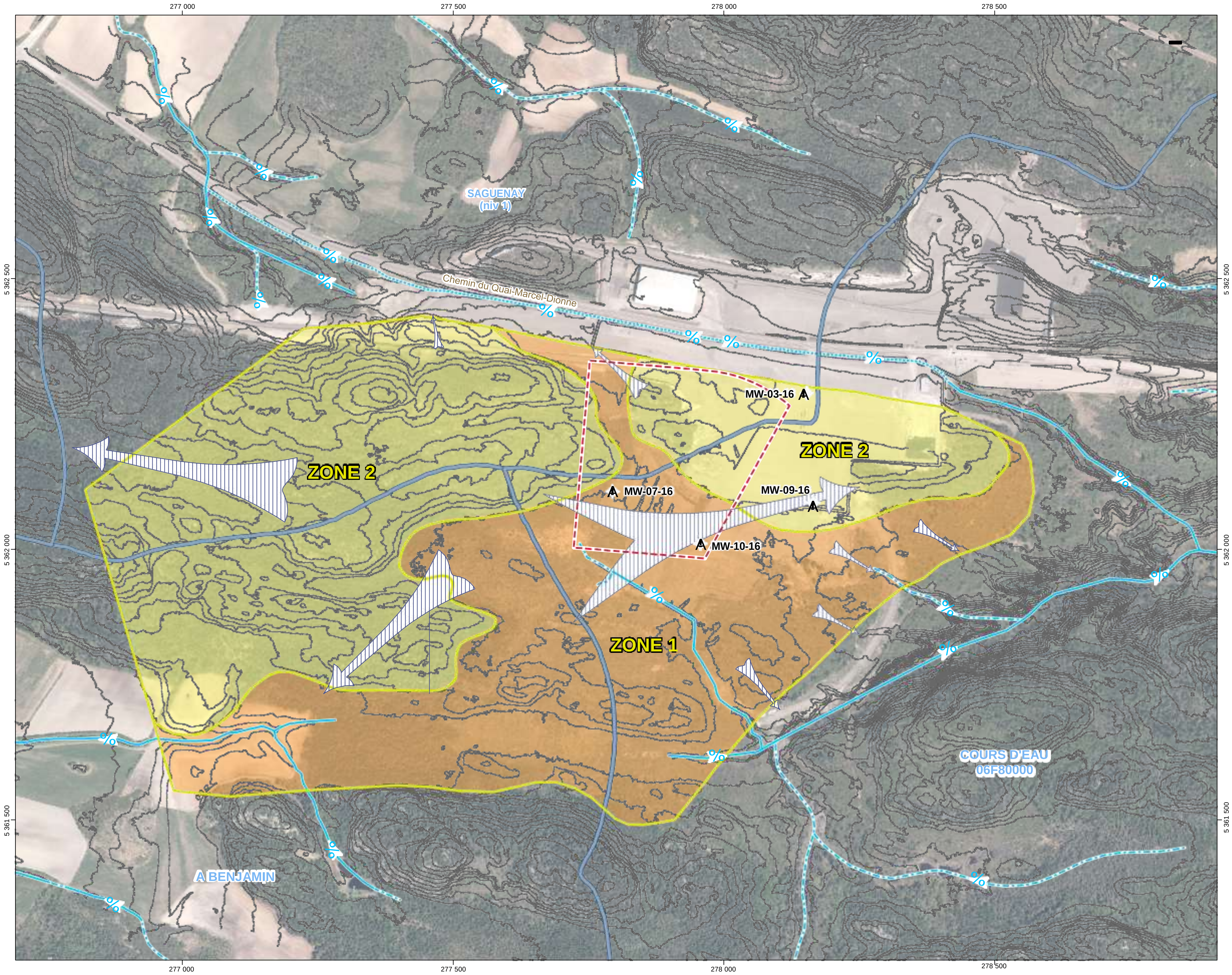
Données météorologie considérées

Nom de la station : Bagotville A
Province : Québec
Latitude : 48,33
Longitude : -71,00
Altitude : 159,10
Identification climat : 7060400
Identification OMM : 71727
Identification TC : YBG

Calcul de la rechargeValeur

Neige au sol :	équivalent en eau (1 cm de neige = 1 mm d'eau) :	
PPM :	précipitations mensuelles de pluie :	
PM :	précipitations mensuelle totale (pluie + neige) :	
ETM :	évapotranspiration mensuelle :	
CN :	coefficient de ruissellement :	84
RM	ruissellement mensuel zone urbaine est (fonction de CN) :	RM = -2,49+0.505*PM
IEM :	infiltration efficace mensuelle (mm) (IEM = PM-ETM-RM) :	
Indice thermique :	somme des indices mensuels :	30,48
IE :	infiltration efficace annuel (cm/an) (=somme des IEM) :	13,9

Date	Temp max.moy.(°C)	Temp min.moy.(°C)	Temp moy.(°C)	Pluie tot. (mm)	Neige tot. (cm)	Précip. tot. (mm)	Neige au sol. dernier jour (cm)	PM (mm)	i (indice thermique)	F (lamda)	a (°C)	ETM (mm/mois)	RM (mm)	IEM (mm)
janv-14	-9,7	-21	-15	14	12,6	26,6	48	18,8	s.o.					
févr-14	-8	-18	-13	0	28	28	72	7,2	s.o.					
mars-14	-5,7	-18	-12	0	52,1	46,5	88	8,8	s.o.					
avr-14	6,9	-3,7	1,6	50,4	12,4	62,8	0	50,4	0,18	1,14	0,50	4,5	22,962	23,0
mai-14	16,4	4,7	10,6	82,6	0,2	82,8	0	82,6	3,12	1,31	0,55	21,2	39,223	22,1
juin-14	24,1	10,9	17,6	70,8	0	70,8	0	70,8	6,72	1,33	0,61	34,5	33,264	3,1
juil-14	25	13,8	19,4	84,3	0	84,3	0	84,3	7,79	1,34	0,63	38,6	40,0815	5,6
août-14	24,3	12,1	18,2	102,2	0	102,2	0	102,2	7,07	1,23	0,62	33,0	49,121	20,0
sept-14	17,9	6,4	12,2	82,6	0	82,6	0	82,6	3,86	1,05	0,56	19,2	39,223	24,2
oct-14	11,9	2,5	7,2	100,6	0	100,6	0	100,6	1,74	0,93	0,52	11,1	48,313	41,2
nov-14	1,4	-6,7	-2,7	22,5	28,9	51,4	2	22,7	s.o.	1,93	s.o.	s.o.	8,9735	s.o.
déc-14	-4	-13	-8,3	8,8	28,6	37,4	22	11	s.o.					



Composantes du projet
Project Components

Empreinte du projet / Project footprint

Station d'échantillonnage
Sampling Station

Puits d'observation des eaux souterraines / goundwater Monitoring Well

Environnement physique
Physical Environment

% 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)

Courbe de niveau (équidistance de 50 cm)
Countour Line (Equidistance of 50 cm)

Indice de vulnérabilité DRASTIC
DRASTIC Vulnerability Index

Zone 1
Socle rocheux recouvert d'argile / Clay covered bedrock
Indice / Index : 113

Zone 2
Socle rocheux affleurant ou sol mince sur roc /
Exposed bedrock or thin soil over rock
Indice / Index : 150

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

Carte / Map F2 - Addenda A
Vulnérabilité du socle rocheux /
Bedrock Vulnerability

Sources :
- Ville de Saguenay, 2016
- Bassins hydrographiques du Québec, MDDEP Québec, 2011
- Étude géotechnique, 2002,
  Carte T6-7 Cartographie des limites géologiques - Site 2 - Vue en plan.

Projet / Project : 634451

0 70 140 m

Projection MTM, fuseau 7, NAD83

1/7 000

00	2016/09/19	Préliminaire / Preliminary	L. Bathalon	S. Fleury
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\addendaA\snc634451_addA_AnF2_vulnerabilite_tab_160919.mxd

Paramètre	Unités	LDR	EC	RES	MW-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	2016-06-29	2016-06-29	2016-05-18
HP C10-C50	µg/L	100	-	2800	nd	nd	nd	110	nd	nd		-	nd
HAP													
Acénaphtène	µg/L	0.03 ou 0.1	-	100	nd	nd	nd	nd	nd	nd	-	-	nd
Benzo(a)anthracène	µg/L	0.03 ou 0.1	-	1,8	nd	nd	nd	nd	nd	nd	-	-	nd
Benzo(a)pyrène	µg/L	0.008 ou 0.01	0,01	1,8	nd	nd	nd	nd	nd	nd	-	-	nd
Benzo(b)fluoranthène	µg/L	0.06 ou 0.1	-	1,8	nd	nd	nd	nd	nd	nd	-	-	nd
Benzo(j)fluoranthène	µg/L	0.06 ou 0.1	-	1,8	nd	nd	nd	nd	nd	nd	-	-	nd
Benzo(k)fluoranthène	µg/L	0.06 ou 0.1	-	1,8	nd	nd	nd	nd	nd	nd	-	-	nd
Chrysène	µg/L	0.03 ou 0.1	-	1,8	nd	nd	nd	nd	nd	nd	-	-	nd
Dibenzo(a,h)anthracène	µg/L	0.03 ou 0.1	-	1,8	nd	nd	nd	nd	nd	nd	-	-	nd
Fluoranthène	µg/L	0.03 ou 0.1	-	14	nd	nd	nd	nd	nd	nd	-	-	nd
Fluorène	µg/L	0.03 ou 0.1	-	110	nd	nd	nd	nd	nd	0,08	-	-	nd
Indéno(1,2,3-cd)pyrène	µg/L	0.03 ou 0.1	-	1,8	nd	nd	nd	nd	nd	nd	-	-	nd
Naphtalène	µg/L	0.03 ou 0.1	-	100	nd	nd	nd	nd	0,04	0,1	-	-	0,05
Phénanthrène	µg/L	0.03 ou 0.1	-	4,7	nd	nd	nd	nd	nd	0,22	-	-	0,07
Métaux													
Aluminium dissous	mg/L	0.03 ou 0.01	0,1	-	0,131	0,09	0,14	nd	nd	nd	-	-	nd
Arsenic dissous	mg/L	0,001	0,0003	0,34	nd	nd	nd	0,003	0,002	0,003	-	-	0,003
Baryum dissous	mg/L	0.02 ou 0.001	1	0,6	0,025	0,06	0,06	nd	0,04	nd	-	-	nd
Cadmium dissous	mg/L	0.001 ou 0.0001	0,005	0,0011	nd	nd	nd	nd	nd	nd	-	-	nd
Calcium dissous	mg/L	0.5 ou 5.0	-	-	22,4	14	14	62	29	63	-	-	64
Chrome total dissous	mg/L	0,005	0,05	0,2	-	nd	nd	nd	nd	nd	-	-	nd
Cobalt dissous	mg/L	0.02 ou 0.0005	-	0,37	nd	nd	nd	nd	nd	nd	-	-	nd
Cuivre dissous	mg/L	0.003 ou 0.001	1	0,0073	0,001	nd	nd	nd	nd	nd	-	-	nd
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	nd	nd	nd	nd	nd	-	-	nd
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	2,3	0,088	0,1	0,074	0,17	0,12	0,17	-	-	0,19
Mercure dissous	mg/L	0,0001	0,001	0,0000013	nd	nd	nd	nd	nd	nd	-	-	nd
Molybdène dissous	mg/L	0.01 ou 0.001	0,07	29	0,007	0,04	0,05	nd	nd	nd	-	-	nd
Nickel dissous	mg/L	0.01 ou 0.001	0,07	0,26	0,002	0,01	nd	nd	nd	nd	-	-	nd
Plomb dissous	mg/L	0.001 ou 0.0001	0,01	0,034	nd	nd	nd	nd	nd	nd	-	-	nd
Sélénium dissous	mg/L	0,001	0,01	0,062	0,001	nd	nd	nd	nd	nd	-	-	nd
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	nd	nd	nd	nd	nd	-	-	nd
Zinc dissous	mg/L	0.005 ou 0.003	5	0,067	nd	0,019	0,011	0,007	0,009	0,009	-	-	nd
Autres analyses inorganique													
Azote ammoniacal	mg/L - N	0,02	-	-	0,31	nd	nd	0,2	nd	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	nd	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 tota	mg/L - P	0,01	-	3	2,78	1,3	2,2	0,23	1,2	0,11	-	-	0,05
Solides dissous totau	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	0,0032	0,08	0,14	0,18	nd	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-Diméthylphéno	µg/L	0.6 ou 1.0	-	1300	nd	nd	nd	nd	nd	nd	-	-	nd
2,4-Dinitrophéno	µg/L	10 ou 1.0	-	130	nd	nd	nd	nd	nd	nd	-	-	nd
2-Méthyl-4,6-dinitrophéno	µg/L	10	-	6,6	-	nd	nd	nd	nd	nd	-	-	nd
4-Nitrophéno	µg/L	1 ou 1.0	60	940	nd	nd	nd	nd	nd	nd	-	-	nd
Phénol	µg/L	0.6 ou 1.0	2000	3400	2	nd	nd	nd	nd	1,7	-	-	nd
2-Chlorophéno	µg/L	0.5 ou 1.0	40	100	nd	nd	nd	nd	nd	nd	-	-	nd
3-Chlorophéno	µg/L	0.5 ou 1.0	-	100	nd	nd	nd	nd	nd	nd	-	-	nd
4-Chlorophéno	µg/L	0.4 ou 1.0	-	100	nd	nd	nd	nd	nd	nd	-	-	nd
2,3-Dichlorophéno	µg/L	0.5 ou 1.0	-	100	nd	nd	nd	nd	nd	nd	-	-	nd
2,4 + 2,5-Dichlorophéno	µg/L	0.3 ou 1.0	700	92	nd	nd	nd	nd	nd	nd	-	-	nd
2,6-Dichlorophéno	µg/L	0.4 ou 1.0	-	100	nd	nd	nd	nd	nd	nd	-	-	nd
3,4-Dichlorophéno	µg/L	0.4 ou 1.0	-	100	nd	nd	nd	nd	nd	nd	-	-	nd
3,5-Dichlorophéno	µg/L	0.4 ou 1.0	-	100	nd	nd	nd	nd	nd	nd	-	-	nd
Pentachlorophéno	µg/L	0.4 ou 1.0	42	8,7	nd	nd	nd	nd	nd	nd	-	-	nd
2,3,4,6-Tétrachlorophéno	µg/L	0.4 ou 1.0	70	11	nd	nd	nd	nd	nd	nd	-	-	nd
2,3,5,6-Tétrachlorophéno	µg/L	0.4 ou 1.0	-	8,5	nd	nd	nd	nd	nd	nd	-	-	nd
2,4,5-Trichlorophéno	µg/L	0.4 ou 1.0	-	46	nd	nd	nd	nd	nd	nd	-	-	nd
2,4,6-Trichlorophéno	µg/L	0.4 ou 1.0	5	39	nd	nd	nd	nd	nd	nd	-	-	nd
HAM													
Benzène	µg/L	0,2	0,5	950	nd	-	-	-	-	nd	nd	nd	-
Chlorobenzène	µg/L	0,2	30	130	nd	-	-	-	-	nd	nd	nd	-
Dichloro-1,2 benzène	µg/L	0,2	150	70	nd	-	-	-	-	nd	nd	nd	-
Dichloro-1,3 benzène	µg/L	0,1	-	100	nd	-	-	-	-	nd	nd	nd	-
Dichloro-1,4 benzène	µg/L	0,2	5	100	nd	-	-	-	-	nd	nd	nd	-
Éthylbenzène	µg/L	0,1	2,4	160	nd	-	-	-	-	0,1	nd	nd	-
Styrène	µg/L	0,1	20	800	nd	-	-	-	-	nd	nd	nd	-
Toluène$^{\text{Note 1}}$	µg/L	0,1	24	200	nd	-	-	-	-	73$^{\text{Note 1}}$	12	9,1	-
Xylènes	µg/L	0,4	300	370	nd	-	-	-	-	nd	-	nd	-

Note 1 : Le puits où l'échantillon MW-10A-16 a été prélevés a été sondé de nouveau le 29 juin et 27 juillet et les résultats en toluène ont montré une valeur de 12 µg/L et 9 µg/L respectant le critère associé à l'eau
nd = valeur inférieure à la limite de détection
- non analysé
Les critères ont été ajustés pour refléter ceux du Guide d'intervention pour la protection des sols et réhabilitation des terrains contaminés, juillet 2016
EC = Eau de consommation : critères d'eau de consommation
RESIE - Eau de surface et égouts

SNC-Lavalin GEM Québec inc.
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Extraits du rapport:

Projet de construction d'une usine de fonte en gueuse
Port de Grande-Anse
Saguenay (Québec)

Évaluation environnementale – Phase I et Caractérisation environnementale – Phase II

North Atlantic Iron Corporation (NAIC)
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Numéro de membre de l'OIQ : 130082

N/Dossier n°	:	634451	Le 16 mars 2016
Distribution	:	Madame Liz McKenzie, directrice des communications (PDF)	

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2.3.3.2 Topographie

Mentionnons qu’une partie du site ne serait pas visée pour la construction de l’usine. Soit la portion sud du lot 4 012 436 qui possède une pente générale d’environ 3 % vers le nord, vers un ruisseau localisé au milieu du lot qui coule vers l’est pour aller se déverser dans la rivière Saguenay à 2 km du site à l’étude.

Dans le cas des lots particulièrement visés pour l’implantation de l’usine, la majorité de la surface naturelle du site (environ 80 %) possède une pente générale d’environ 2 % vers le sud-est soit vers le ruisseau. Une crête rocheuse d’environ 5 m de hauteur est présente au nord-ouest du site qui plonge d’environ 20 m vers le nord dans ce secteur.

La plateforme remblayée au nord-est du site est construite environ 1,0 à 1,5 m au-dessus du niveau du chemin du quai Marcel-Dionne et possède une pente régulière de 2 % vers le nord. Selon l’information disponible, le remblai aurait une épaisseur variant de 2 m à 5 m selon les secteurs.

3.2 Résultats et interprétation

3.2.1 Stratigraphie des sols

La description des sols au chantier a été effectuée sur la base d’un examen visuel et d’essais en laboratoire (analyses granulométriques) des échantillons récupérés lors de la réalisation des sondages et les profondeurs sont mesurées à l’aide d’une chaîne à mesurer graduée en mètres. La stratigraphie simplifiée des sols rencontrés dans les sondages est présentée au tableau 2 suivant :

Tableau 2 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	--

Sondage n°[2]	Élévation du sol	Remblai	Terre végétale	Dépôt naturel	Roc (profondeur)	Roc (élévation)	Commentaire
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
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.

Dans ce tableau, le remblai consiste essentiellement en du roc dynamité rencontré dans la plateforme construite entre 2012 et 2014 servant à l'accueil d'entreprises potentielles. La terre végétale représente le couvert végétal naturel du secteur et le dépôt naturel consiste en un silt argileux à un silt et argile gris qui contient également des traces de sable fin. Ce dépôt possède une résistance raide à dure, un indice de plasticité faible à moyenne. Finalement, la qualité du roc rencontrée est qualifiée de très mauvaise à excellente selon le secteur et se compose essentiellement 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.

3.2.2 Conditions hydrogéologiques de l'eau souterraine

Les niveaux d'eau stabilisés ont été mesurés à l'intérieur des puits d'observation et les élévations piézométriques calculées à partir de ces mesures ainsi que les numéros attribués aux ruisseaux du secteur, sont présentés au tableau 3 et sur le dessin 5 joint à l'annexe 1 de ce rapport. Les schémas de construction des puits d'observation correspondants aux relevés de niveaux d'eau souterraine sont montrés sur les rapports de forage à l'annexe 2 de ce rapport.

Note: Le dessin 5 correspond à la carte F1. Les rapports de forage de l'annexe 2 sont présentés à la fin de la présente annexe.

Tableau 3 Élévations piézométriques des eaux souterraines et résumé de la construction des puits d'observation

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.

Selon ces sources d'informations et l'examen des rapports de forage, les précipitations sur le terrain à l'étude se drainent principalement par ruissellement sur la surface du terrain, notamment dans les secteurs caractérisés par des dépôts superficiels intacts de sols jugés peu perméables et comportant des proportions relativement importantes de particules silteuses ou argileuses. Dans les aires caractérisées par des affleurements rocheux, les eaux de précipitations se drainent soit par ruissellement ou encore par infiltration souterraine à travers les réseaux de fractures du roc. Les eaux d'infiltration souterraine percolent en fonction des gradients hydrauliques observés dans les puits d'observation, soit en général vers le nord-est et envers les cours d'eau qui sont visibles à un peu plus de 600 m dans cette direction (milieux récepteurs présumés des écoulements souterrains). En effet, le gradient hydraulique moyen relevé entre les puits d'observation MW-07-16 et MW-03A-16 est d'environ 2,2 %. Dans d'autres secteurs du terrain à l'étude et en raison de l'absence ou du nombre limité de puits d'observation et de relevés de la nappe, notre interprétation du contexte hydrogéologique et notre expérience nous portent à croire que les directions du drainage souterrain puissent être localement influencées par la présence de creux topographiques vers lesquels les écoulements d'eaux de surface sont orientés. Ainsi, on ne peut écarter la possibilité d'écoulements souterrains comme suit :

› Près de la limite sud-est du terrain : vers le sud-est et envers un complexe d'eau à l'est formé des ruisseaux intermittent numéros 5, 8, 9 et 10 qui se déverse dans la rivière Saguenay (2 km à l'est) ;

- Dans le secteur nord-ouest : vers le nord-ouest et envers le ruisseau intermittent n° 6 qui longe le chemin du quai Marcel-Dionne en direction de l’ouest qui se déverse dans la rivière Saguenay (1,4 km au nord) en passant par des terres agricoles;
- Près de limite sud-ouest du terrain : vers le sud-ouest et envers le ruisseau intermittent n° 1 qui se déverse dans l’Anse-à-Benjamin ou la baie des Ha! Ha! (4 km au sud) en passant par des terres agricoles;
- Finalement, près de la limite ouest dans une dépression topographique entre deux butons de roc.

Ces interprétations des différents sens de drainage de la nappe devront être prises en compte pour la détermination des emplacements de puits d’observation et de contrôle de la qualité des eaux souterraines, dans le cadre du projet à l’étude.

3.2.3 Vulnérabilité de l’eau souterraine selon l’indice DRASTIC

En fonction de la description du contexte hydrogéologique décrit précédemment, la vulnérabilité de l’eau souterraine à la contamination par les activités anthropiques sur le terrain est jugée moyenne dans les secteurs occupés par des dépôts superficiels de sols peu perméables. Par contre, cette vulnérabilité est élevée au-delà de ces aires de sols peu perméables et notamment dans les secteurs des crêtes topographiques où on retrouve une unité hydrostratigraphique caractérisée par un socle rocheux fracturé et plus perméable à faible profondeur ou à la surface du terrain.

Compte tenu des informations disponibles et de la variabilité de la topographie et de la stratigraphie des sols sur le site, nous sommes d’avis que l’indice de vulnérabilité selon la méthode DRASTIC du MDDELCC varie de 108 (secteur argileux) à 159 (recouvert par une couche mince de sols de moins de 2 m). Selon la classification de cet indice, le degré de vulnérabilité de la nappe sur le terrain est moyen. Cependant, elle est un peu plus vulnérable dans les secteurs où le roc est recouvert d’une couche mince de sols. Le détail du calcul est présenté à l’annexe 7 du présent rapport. *Note: L'annexe 7 correspond à l'annexe F3.*

3.2.4 Classification de l’aquifère

Selon le système de classification des eaux souterraines du Québec de la Politique du MDDELCC, l’eau souterraine appartient à une classe IIB, en raison de l’absence d’ouvrages de captage des eaux souterraines à l’intérieur d’un rayon de 1 km du site (selon le système d’information hydrogéologique du MDDELCC et secteur desservi par l’aqueduc municipal) mais peut potentiellement devenir une source d’alimentation en eau potable.

3.2.5 Observations organoleptiques

Aucun indice organoleptique (visuel et olfactif) n’a été relevé par les surveillants de chantier lors de la réalisation des travaux.

3.2.6 Analyses chimiques

Les résultats d’analyses des sols et des eaux sont présentés aux tableaux de l’annexe 3 et les certificats d’analyses chimiques sont en annexe 4.

Note: Les tableaux et certificats d'analyses sont ceux apparaissant aux annexes F1 et F2.

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NOTES EXPLICATIVES
RAPPORT DE SONDAGE
(page 1 de 2)

Un rapport de sondage permet de résumer la stratigraphie des sols et du roc, leurs propriétés ainsi que les conditions d'eau souterraine. Cette note a pour but d'expliquer la terminologie, les symboles et abréviations utilisés.

COUPE STRATIGRAPHIQUE

1. PROFONDEUR – NIVEAU

La profondeur et le niveau des différents contacts stratigraphiques sont donnés par rapport à la surface du terrain à l'endroit des sondages au moment de leur exécution. Les niveaux sont indiqués en fonction d'un système indiqué dans l'entête du rapport de sondage.

2. DESCRIPTION DES SOLS

Les sols sont décrits selon leur nature et leurs propriétés géotechniques.

Les dimensions des particules constituant un sol sont les suivantes :

NOM	DIMENSION (mm)		
Argile		<	0,002
Silt	0,002	-	0,08
Sable	0,08	-	5
Gravier	5	-	80
Caillou	80	-	300
Bloc		>	300

La proportion des divers éléments de sol, définis selon la dimension des particules, est donnée d'après la terminologie descriptive suivante :

TERMINOLOGIE DESCRIPTIVE	PROPORTION DE PARTICULES (%)		
Traces	1	-	10
Un peu	10	-	20
Adjectif (ex. : sableux, silteux)	20	-	35
Et (ex. : sable et gravier)		>	35

2.1 COMPACITÉ DES SOLS PULVÉRULENTS

La compacité des sols pulvérulents est évaluée à l'aide de l'indice de pénétration « N » obtenu par l'essai de pénétration standard :

COMPACITÉ	INDICE DE PÉNÉTRATION « N » (coups / 300 mm)		
Très lâche		<	4
Lâche	4	-	10
Compacte ou moyenne	10	-	30
Dense	30	-	50
Très dense		>	50

2.2 CONSISTANCE ET PLASTICITÉ DES SOLS COHÉRENTS

La consistance des sols cohérents est évaluée à partir de la résistance au cisaillement. La résistance au cisaillement non drainé de l'argile intacte (s_u) et de l'argile remaniée (s_r) est mesurée en chantier ou en laboratoire.

CONSISTANCE	RÉSISTANCE AU CISAILLEMENT, s_u (kPa)		
Très molle		<	12
Molle	12	-	25
Ferme	25	-	50
Raide	50	-	100
Très raide	100	-	200
Dure		>	200

PLASTICITÉ	LIMITE DE LIQUIDITÉ, W_L %		
Faible		<	30
Moyenne	30	-	50
Élevée		>	50

3. DESCRIPTION DU ROC

Le roc est décrit en fonction de sa nature géologique, de ses caractéristiques structurales et de ses propriétés mécaniques.

L'indice de qualité du roc (RQD) est déterminé selon la norme ASTM D 6032.

CLASSIFICATION	INDICE DE QUALITÉ RQD (%)		
Très mauvaise qualité		<	25
Mauvaise qualité	25	-	50
Qualité moyenne	50	-	75
Bonne qualité	75	-	90
Excellente qualité	90	-	100

JOINTS	ESPACEMENT MOYEN (mm)		
Très rapprochés	0	-	60
Rapprochés	60	-	200
Moyennement espacés	200	-	600
Espacés	600	-	2000
Très espacés		>	2000

RÉSISTANCE	RÉSISTANCE À LA COMPRESSION UNIAXIALE, q_u (MPa)		
Extrêmement faible		<	1
Très faible	1	-	5
Faible	5	-	25
Moyennement forte	25	-	50
Forte	50	-	100
Très forte	100	-	250
Extrêmement forte		>	250

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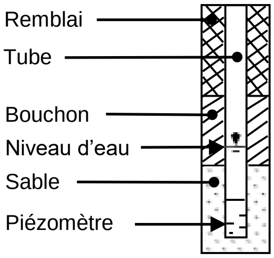
NOTES EXPLICATIVES

RAPPORT DE SONDAGE

(page 2 de 2)

NIVEAU D'EAU

La colonne « Niveau d'eau » indique le niveau de l'eau souterraine mesuré dans un tube d'observation, un piézomètre, un puits d'observation ou directement dans un sondage. La date du relevé est également indiquée dans cette colonne. Le croquis ci-contre illustre les différents symboles utilisés.



ÉCHANTILLONS

1. TYPE ET NUMÉRO

La colonne « Type et numéro » correspond à la numérotation de l'échantillon. Il comprend deux lettres identifiant le type d'échantillonnage, suivi d'un chiffre séquentiel. Les types d'échantillonnage sont les suivants :

CF :	carottier fendu	CR :	carottier diamanté
CG :	carottier grand diamètre	VR :	prélèvement manuel
TM :	tube à paroi mince	ET :	tarière
TU :	tube échantillonneur en plastique (Geoprobe)		

2. ÉTAT

La profondeur, la longueur et l'état de chaque échantillon sont indiqués dans cette colonne. Les symboles suivants illustrent l'état de l'échantillon :

☒ Remanié ▨ Intact ■ Perdu ▥ Symbole utilisé pour l'échantillonnage avec un carottier diamanté

3. RÉCUPÉRATION

La récupération de l'échantillon correspond à la longueur récupérée de l'échantillon par rapport à la longueur de l'enfoncement de l'échantillonneur, exprimée en pourcentage.

ESSAIS IN SITU ET EN LABORATOIRE

Les résultats des essais effectués en chantier et en laboratoire sont indiqués dans les colonnes « Essais in situ et en laboratoire » à la profondeur correspondante.

La liste d'abréviations suivante sert à identifier ces essais.

ABRÉVIATIONS

A	Absorption, L/min-m (essai d'eau sous pression)
AC	Analyses chimiques
C	Essai de consolidation
C_c	Coefficient de courbure
C_U	Coefficient d'uniformité
s_u	Résistance au cisaillement à l'état intact, mesurée au scissomètre de chantier, kPa
s_r	Résistance au cisaillement à l'état remanié, mesurée au scissomètre de chantier, kPa
s_{us}	Résistance au cisaillement à l'état intact, mesurée au pénétromètre à cône (cône suédois), kPa
s_{rs}	Résistance au cisaillement à l'état remanié, mesurée au pénétromètre à cône (cône suédois), kPa
s_{up}	Résistance au cisaillement à l'état intact, mesurée au scissomètre portatif, kPa
s_{rp}	Résistance au cisaillement à l'état remanié, mesurée au scissomètre portatif, kPa
D_r	Densité relative des particules solides
E_M	Module pressiométrique, kPa ou MPa
G	Analyse granulométrique par tamisage et lavage
I_L	Indice de liquidité
I_p	Indice de plasticité, %
k_c	Coefficient de perméabilité (conductivité hydraulique) mesuré en chantier, m/s
k_L	Coefficient de perméabilité (conductivité hydraulique) mesuré en laboratoire, m/s
N_{dc}	Indice de pénétration (essai de pénétration dynamique au cône, DCPT)
N	Indice de pénétration (essai de pénétration standard, SPT)
P_{80}	Analyse granulométrique par lavage au tamis 80 μm
P_L	Pression limite de l'essai pressiométrique, kPa
P_r	Essai Proctor
γ	Poids volumique, kN/m^3
γ'	Poids volumique déjaugé, kN/m^3
q_u	Résistance à la compression uniaxiale du roc, MPa
R	Refus à l'enfoncement du carottier fendu
S	Analyse granulométrique par sédimentométrie
S_t	Sensibilité (s_u/s_r)
T.A.S.	Taux d'agressivité du sol
w	Teneur en eau, %
w_L	Limite de liquidité, %
w_p	Limite de plasticité, %

Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

BOREHOLE : BH-01-16

DATE : 2016-01-20
COORDINATES : UTM NAD27
E : 361981,0 **N :** 5362310,0
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES: TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A: WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	D LABORATO: OTHER TESTS	Y TESTS: ▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	137,10	Organic soil		CF-1		100				
0,60	136,50	Brown clayey silt		CF-2		100	15			
1,70	135,40	Clayey silt, traces of gravel		CF-3		100	19			
				CF-4		100	51			
3,00	134,10	Clayey silt, traces of sand and gravel		CF-5		100	19			
				CF-6		100	30			
6,00	131,10	Grey silt, some gravel, traces of sand. Presence of cobbles		CF-7		100	63			
				CR-8		35				
9,00	128,10	Sand, some silt, traces of gravel		CF-9		23	18		N: 4+4+14/13 cm	

REMARKS :

DRILLING METHOD :

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Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-01-16

DATE : 2016-01-20
COORDINATES : UTM NAD27
E : 361981,0 **N :** 5362310,0
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES				IN SITU AND LABORATORY TESTS		
				TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
		Rock : Pink granitic rock (Le granite de La Baie), coarsed grained, composed of feldspar, quartz, minor amount of biotite, hornblende. Presence of pervasive alteration to hematite, as infilling of micro-fracture in feldspar. Rock is very hard, however become brittle with increasing level of alteration. Spacing between the joints varies from 10 m to 250 mm. Joints surface are rough and irregular. Some partially open joints have a soft infilling of hematite. Main set of structural features represented by horizontal to sub-horizontal joints. Rock quality is poor to fair (RQD from 0 to 65).		CR-10		59	0			
11				CR-11		100	65			
11,85	125,25	**End of borehole**								
12										
13										
14										
15										
16										
17										
18										
19										
20										

REMARKS :

DRILLING METHOD :

Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-02-16

DATE :
COORDINATES : UTM NAD27
E : 362135,5 **N :** 5362300,4
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS: WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	138,39									
		Rock Fill								
1,30	137,09	Rock Fill								
4,00	134,39	**End of borehole**								

1 2 3 4 5 6 7 8 9 10

REMARKS :

DRILLING METHOD :

F:\Geotec80\Style_projet634451-LOG-BH-INCL-2014(AM).sty PLOTTED: 2016-03-02 14:28hrs

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-04-16

DATE : 2016-01-21
COORDINATES : UTM NAD27
E : 361970,6 **N :** 5362234,1
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES				IN SITU A	D LABORATO	Y TESTS
				TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	139,61	Organic soil								
0,25	139,36	Brown peat		CF-1		100	2			
1,00	138,61	Brown sand, some gravel, traces of silt. Presence of cobbles		CF-2		75	28			
3,00	136,61	Grey sand, some silt and gravel. Presence of cobbles and boulders		CR-3		88				
				CF-4		75	42			
				CF-5		8	92			
4,75	134,86	Boulders								
5,45	134,16	Till fill		CR-6		30				
				CR-7		16				
				CR-8		49				
7,30	132,31	Rock : pale grey ortho-gneiss, medium to coarse grained, composed of quartz, feldspar, traces of biotite, hornblende, magnetite, and garnet. The rock is generally very hard and fresh (not altered). Foliation defined by the alignment of silicate and mafic minerals. Spacing between the joints varies from 10 m to 250 mm. Joints surface are rough and irregular. Main set of structural features represented by horizontal to sub-horizontal joints. Rock quality is poor		CR-9		16	0			
				CR-10		100	82			
9,49	130,12									

REMARKS :

DRILLING METHOD :

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BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-05-16

DATE : 2016-01-26
COORDINATES : UTM NAD27
E : 362110,6 **N :** 5362178,3
AZIMUT : ° **PLUNGE :** °

				SAMPLES				IN SITU A	D LABORATO	Y TESTS
DEPTH (m)	**ELEVATION (m)**	**DESCRIPTION**	**WATER LEVEL**	**TYPE AND NUMBER**	**CONDITION**	**RECOVERY (%)**	**N or RQD (%)**	**WATER CONTENT AND ATTERBERG LIMITS (%)** W_P W W_L	**OTHER TESTS**	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✪ S_{rs} (kPa) N_{dc} (blows/300 mm)
	140,10							20 40 60 80		50 100 150
		Organic soil		CF-1	☒	100			N: 6-3-5/10cm	
0,40	139,70	Rock: pink, unaltered, granitic rock.		CR-2		100	40			
				CR-3		100	65			
2,79	137,31	**End of borehole**								

REMARKS :

DRILLING METHOD :

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Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

BOREHOLE : BH-06-16

DATE :
COORDINATES : UTM NAD27
E : 362344,6 **N :** 5362179,9
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A D LABORATO Y TESTS WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✡ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	140,78	Rock Fill								
2,00	138,78	Rock : undefined								
3,50	137,28	**End of borehole**								

REMARKS :

DRILLING METHOD :

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BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation

PROJECT : Pig Iron Production Plant

LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

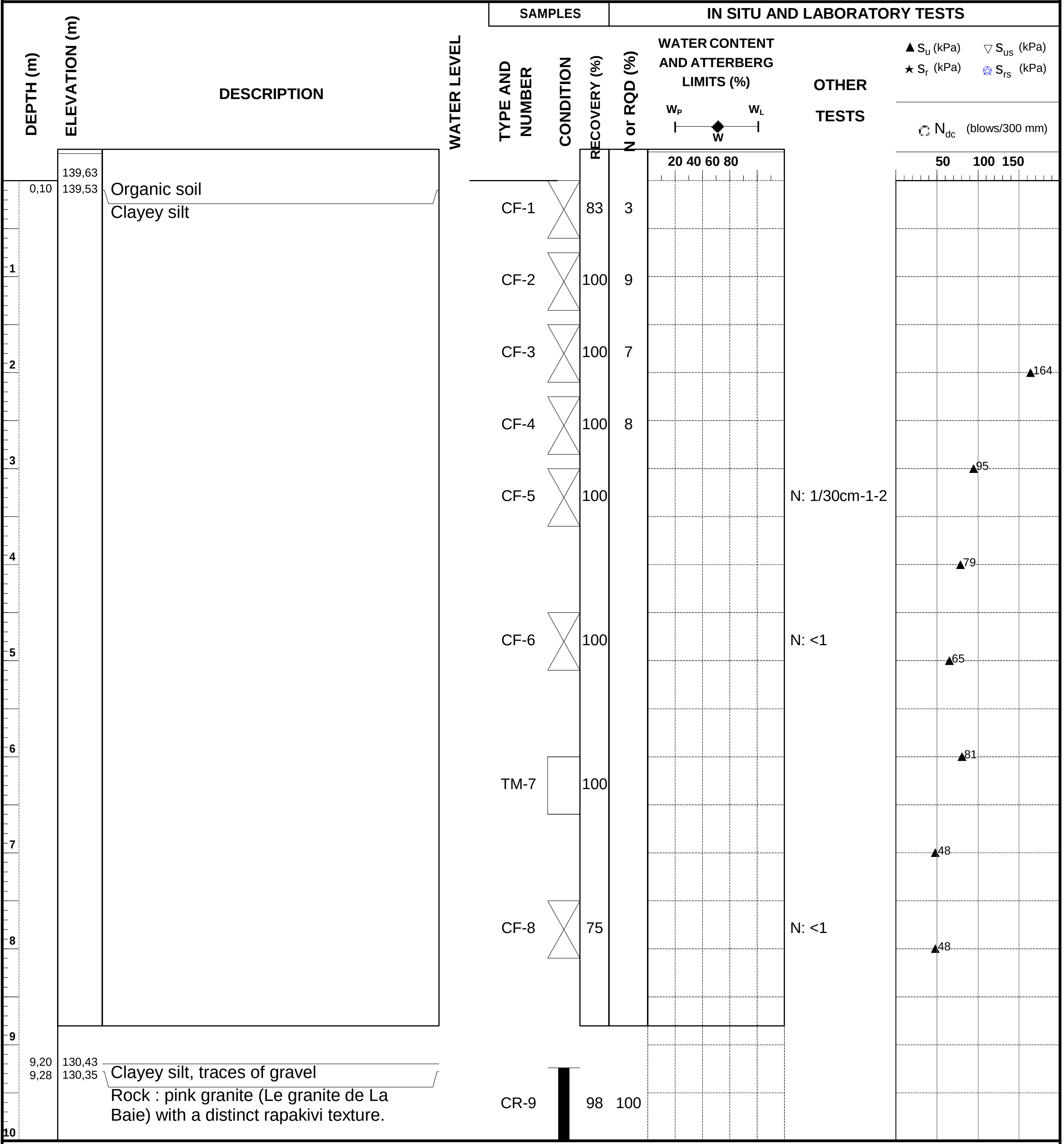
BOREHOLE : BH-08-16

DATE : 2016-01-15

COORDINATES : UTM NAD27

E : 362114,5 **N :** 5362084,3

AZIMUT : ° **PLUNGE :** °



DEPTH (m)	ELEVATION (m)	DESCRIPTION
	139,63	Organic soil
0,10	139,53	Clayey silt
9,20	130,43	Clayey silt, traces of gravel
9,28	130,35	Rock : pink granite (Le granite de La Baie) with a distinct rapakivi texture.

TYPE AND NUMBER	RECOVERY (%)	N or RQD (%)	OTHER TESTS
CF-1	83	3	
CF-2	100	9	
CF-3	100	7	
CF-4	100	8	
CF-5	100		N: 1/30cm-1-2
CF-6	100		N: <1
TM-7	100		
CF-8	75		N: <1
CR-9	98	100	

REMARKS :

DRILLING METHOD :

Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-08-16

DATE : 2016-01-15
COORDINATES : UTM NAD27
E : 362114,5 **N :** 5362084,3
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES: TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A D LABORATO Y TESTS: WATER CONTENT AND ATTERBERG LIMITS (%) W	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm)
								W_P W W_L 20 40 60 80		50 100 150
11		Composed of plagioclase feldspar, potassium feldspar, quartz, hornblende, Bbotite, and magnetite. General texture is equigranular and massive. Presence of subhorizontal joints, rough and irregular surfaces. Excellent quality (RQD = 100%).								
11,40 12	128,23	Rock : very dark grey gneiss (amphibolite), fine to medium grained, composed of biotite, hornblende, minor amount of plagiocase feldspar. Presence of subhorizontal joints, rough and irregular surfaces. Excellent quality (RQD = 100%).		CR-10		100	100			
12,41 13 14 15 16 17 18 19 20	127,22	**End of borehole**								

REMARKS :

DRILLING METHOD :

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-11-16

DATE :
COORDINATES : UTM NAD27
E : 362341,2 **N :** 5362014,4
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES: TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS: WATER CONTENT AND ATTERBERG LIMITS (%) W	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) / N_{dc} (blows/300 mm)
								W_P ⊢—◆—⊣ W_L, W 20 40 60 80		50 100 150
	141,64	Rock Fill								
4,50	137,14	Clayey Deposit								
6,30	135,34	**End of borehole**								

REMARKS :

DRILLING METHOD :

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Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

BOREHOLE : BH-12-16

DATE :
COORDINATES : UTM NAD27
E : 362289,1 **N :** 5362015,8
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES				IN SITU A	D LABORATO	Y TESTS
				TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	WATER CONTENT AND ATTERBERG LIMITS (%) W$_P$ W W$_L$ 20 40 60 80	OTHER TESTS	▲ S$_u$ (kPa) ▽ S$_{us}$ (kPa) ★ S$_r$ (kPa) ✩ S$_{rs}$ (kPa) N$_{dc}$ (blows/300 mm) 50 100 150
	141,65	Rock Fill								
5,30	136,35	Clayey Deposit								
5,90	135,75	**End of borehole**								

1 2 3 4 5 6 7 8 9 10

REMARKS :

DRILLING METHOD :

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BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

BOREHOLE : BH-13-16

DATE :
COORDINATES : UTM NAD27
E : 362244,7 **N :** 5362018,3
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS: WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	141,73	Rock Fill								
4,80	136,93	Clayey Deposit								
5,95	135,78	**End of borehole**								

Depth scale: 1 2 3 4 5 6 7 8 9 10

REMARKS :

DRILLING METHOD :

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BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-14-16

DATE :
COORDINATES : UTM NAD27
E : 362225,5 **N :** 5362055,1
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A D LABORATO Y TESTS WATER CONTENT AND ATTERBERG LIMITS (%) WP W WL 20 40 60 80	OTHER TESTS	▲ Su (kPa) ▽ Sus (kPa) ★ Sr (kPa) ✩ Srs (kPa) Ndc (blows/300 mm) 50 100 150
	141,97									
		Rock Fill								
3,20	138,77	Clayey Deposit								
4,20	137,77	**End of borehole**								

REMARKS :

DRILLING METHOD :

Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-15-16

DATE :
COORDINATES : UTM NAD27
E : 362261,6 **N :** 5362055,4
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	SAMPLES CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS WATER CONTENT AND ATTERBERG LIMITS (%) W	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm)
	141,98	Rock Fill						20 40 60 80		50 100 150
4,00	137,98	Rock : undefined								
6,40	135,58	**End of borehole**								

Depth scale: 1 2 3 4 5 6 7 8 9 10

REMARKS :

DRILLING METHOD :

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Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-16-16

DATE :
COORDINATES : UTM NAD27
E : 362243,9 **N :** 5362088,1
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES				IN SITU AND LABORATORY TESTS		
				TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm)
	142,16							20 40 60 80		50 100 150
		Rock Fill								
3,30	138,86	Rock : undefined								
5,70	136,46	**End of borehole**								

REMARKS :

DRILLING METHOD :

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BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

BOREHOLE : BH-17-16

DATE :
COORDINATES : UTM NAD27
E : 362314,2 **N :** 5362052,9
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	D LABORATO OTHER TESTS	Y TESTS ▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✪ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	142,09									
		Rock Fill								
4,50	137,59	Rock : undefined								
7,60	134,49	**End of borehole**								

REMARKS :

DRILLING METHOD :

Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-18-16

DATE : 2016-01-25
COORDINATES : UTM NAD27
E : 362027,7 **N :** 5362217,6
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	D LABORATO OTHER TESTS	Y TESTS ▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	139,40									
0,26	139,14	Organic Soil								○10
		End of borehole								

1
2
3
4
5
6
7
8
9
10

REMARKS :

DRILLING METHOD :

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Qualitas

BOREHOLE LOG

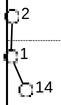
CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-19-16

DATE : 2016-01-25
COORDINATES : UTM NAD27
E : 362058,1 **N :** 5362204,1
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	D LABORATO OTHER TESTS	Y TESTS ▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	139,58	Organic Soil								
0,15	139,43	Clayey Deposit								2 1
0,85	138,73	**End of borehole**								14
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										



REMARKS :

DRILLING METHOD :

Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

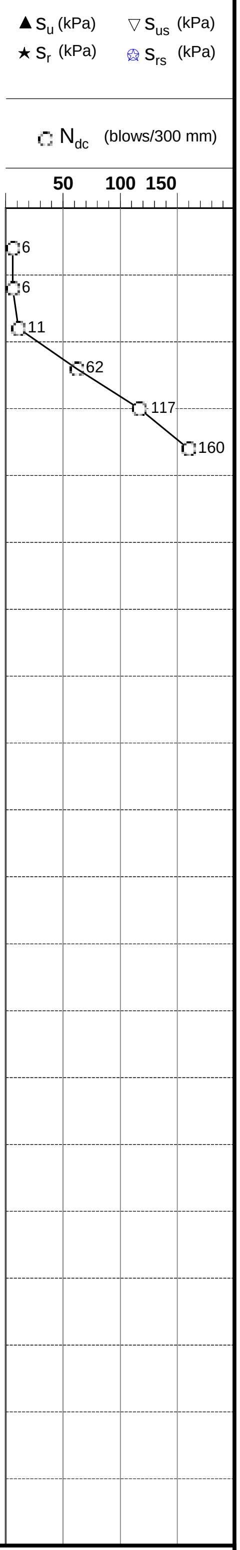
FILE : 634451

BOREHOLE : BH-20-16

DATE : 2016-01-25
COORDINATES : UTM NAD27
E : 362021,0 **N :** 5362168,0
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES: TYPE AND NUMBER	SAMPLES: CONDITION	SAMPLES: RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS: WATER CONTENT AND ATTERBERG LIMITS (%)	OTHER TESTS
	139,94	Organic Soil							
0,30	139,64	Clayey Deposit							
1,80	138,14	**End of borehole**							

Water content legend: W_P ├──◆──┤ W_L, W; scale 20 40 60 80



Depth scale (m): 1 2 3 4 5 6 7 8 9 10

REMARKS :

DRILLING METHOD :

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation

PROJECT : Pig Iron Production Plant

LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-21-16

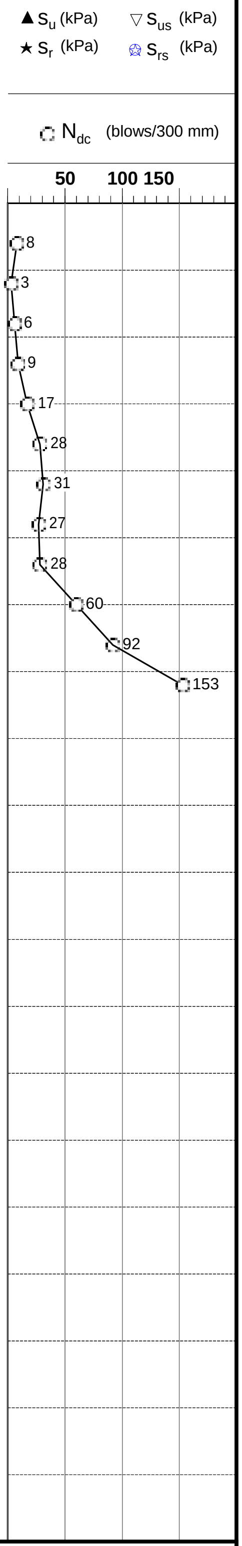
DATE : 2016-01-25

COORDINATES : UTM NAD27

E : 362061,0 **N :** 5362161,5

AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES: TYPE AND NUMBER	SAMPLES: CONDITION	SAMPLES: RECOVERY (%)	SAMPLES: N or RQD (%)	IN SITU AND LABORATORY TESTS: WATER CONTENT AND ATTERBERG LIMITS (%)	IN SITU AND LABORATORY TESTS: OTHER TESTS
	139,79	Organic Soil							
0,20	139,59	Clayey Deposit							
3,60	136,19	**End of borehole**							



REMARKS :

DRILLING METHOD :

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BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

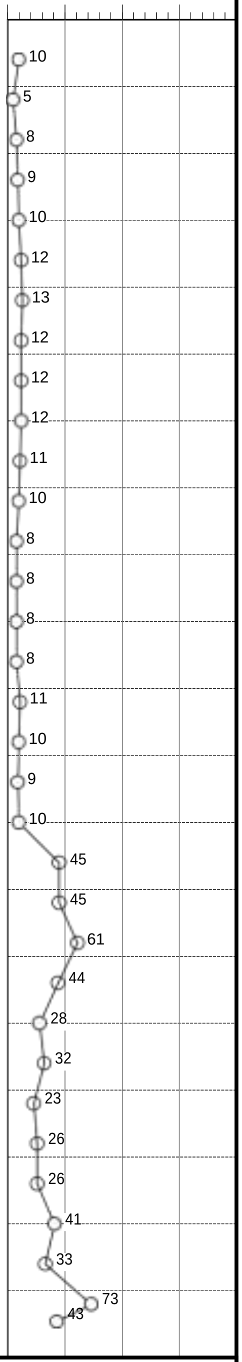
BOREHOLE : BH-22-16

DATE : 2016-01-25
COORDINATES : UTM NAD27
E : 362005,7 **N :** 5362110,1
AZIMUT : ° **PLUNGE :** °

SAMPLES | **IN SITU AND LABORATORY TESTS**

DEPTH (m) | **ELEVATION (m)** | **DESCRIPTION** | **WATER LEVEL** | **TYPE AND NUMBER** | **CONDITION** | **RECOVERY (%)** | **N or RQD (%)** | **WATER CONTENT AND ATTERBERG LIMITS (%)** W_P W W_L 20 40 60 80 | **OTHER TESTS** | ▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) ○ N_{dc} (blows/300 mm) 50 100 150

DEPTH (m)	ELEVATION (m)	DESCRIPTION
	140,30	Organic Soil
0,25	140,05	Clayey Deposit
9,73	130,57	End of borehole



REMARKS :

DRILLING METHOD :

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Qualitas

BOREHOLE LOG

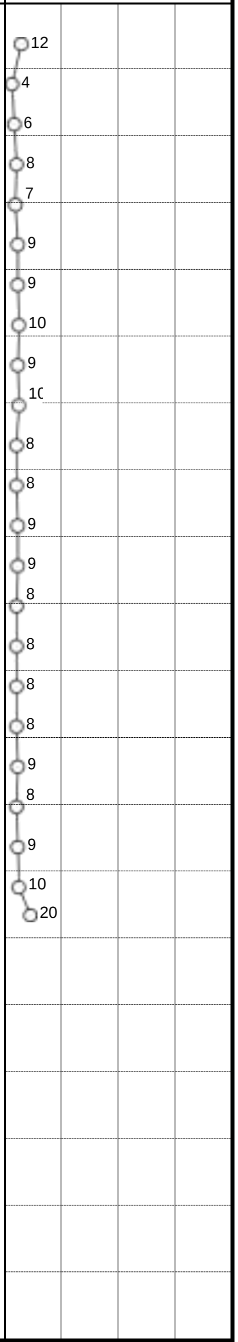
CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : BH-23-16

DATE : 2016-01-25
COORDINATES : UTM NAD27
E : 362052,5 **N :** 5362102,2
AZIMUT : ° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) ○ N_{dc} (blows/300 mm) 50 100 150
	139,89									
0,15	139,74	Organic Soil								
		Clayey Deposit								
6,81	133,08	**End of borehole**								



Depth scale: 1 2 3 4 5 6 7 8 9 10

REMARKS :

DRILLING METHOD :

F:\Geotec80\Style_projet634451-LOG-BH-INCL-2014(AM).sty PLOTTED: 2016-03-02 14:28hrs

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-03A-16

DATE :
COORDINATES : UTM NAD27
E :362335,3 **N :**5362288,3
AZIMUT :° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES				IN SITU A	D LABORATO	Y TESTS
				TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
	138,66									
		Rock Fill								
2,30	136,36	Rock : undefined								

REMARKS :

DRILLING METHOD :

Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-03A-16

DATE :
COORDINATES : UTM NAD27
E :362335,3 **N :**5362288,3
AZIMUT :° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	SAMPLES CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
11										
12										
12,10	126,56	**End of borehole**								
13										
14										
15										
16										
17										
18										
19										
20										

REMARKS :

DRILLING METHOD :

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-03B-16

DATE :
COORDINATES : UTM NAD27
E :362335,3 **N :**5362288,3
AZIMUT :° **PLUNGE :** °

	DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES: TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A: WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L	D LABORATO: OTHER TESTS	Y TESTS: ▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm)
		138,66							20 40 60 80		50 100 150
			Rock Fill								
1											
2											
3	2,90	135,76	**End of borehole**								
4											
5											
6											
7											
8											
9											
10											

REMARKS :

DRILLING METHOD :

F:\Geotec80\Style_projet634451-LOGMW-BH-INCL-2014(AM).sty PLOTTED: 2016-03-02 14:44hrs

BOREHOLE LOG

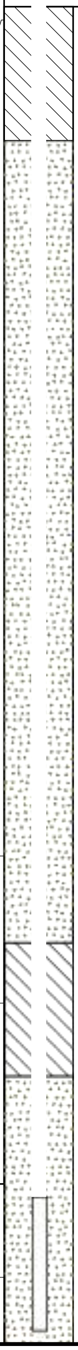
CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

BOREHOLE : MW-07-16

DATE : 2016-01-19
COORDINATES : UTM NAD27
E :361973,7 **N :**5362113,9
AZIMUT :° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION
	140,41	Organic soil
0,10	140,31	Clayey silt
6,35	134,06	Silty sand and gravel.
7,45	132,96	Broken rock. Multiple pieces, presence of oxydation along the joints and silt coating on the joints surfaces.
9,50	130,91	Rock : dark grey para-gneiss, medium to coarse grained. Composed of feldspar,

WATER LEVEL 2016-01-20



SAMPLES

TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)
CF-1		83	5
CF-2		100	9
CF-3		100	5
CF-4		100	5
CF-5		100	
CF-6		100	
CF-7		58	14
CR-8		35	0
CR-9		100	0
CR-10		100	0
CR-11		100	0
CR-12		100	0
CR-13		100	53

IN SITU AND LABORATORY TESTS

WATER CONTENT AND ATTERBERG LIMITS (%)
W_P W_L W
20 40 60 80

OTHER TESTS
N: PDS

▲ S_u (kPa) ▽ S_{us} (kPa)
★ S_r (kPa) ✩ S_{rs} (kPa)
○ N_{dc} (blows/300 mm)
50 100 150

REMARKS :

DRILLING METHOD :

Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-07-16

DATE : 2016-01-19
COORDINATES : UTM NAD27
E :361973,7 **N :**5362113,9
AZIMUT :° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL 2016-01-20	SAMPLES TYPE AND NUMBER	SAMPLES CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS: WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
10,45	129,96	quartz, garnet, and traces biotite. Presence of alteration (in sericite) along the joint surfaces. Joints surfaces are rough and irregular. Rock quality very poor to fair (RQD 0 to 53%).								
		End of borehole								

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REMARKS :

DRILLING METHOD :

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BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-07-16

DATE : 2016-01-19
COORDINATES : UTM NAD27
E :361973,7 **N :**5362113,9
AZIMUT :° **PLUNGE :** °

				SAMPLES				IN SITU A	D LABORATO	Y TESTS
DEPTH (m)	**ELEVATION (m)**	**DESCRIPTION**	**WATER LEVEL** 2016-01-20	**TYPE AND NUMBER**	**CONDITION**	**RECOVERY (%)**	**N or RQD (%)**	**WATER CONTENT AND ATTERBERG LIMITS (%)** W_P W W_L 20 40 60 80	**OTHER TESTS**	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
21										
22										
23										
24										
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26										
27										
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30										

REMARKS :

DRILLING METHOD :

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Qualitas

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-09-16

DATE :
COORDINATES : UTM NAD27
E :362343,1 **N :**5362085,9
AZIMUT :° **PLUNGE :** °

	DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES TYPE AND NUMBER	SAMPLES CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU A: WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L	D LABORATO: OTHER TESTS	Y TESTS: ▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa); N_{dc} (blows/300 mm)
		142,11							20 40 60 80		50 100 150
			Rock Fill								
1											
2											
3											
4	3,90	138,21	Rock : undefined								
5											
6											
7											
8											
9											
10											

REMARKS :

DRILLING METHOD :

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BOREHOLE LOG

Page 2 of 2

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-09-16

DATE :
COORDINATES : UTM NAD27
E :362343,1 **N :**5362085,9
AZIMUT :° **PLUNGE :** °

DEPTH (m)		ELEVATION (m)	DESCRIPTION	WATER LEVEL	SAMPLES				IN SITU A	D LABORATO	Y TESTS
					TYPE AND NUMBER	CONDITION	RECOVERY (%)	N or RQD (%)	WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✪ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
11											
12											
13											
14	14,01	128,10	**End of borehole**								
15											
16											
17											
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19											
20											

REMARKS :

DRILLING METHOD :

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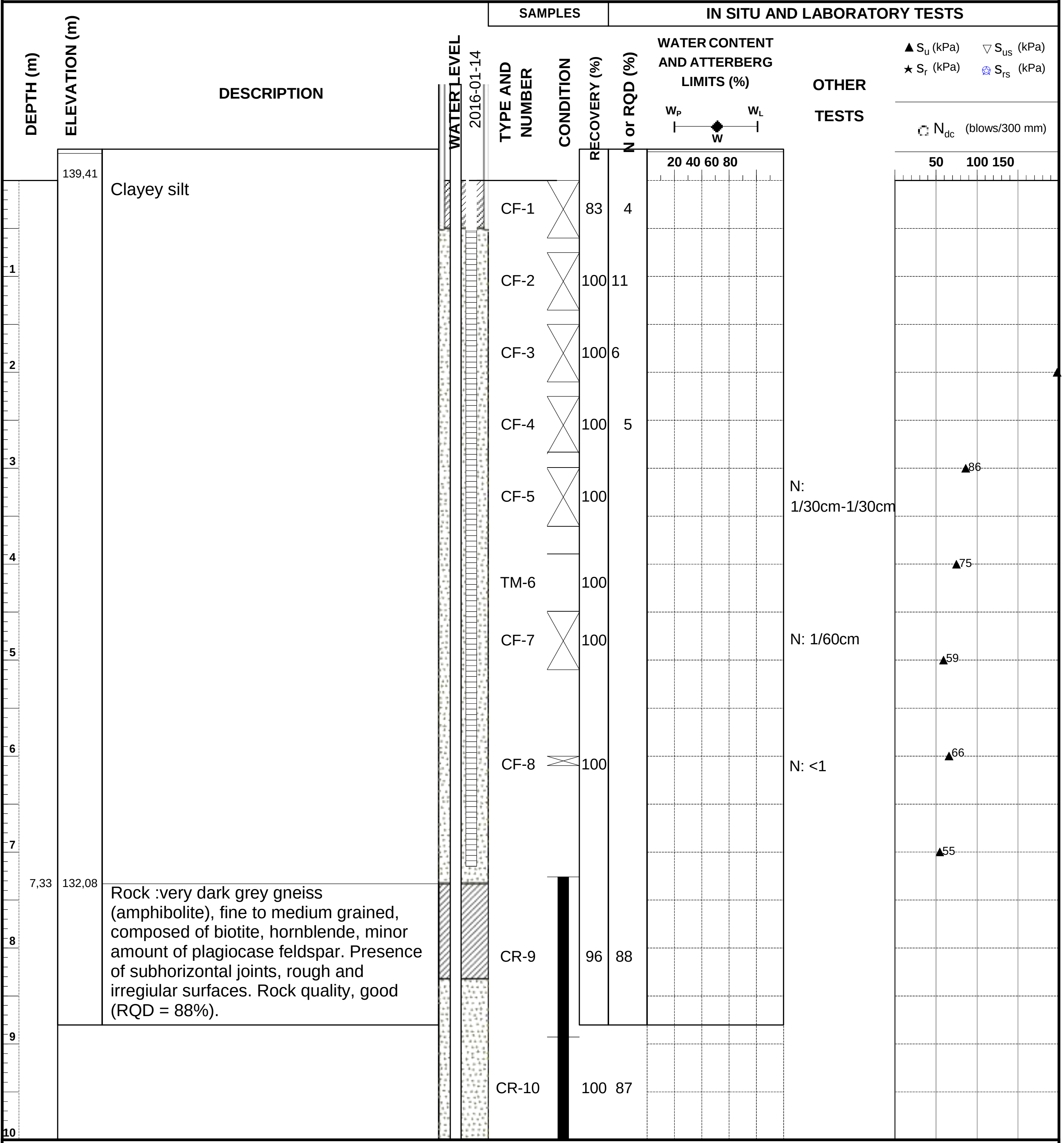
BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

BOREHOLE : MW-10-16

DATE : 2016-01-13
COORDINATES : UTM NAD27
E :362134,0 **N :**5362014,7
AZIMUT :° **PLUNGE :** °



DEPTH (m)	ELEVATION (m)	DESCRIPTION	TYPE AND NUMBER	RECOVERY (%)	N or RQD (%)	OTHER TESTS
	139,41	Clayey silt	CF-1	83	4	
			CF-2	100	11	
			CF-3	100	6	
			CF-4	100	5	
			CF-5	100		N: 1/30cm-1/30cm
			TM-6	100		
			CF-7	100		N: 1/60cm
			CF-8	100		N: <1
7,33	132,08	Rock :very dark grey gneiss (amphibolite), fine to medium grained, composed of biotite, hornblende, minor amount of plagiocase feldspar. Presence of subhorizontal joints, rough and irregiular surfaces. Rock quality, good (RQD = 88%).	CR-9	96	88	
			CR-10	100	87	

REMARKS :

DRILLING METHOD :

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-10-16

DATE : 2016-01-13
COORDINATES : UTM NAD27
E :362134,0 **N :**5362014,7
AZIMUT :° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL 2016-01-14	SAMPLES TYPE AND NUMBER	SAMPLES CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
10,48	128,93	**End of borehole**								

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REMARKS :

DRILLING METHOD :

BOREHOLE LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

BOREHOLE : MW-10-16

DATE : 2016-01-13
COORDINATES : UTM NAD27
E :362134,0 **N :**5362014,7
AZIMUT :° **PLUNGE :** °

DEPTH (m)	ELEVATION (m)	DESCRIPTION	WATER LEVEL 2016-01-14	SAMPLES TYPE AND NUMBER	SAMPLES CONDITION	RECOVERY (%)	N or RQD (%)	IN SITU AND LABORATORY TESTS WATER CONTENT AND ATTERBERG LIMITS (%) W_P W W_L 20 40 60 80	OTHER TESTS	▲ S_u (kPa) ▽ S_{us} (kPa) ★ S_r (kPa) ✩ S_{rs} (kPa) N_{dc} (blows/300 mm) 50 100 150
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										

REMARKS :

DRILLING METHOD :

F:\Geotec80\Style_projet634451-LOGMW-BH-INCL-2014(AM).sty PLOTTED: 2016-03-02 14:44hrs

TEST PIT LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

TEST PIT : PE-24-16

DATE : 2016-02-04
OFFSET (UPLINE/BACKLINE):
HUB COORDINATES : UTM NAD27
E : 361821,71 **N :** 5362309,23

DEPTH (m)	ELEVATION (m)	DESCRIPTION	SAMPLES TYPE AND	COBBLES VOL %	BOULDERS VOL % (mm max.diam)	OTHER TESTS
	150,34					
		Peat				
0,20	150,14	**End of test pit** **Refusal on assumed bedrock**				

1

2

REMARKS :

Trench wall stability: stable

EQUIPMENT : Komatsu PC 210

TEST PIT DIMENSIONS AT GROUND SURFACE : 1,8m x 3,0m

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TEST PIT LOG

Page 1 of 1

CLIENT : North Atlantic Iron Corporation

PROJECT : Pig Iron Production Plant

LOCATION : Grand-Anse, La Baie, Quebec

FILE : 634451

TEST PIT : PE-25-16

DATE : 2016-02-04

OFFSET (UPLINE/BACKLINE):

HUB COORDINATES : UTM NAD27

E : 361824,75 **N :** 5362218,32

DEPTH (m)	ELEVATION (m)	DESCRIPTION	SAMPLES			OTHER TESTS
			TYPE AND	COBBLES VOL %	BOULDERS VOL % (mm max.diam)	
	148,78					
		Organic Soil				
0,10	148,68	**End of test pit** **Refusal on assumed bedrock**				
1						
2						

REMARKS :

Trench wall stability: stable

EQUIPMENT : Komatsu PC210

TEST PIT DIMENSIONS AT GROUND SURFACE : 1,8m x 3,0m

F:\Geotec80\Style_projet634451--LOG-TP(PHOTO)-2014(AM).sty PLOTTED: 2016-03-02 14:46hrs

TEST PIT LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

TEST PIT : PE-26-16

DATE : 2016-02-04
OFFSET (UPLINE/BACKLINE):
HUB COORDINATES : UTM NAD27
E : 361811,96 **N :** 5362133,46

DEPTH (m)	ELEVATION (m)	DESCRIPTION	SAMPLES TYPE AND	COBBLES VOL %	BOULDERS VOL % (mm max.diam)	OTHER TESTS
	146,76	Organic Soil				
0,20	146,56	Beige silty sand.				
0,40	146,36	**End of test pit** **Refusal on assumed bedrock**				

Depth scale: 1, 2

REMARKS :

Trench wall stability: stable

EQUIPMENT : Komatsu PC210

TEST PIT DIMENSIONS AT GROUND SURFACE : 1,8m x 3,0m

TEST PIT LOG

CLIENT : North Atlantic Iron Corporation
PROJECT : Pig Iron Production Plant
LOCATION : Grand-Anse, La Baie, Quebec
FILE : 634451

TEST PIT : PE-27-16

DATE : 2016-02-04
OFFSET (UPLINE/BACKLINE):
HUB COORDINATES : UTM NAD27
E : 361834,62 **N :** 5362267,76

DEPTH (m)	ELEVATION (m)	DESCRIPTION	SAMPLES			OTHER TESTS
			TYPE AND	COBBLES VOL %	BOULDERS VOL % (mm max.diam)	
	143,79	Organic Soil and peat				
0,60	143,19	Grey silt and sand.				
1,00	142,79	Fragmented bedrock.				
1,20	142,59	**End of test pit** **Refusal on assumed bedrock**				

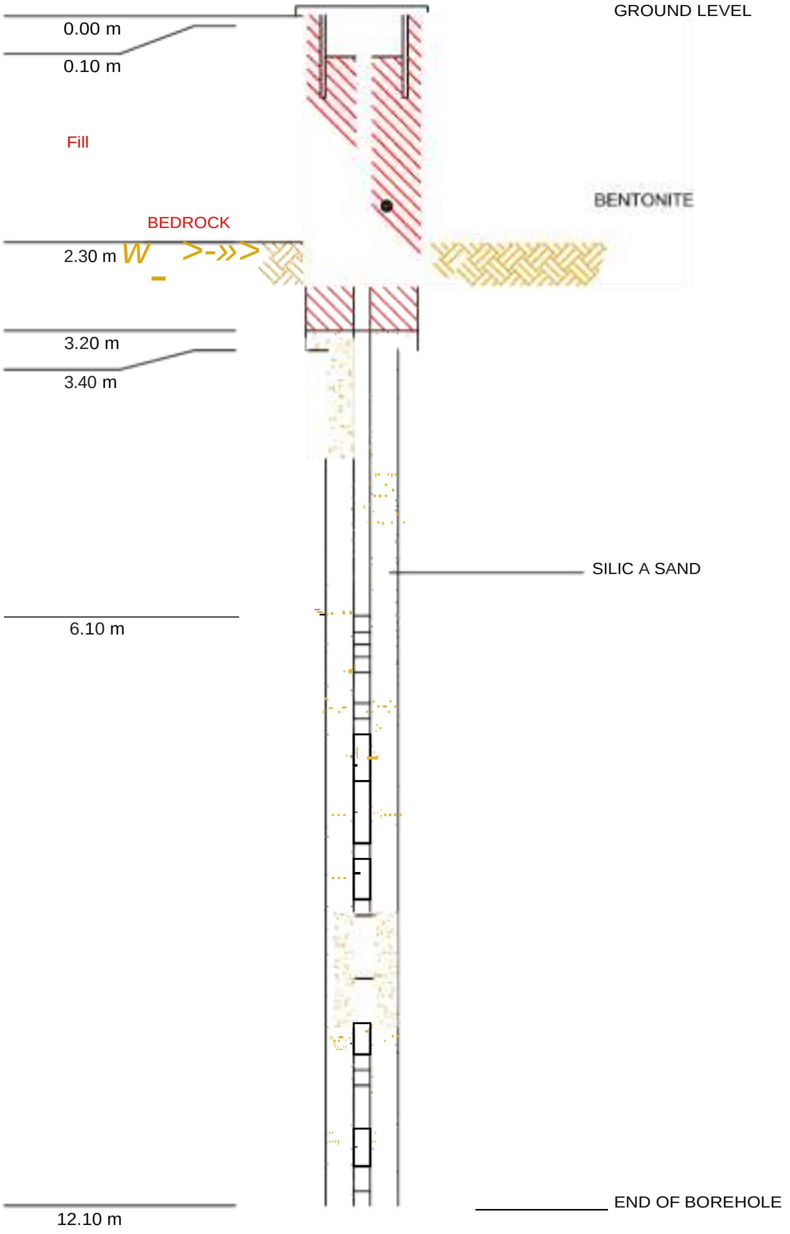
REMARKS :

Weak water seepage at 0.6 m in depth.
Trench wall stability: stable

EQUIPMENT : Komatsu PC210

TEST PIT DIMENSIONS AT GROUND SURFACE : 2,0m x 4,0m

MW-03A-16



SNC•LAVALIN

CLIENT • North Atlantic Iron Corporation

PROJECT • Pig Iron Production Plant

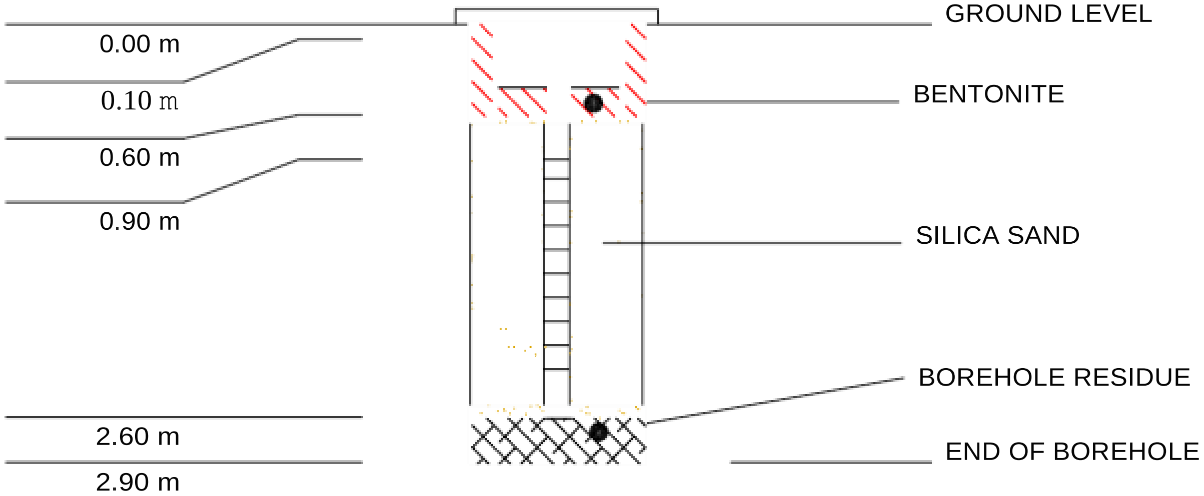
LOCATION Grande-Baie, La Baie, Quebec

TITLE • MW-03A-16 piezometer

SCALE •	DATE •	FILE •	DRAWING •
1 : 75	2016-01-18	634451	634451-01

FORMAT 8,5x11

MW-038-16



SNC•LAVALIN

CLIENT • North Atlantic Iron Corporation

PROJECT • Pig Iron Production Plant

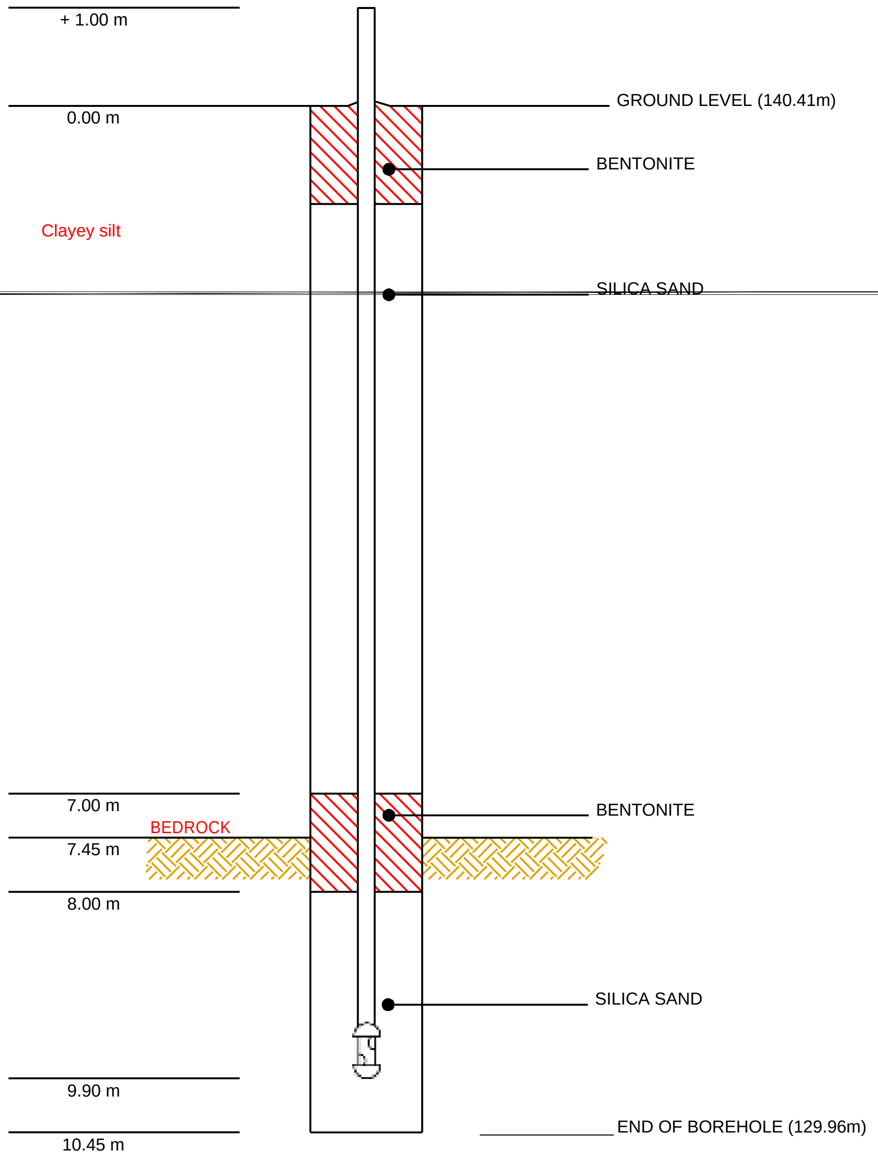
LOCATION Grande-Baie, La Baie, Quebec

TITLE • MW-03B-16 piezometer

SCALE •	DATE •	FILE •	DRAWING •
1 : 50	2016-01-18	634451	634451-02

FORMAT 8,5x11

BH-07-16



SNC·LAVALIN

CLIENT : North Atlantic Iron Corporation

PROJECT : Pig Iron Production Plant

LOCATION : Grande-Baie, La Baie, Quebec

TITLE : BH-07-16 piezometer

SCALE :	DATE :	FILE :	DRAWING :
1 : 75	2016-01-28	634451	634451-04

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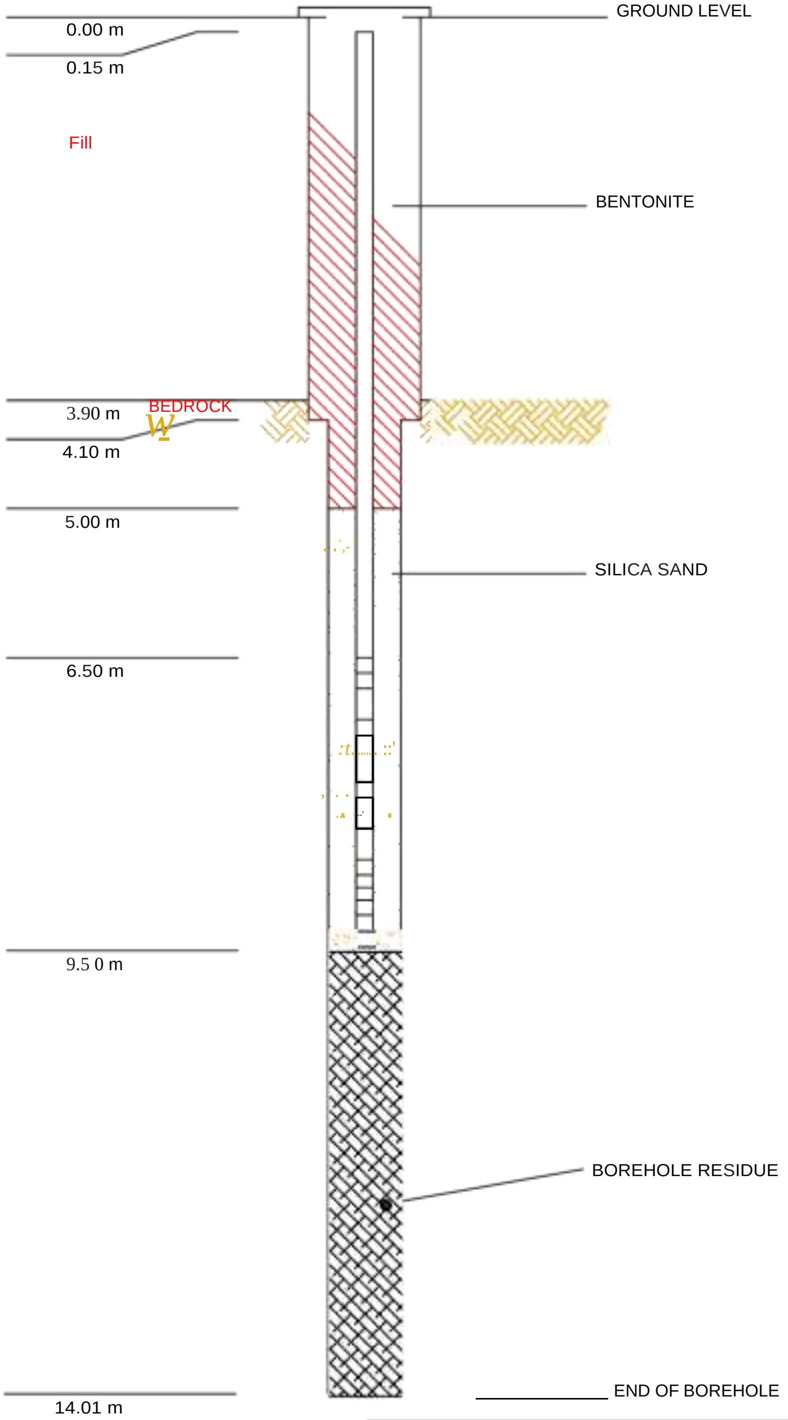
FORMAT 8,5x11

MW-09-16



SNC•LAVALIN

CLIENT · North Atlantic Iron Corporation

PROJECT • Pig Iron Production Plant

LOCATION Grande-Baie, La Baie, Quebec

TITLE • MW-09-16 piezometer

SCALE •	DATE •	FILE •	DRAWING •
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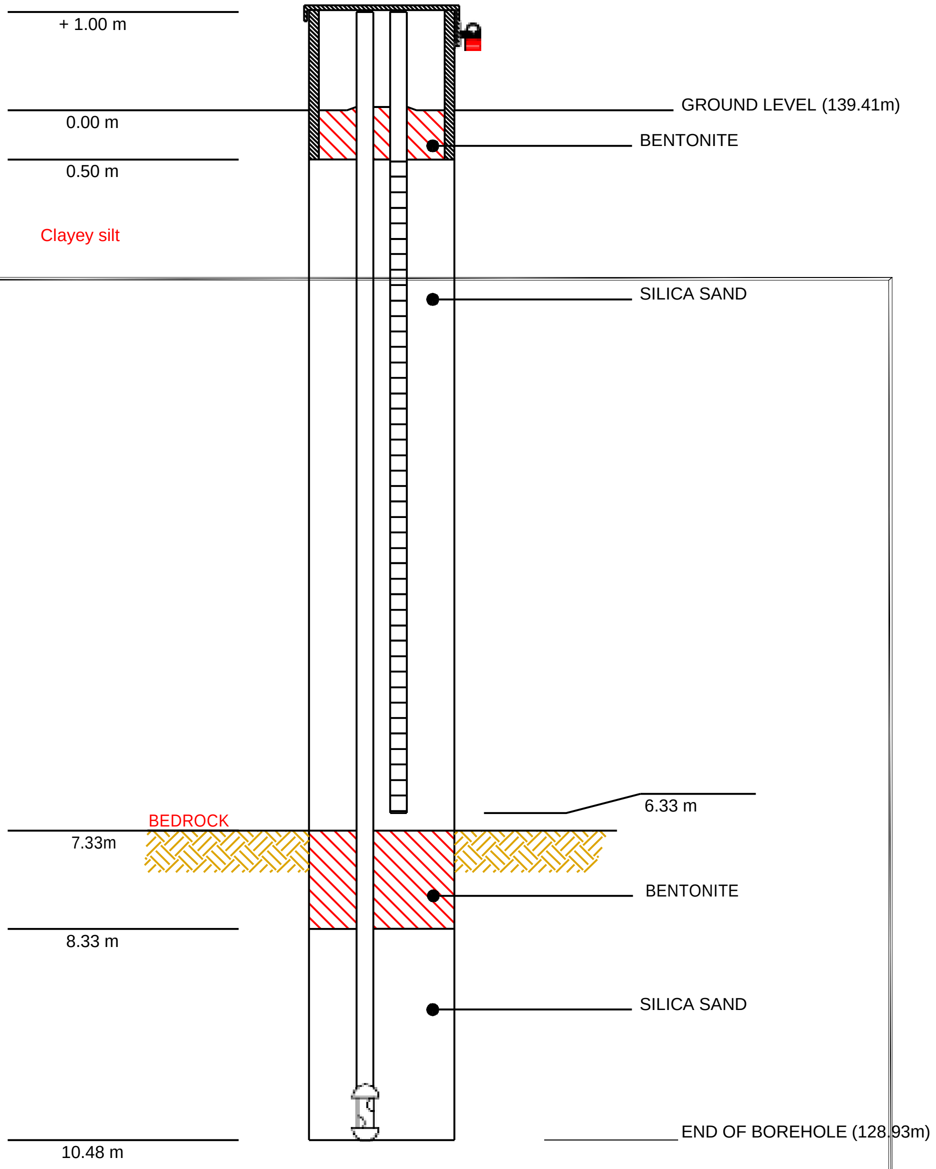
FORMAT 8,5x11

MW-10-16



SNC·LAVALIN

CLIENT : North Atlantic Iron Corporation

PROJECT : Pig Iron Production Plant

LOCATION : Grande-Baie, La Baie, Quebec

TITLE : MW-10-16 piezometer

SCALE :	DATE :	FILE :	DRAWING :
1 : 75	2016-01-28	634451	634451-04

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FORMAT 8,5x11

SNC·LAVALIN
360, Saint-Jacques, 16th Floor
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514-393-1000 - 514-392-4758
www.snclavalin.com