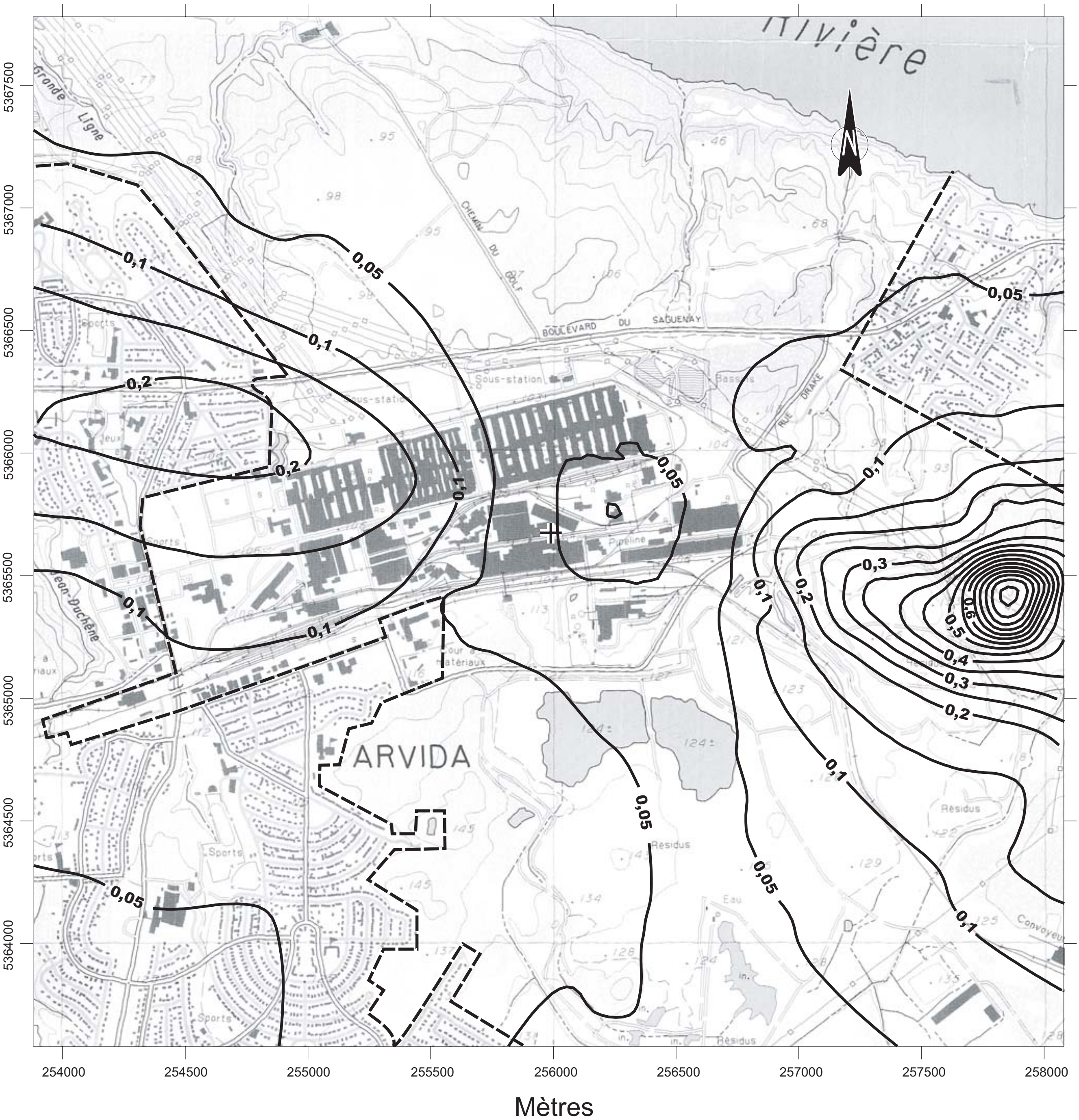
Source : CARTE DU MINISTÈRE DES RESSOURCES NATURELLES, QUÉBEC, 1994.



LÉGENDE :

- - - - - - - - - - Courbes de concentrations

— — — — — Limite de propriété

ÉCHELLE 1 : 25 000

0 0,5 1,0 Km

ALCAN

CONCENTRATIONS MOYENNES ANNUELLES DE CO (µg/m³) - Année 2000

TECSULT

PROJET : **14041**

DATE : **Septembre 2005**

FIGURE : **8.1.7**

14041-8.1.7.ai (15/09/05) pc_cm

8.1.7 Correspondence Table

Source : CARTE DU MINISTÈRE DES RESSOURCES NATURELLES, QUÉBEC, 1994.	Source: MAP FROM THE MINISTÈRE DES RESSOURCES NATURELLES, QUEBEC, 1994.
Mètres	Metres
LÉGENDE	LEGEND
Courbes de concentrations	Concentration Curves
Limite de propriété	Property Limits
ÉCHELLE 1 : 25 000	SCALE 1:25,000
CONCENTRATIONS MOYENNES ANNUELLESDE CO (µg/m³) - Année 2000	ANNUAL AVERAGE CONCENTRATIONS OF CO (µg/m3) – Year 2000
PROJET : 14041	PROJECT: 14041
DATE : Septembre 2005	DATE: September 2005

8.1.2.9 *Results – Concentrations of Nitrogen Dioxide (NO_2)*

Emissions of nitrogen oxides (NOx) from the spent pot lining processing plant will come from the boiler. These concentrations are assumed to be in the form of nitrogen dioxide (NO_2). The source's characteristics are listed in Appendix E-3. Ground-level concentrations of NO_2 were assessed for periods of one hour, 24 hours and one year.

Table 8.1.8 shows the modelled maximum concentrations outside the property limits for each of the periods. These concentrations are compared to the ambient air criteria specified by the Quebec MDDEP's Direction du suivi de l'état de l'environnement as part of the project assessment under the Quebec *Environment Quality Act* (see Appendix D): 400 $\mu g/m^3$ for 1 hour and 200 $\mu g/m^3$ for 24 hours.

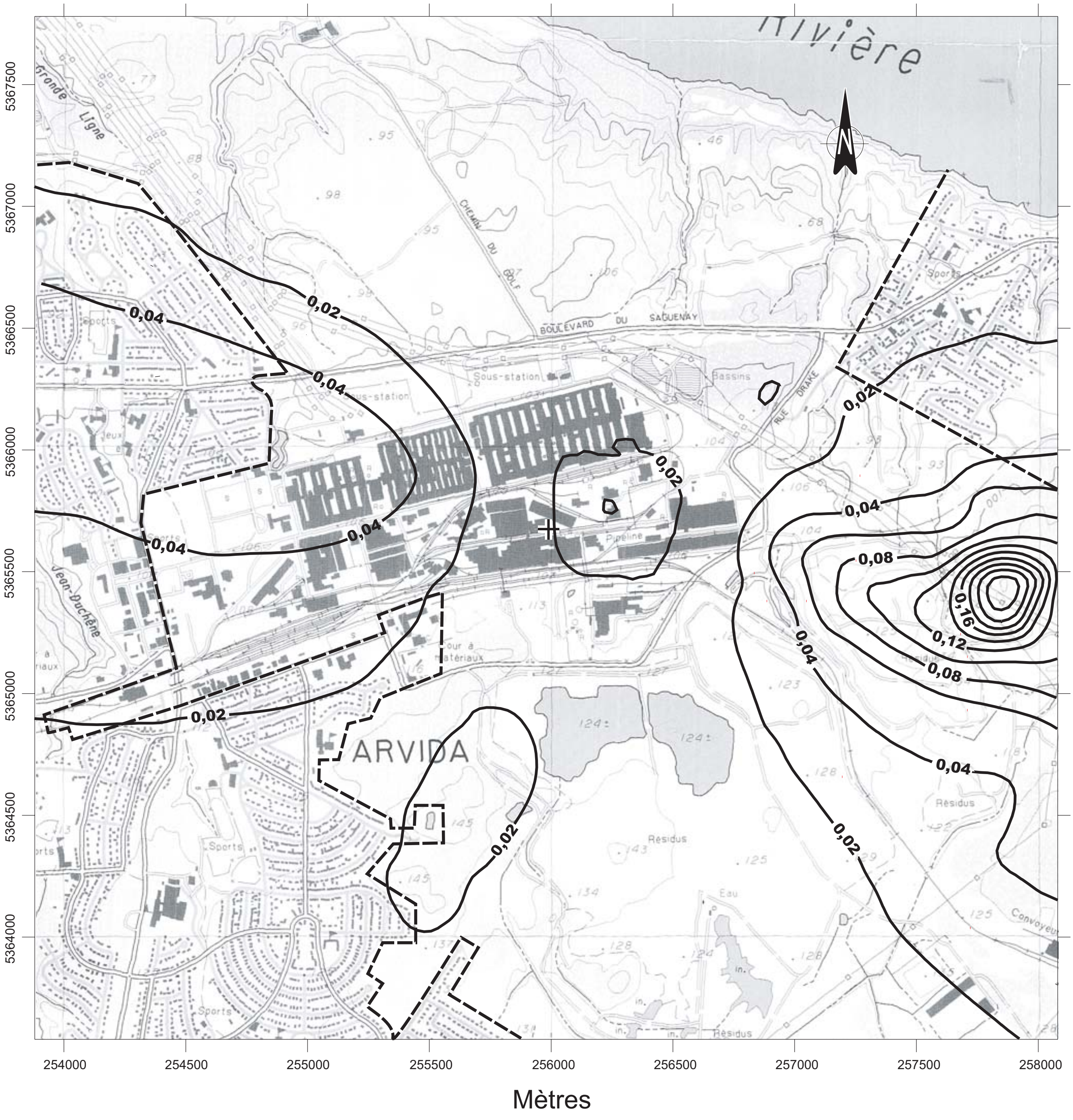
Table 8.1.8 Modelled Maximum Concentrations of NO_2

Period	Meteorological Data Year	Maximum Concentration ($\mu g/m^3$)	Standard ($\mu g/m^3$)	Criterion Percentage (%)
1 hour	1996	7.17	400	1.8
	1997	5.33		1.3
	1998	4.09		1.0
	1999	3.75		1.0
	2000	5.49		1.4
24 hours	1996	0.34	200	0.2
	1997	0.65		0.3
	1998	0.88		0.4
	1999	0.71		0.4
	2000	0.65		0.3
1 year	1996	0.06	100	0.06
	1997	0.05		0.05
	1998	0.06		0.06
	1999	0.06		0.06
	2000	0.06		0.06

Figure 8.1.8 illustrates the isograms of maximum concentrations of NO_2 calculated on an annual basis for the year that had the worst results (year 2000) within a 2 km radius of the plant.

The results show that the impact of emissions of NO_2 caused by the spent pot lining processing plant boiler is minimal. In fact, ground-level concentrations calculated are less than 2% of the criterion.

Source : CARTE DU MINISTÈRE DES RESSOURCES NATURELLES, QUÉBEC, 1994.



LÉGENDE :

- Courbes de concentrations
- Limite de propriété

ÉCHELLE 1 : 25 000

0 0,5 1,0 Km

CONCENTRATIONS MOYENNES ANNUELLES DE NO_2 (µg/m³) - Année 2000

ALCAN

TECSULT

PROJET : **14041**

DATE : **Septembre 2005**

FIGURE : **8.1.8**

14041-8.1.8.ai (15/09/05) pc_cm

8.1.8 Correspondence Table

Huile lourde	Dead Oil
Wagon de chlore	Chlorine Car
Acide	Acid
Oléum	Oleum
PSI	PSI
Rayon	Radius
Première habitation	First House
Échelle en pieds	Scale in Feet
LÉGENDE	LEGEND
Limite de propriété	Property Limits
Hors de la limite Alcan	Outside Alcan's Property
Seuil de blessures et limites de projection de débris	Minor Injury Threshold and Limits of Debris Projection
Seuil de blessures majeures	Major Injury Threshold
Seuil de dommages importants aux structures d'acier et seuil de brie majeure aux equipements	Significant Damages Threshold on Steel Structures and Major Equipment Failure Threshold
NOTE:	Note:
Résultats obtenus à l'aide du logiciel PHAST	Results obtained using the PHAST software
Source:	Source:
Dessin No. AO-159032AC-R-06 de CEGERTEC	Drawing # AO-159032AC-R-06 from CEGERTEC
USINE DE TRAITEMENT DE LA BRASQUE USÉE	SPENT POT LINING PROCESSING PLANT
Étude d'impact environmental	Environmental Impact Assessment
Élément d'analyse des risques technologiques	Technological Risk Analysis Components
Scénario normalize	Standardized Scenario
Explosion	Explosion
Dessiné par	Drawn by
Vérifié par	Verified by
Échelle 1:8000	Scale 1:8000
Date Sept. 2005	Date Sept 2005
Nº contract	Contract #
Figure 8.4.2	Figure 8.4.2

8.1.3 Greenhouse Gas

The pot lining processing plant greenhouse gas sources are as follows:

- the vapour raising boiler, which consumes natural gas: 95,000 tons of CO_2 annually;
- the gas incinerator of the hot water tank's air vent, which consumes natural gas: 55 tons of CO_2 annually;
- methane emissions generated by pot lining during various spent pot lining processing plant activities: 94.5 tons of methane annually, which means 1,983 tons annually in CO_2 equivalent.

In total, the greenhouse gas emissions from the pot lining processing plant could total 97,000 tons per year in CO_2 equivalent.

In Canada, CO_2 is the main greenhouse gas. Total emissions of GHG in Canada in 2002, expressed in CO_2 equivalent (CO_2-e), were 731 MT. For the province of Quebec, total emissions of GHG in 2002 were assessed at 91.5 MT.[16]

Emissions of CO_2 from the pot lining processing plant would represent approximately 0.013% of emissions in Canada and 0.10% of emissions in Quebec.

In 2002, greenhouse gas emissions for all activities in the Jonquière complex were assessed at 1.93 MT in CO_2 equivalent, of which approximately 0.41 MT were associated with the activities of the last four Söderberg potrooms, closed in April 2004, which corresponds to an emission reduction of 21%.

Also remember that Alcan announced, in September 2000, the establishment of a long-term management program for greenhouse gas emissions, as part of its TARGET program and, in October 2002, they signed an agreement of voluntary reduction of greenhouse gas with the Quebec government, which applies until 2007.

Considering the initiatives taken by Alcan concerning the reduction of greenhouse gas and the closure of the Söderberg potrooms, the GHG contribution of the pot lining processing plant will have been largely offset.

8.1.4 Hydrology and Water Quality

8.1.4.1 *Use of Water Resources*

The additional need for raw water at the spent pot lining processing plant is assessed at 205,000 m^3/year. This quantity is approximately 660 m^3/day, i.e. approximately 1% of the Jonquière complex's current consumption. The supply of raw water for the Jonquière complex comes mainly from the Pont-Arnaud's pumping station. A certain portion of the water consumed at the Jonquière complex also comes from the Jonquière water supply system. At present, the Pont-Arnaud station rate of flow is 50,000 m^3/day, with peaks that can reach 65,000 m^3/day in the summer. The rate of flow from the water supply is 10,000 m^3/day.

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16 Source: Environment Canada, *Canada's 1990-2002 Greenhous Gas Inventory*

Furthermore, according to the hydrometric data obtained from the Centre d'expertise hydrique of the ministère de l'Environnement du Québec, the Chicoutimi River water flow measured at a station located at 0.3 km downstream of the Portage-des-Roches dam is 49,4 m^3/s, i.e. the equivalent of 4,268,160 m^3/day. During peak periods, the combined demand of the Jonquière complex and the pot lining processing plant is only 1.8% of the River water flow.

If all data is taken into account, we can conclude that there will not be a negative interface between the project and the municipal water supply.

8.1.4.2 *Impacts Related to Liquid Discharges*

As mentioned in Chapter 3, the pot lining processing process does not generate wastewater. All water that comes into contact with the pot lining is reintroduced in the process. Liquid discharges from the pot lining processing plant are made up only of water flushed from the vapour raising boiler and water flushed from the water cooling system. The typical composition of these waters is shown in Section 3.2.3. These liquid discharges are sent to the Jonquière complex's sewage treatment system where settling and neutralizing tanks are found. The effluent of this system (Outfall B) is sent to the Saguenay River (see Figure 3.2.2).

CUMULATIVE EFFECTS

To assess the cumulative effects related to liquid discharges, current activities of the Jonquière complex were taken into account. These activities are the main activities likely to have an effect on the hydrous environment in the study area. Also, no future large-scale projects that could have a significant effect on the hydrous environment in the study area were identified.

The extraction flow, from the pot lining processing plant, i.e. a total flow of 8.0 m^3/hr, is approximately 1% of the current average flow of waterwaste sent to the Jonquière complex sewage treatment system, which is 800 m^3/hr. For regularly-monitored parameters for the water released at Outfall B and considering, in a very conservative manner, that the additional load sent to the sewage treatment system would not be reduced, it is estimated that the potential increase of the load due to water drainage from the pot lining processing plant water cooling system would be as follows:

- arsenic: 1.8%
- cyanides: 4.6%
- mercury: 6.2%
- suspended solids: 0.2 to 0.5%

This estimate was calculated taking into consideration that the contaminants in the raw water used as back-up to the water cooling system will be concentrated, by evaporation, in the system's water drainage. The processing process does not generate these contaminants.

As for mercury, the ministère de l'Environnement du Québec had determined that the maximum quantity of mercury that could be released in the Saguenay through the outfall of the Alcan industrial complex in Jonquière was 8.09 grams per day (g/d). This environmental objective of discharge was established in order to protect the aquatic environment and to ensure that the water quality criterion would not be exceeded at the sites. In 2000 and 2001, the mercury discharges at Outfall B were 3 g/d, which is below the environmental discharge objective.

The small flow increase of the Jonquière complex treatment system (Outfall B) associated with the pot lining processing plant will not affect the treatment capacity and will not cause a significant increase in discharges from the Jonquière complex in the Saguenay River.

Thus the impact of this additional discharge on the Saguenay River is considered as minor.

8.1.5 Waste Management Site

As described in Section 3.1.1, during construction, the soil will not be contaminated. Thus, the excavated soil will be used as fill for the site or sent to the Jonquière complex industrial waste disposal site (IWDS).

The waste generated by the pot lining processing plant (other than carbon and inert materials) that will be stored for future upgrading, are:

- Colloidal iron dioxides formed at the time of the destruction of cyanides; approximately 135 tons per year (water base); and
- Equipment descaling residues, quantities are estimated at approximately 100 tons per year.

This waste will be characterized to ensure that it does not have characteristics of residual hazardous material, as defined in the *Hazardous Materials Regulation*. It will be disposed of at the red clay disposal site close to the Jonquière complex. This site is authorized to receive between 800,000 and 900,000 tons of waste per year. According to the expected composition of this waste, it is not considered as residual hazardous materials and will be compatible with the waste sent to the red clay disposal site. Among other things, this clay already contains considerable quantities of iron dioxide; this is what gives it its red colour. Also note that the control of waste sent to the red clay storage site is also very important for the operation of alumina plants, where is returned all the leachate for this site.

The impact on the environment associated with the disposal of waste generated by the pot lining processing plant at the red clay disposal site is minimal considering that:

- the additional quantity of waste coming from the pot lining processing plant is very small (0.03%) compared to the quantities of residue received at this site annually;
- the design and the management of the site (recycling of leachate) help minimize the potential impact on the environment.

8.1.6 Ambient Noise

Two sources of noise were analyzed to study the noise generated by this project: point (or stationary) sources from plant equipment, and mobile sources related to the trucking caused by the project.

8.1.6.1 *Projection Calculation Method*

The calculation method for simulations relating to point sources is in accordance with the method described in Appendix D of the *Regulations respecting pits and quarries (Q-2, A.2)* and published in the *Gazette officielle du Québec*, August 3, 1977. In order to acquire an image that is more representative of the noise levels resulting from the operations, a calculation of the ground effect attenuation was added to the method.

Using this calculation method, the distance attenuation is calculated for a hemispheric propagation according to the following relationship:

$$A\ (dist) = 20 \log d_2 / d_1$$

Where d_2 is the distance between the source and the assessment point considered and d_1 is the distance between the source and the measurement point in a coherent unit.

To calculate the screen effect, the Meakawa theory, which was brought into widespread use by Kurze, is used based on the following relationship:

$$A\ (screen) = -10 * \log 40 \Delta / \lambda$$

In this relationship, Δ is the acoustic distance difference between the direct route of the wave and the passage over the screen, and λ is the wave length considered in one coherent unit. For all calculations, the frequency of 500 Hz was considered since there are no intrusive frequencies.

Finally, the ground effect attenuation is established based on the following relationship:

$$A\ (ground) = 5 * \log\ (3Z+2h) / d$$

In this relationship, **d** is the distance between the source point and the reception point, **Z** is the height of the reception and **h** the height of the source.

As for the noise caused by the traffic of vehicles on the site, access roads and nearby roads, the propagation model used is the one developed jointly by the Technical Research Division of the Canada Mortgage and Housing Corporation (CMHC) and the Division of Building Research of the National Research Council of Canada (NRC). This model was the subject of the publication: *Road and Rail Noise: Effects on Housing*. This publication was first published in 1977 and revised in 1982 in its international version. This mathematical model was established based on daily flows, percentage of heavy goods vehicles, topography and obstacles (natural or built), the level of noise equivalent to the different assessment points considered.

8.1.6.2 *Characterization of Impact Sources*

8.1.6.2.1 Pot Lining Processing Plant

STATIONARY EQUIPMENT FOR THE OPERATION OF THE PLANT

The sources linked to the operation of the plant are mainly located inside the building. The noise level anticipated in the building is 80 dBA. The attenuation that provides the building walls is at least 35 to 40 dBA, and the noise level at 1 metre from the façade will be 40 to 45 dBA. Since the noise levels from this source are negligible in the nearest residential districts, this source is not considered in the study.

The second group of noise sources is mainly stationary sources located outside the plant. For the simulations, the source noise levels produced by this equipment were established based on the information obtained from the officials, the project designers and the equipment manufacturers. The main sources considered are the various dust extractors and ventilators used during the operation of the plant. The noise levels and the source height are described in Table 8.1.9.

Table 8.1.9 Source Noise Levels Considered for the Simulations

EQUIPMENT	NOISE LEVEL (in dBA)	MEASURING DISTANCE (in metres)	SOURCE HEIGHT (in metres)
Dust Extractor – Pot Lining Handling	95	1	24
Dust Extractor – Pot Lining Crushing	85	1	30
Dust Extractor – Crushed Pot Lining Silos	80	1	34
Cooling Tower	85	1	8
Ventilation System – Leachate Gas	80	1	30

For the purposes of the plant stationary equipment simulation, 270 assessment points were considered. The assessment points were determined in order to set up a dot grid equidistant between 300 metres. This grid helps trace the plant noise propagation isograms.

TRANSPORTATION TO SUPPLY THE PLANT WITH RAW MATERIALS

Spent pot lining arriving by train totals 539 freight cars per year, i.e. less than 1.15% of the railway traffic generated by the industrial complex. There will be no convoys designated specifically to the transportation of spent pot lining. It will arrive at the processing plant in a regular fashion, i.e. in the existing convoys.

There are two trucks per day, i.e. 4 runs, with material arriving from outside the site during peak periods and normal periods. The roads currently used to access the Alcan property are Saguenay Boulevard and Drake Street.

8.1.6.2.2 Storage Site and Transportation Inside the Property

EQUIPMENTS FOR DEVELOPING THE STORAGE SITE

The equipment used to develop the waste storage site is, based on the nature of work, a mechanical shovel, a power ram and a road roller. The average noise levels produced are 85 dBA at 15 metres during normal operations. Depending on the equipment used on the site, the level at 15 metres from the source will vary between 85 and 90 dBA.

EQUIPMENT USED FOR THE OPERATION OF THE STORAGE SITE

The equipment used for the operation of the site is a mechanical shovel, a power ram and a road roller. The average noise levels produced by this equipment are 90 dBA at 15 metres during normal operations.

TRANSPORTATION FOR THE OPERATION OF THE SITE

Transportation by truck from the processing plant to the storage site will be done inside the property limits. To operate the pot lining processing plant (raw material and solid wastes), it will take 46 vehicle runs per 10-hour day but, during peak periods, there will be 342 runs per day.

8.1.7 Impact Analysis on Ambient Noise

8.1.7.1 *Impacts Linked to the Stationary Sources Used for the Operation of the Plant*

Simulations were carried out for the area located within a 1.2 to 3.3 km radius of the implementation site of the spent pot lining processing plant. This area is justified because of the residential districts that are found there. Some other areas located in the radius of the implementation site are not urbanized (northern and northeastern areas).

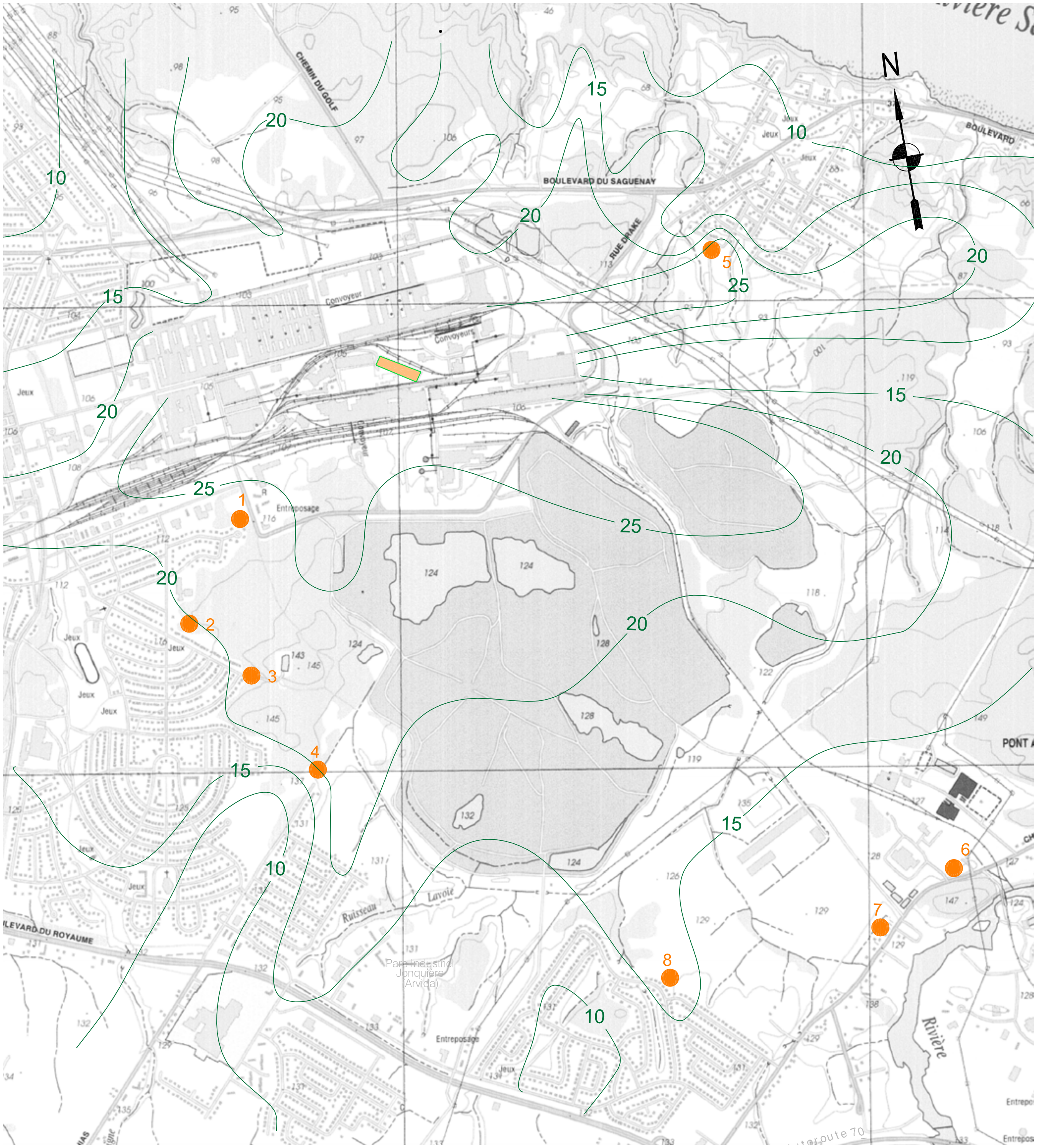
Figure 8.1.9 shows the results of the noise simulations for the different processing plant stationary sources. The isograms show the propagation of noise, in ranges of 5 dBA, from noises produced by the plant only. You will notice that the propagation in southwestern and southeastern directions is, all in all, regular because of the lack of a topographic natural screen. The noise is reduced in southwestern side near Mathias Street. This situation results from the natural topography of the site.

Simulations indicate that, from the nearest houses located on Juchereau Street, nearly on kilometre from the implementation site, the noise level Leq_{24h} is 23.5 dBA. Figure 8.1.9 indicates a movement of noise isopleths toward the northeast of the plant in the direction of the first row of houses on Beaulieu Street. This noise movement results from the lack of a natural or built screen. The resulting noise level, Leq_{24h}, stays however at 25 dBA. In other words, the noise levels resulting from the operation of the plant will be greatly below the noise levels measured both day and night in the area.

Tables 8.1.10 and 8.1.11 repeat, for the measurement points considered on the site, the calculation results, the anticipated levels, both for background noise (L95 %) and the ambient noise level (Leq), and the resulting increases. From the calculation results viewpoint, the resulting increases in the areas considered will be nil in the daytime. At night, only point 5 shows a background noise increase of 0.2 dBA and an ambient noise increase of 0.1.

Table 8.1.10 Levels of Noise Anticipated During the Day and Resulting Increases at the Measurement Points Considered (dBA)

Measurement Point	Calculated Noise Level	Background Noise Level (L95%)		Background Noise Increase	Equivalent Level (Leq)		Equivalent Level Increase
		Current	Anticipated		Current	Anticipated	
1	23.5	51.2	51.2	0.0	54.5	54.5	0.0
2	19.8	45.4	45.4	0.0	48.5	48.5	0.0
3	20.8	44.5	44.5	0.0	47.0	47.0	0.0
4	18.0	42.7	42.7	0.0	45.9	45.9	0.0
5	25.2	46.7	46.7	0.0	51.1	51.1	0.0
6	14.8	41.0	41.0	0.0	53.5	53.5	0.0
7	11.7	42.8	42.8	0.0	53.1	53.1	0.0
8	16.6	36.7	36.7	0.0	50.6	50.6	0.0



Légende :

Isophone (en dBA)

Usine projetée

Point de mesure

Échelle: 1: 25 000

Isophones de bruit, Leq 24h

TECSULT

Projet : 14041

Date : Septembre 2005

Figure : 8.1.9

14041_Figure_8.1.9_2005-09_fm.dwg

8.1.9 Correspondence Table

Source : CARTE DU MINISTÈRE DES RESSOURCES NATURELLES, QUÉBEC, 1994.	Source: MAP FROM THE MINISTÈRE DES RESSOURCES NATURELLES, QUEBEC, 1994.
Mètres	Metres
LÉGENDE	LEGEND
Courbes de concentrations	Concentration Curves
Limite de propriété	Property Limits
ÉCHELLE 1 : 25 000	SCALE 1:25,000
CONCENTRATIONS MOYENNES ANNUELLES DE NO2 (µg/m^3) - Année 2000	ANNUAL AVERAGE CONCENTRATIONS OF NO2 (µg/m3) – Year 2000
PROJET : 14041	PROJECT: 14041
DATE : Septembre 2005	DATE: September 2005

Table 8.1.11 Level of Noise Anticipated at Night and Resulting Increases at the Measurement Points Considered (dBA)

Measurement Point	Calculated Level of Noise	Background Noise Level (L95%)		Background Noise Increase	Equivalent Level (Leq)		Equivalent Level Increase
		Current	Anticipated		Current	Anticipated	
1	23.5	53.5	53.5	0.0	56.4	56.4	0.0
2	19.8	42.3	42.3	0.0	47.1	47.1	0.0
3	20.8	43.2	43.2	0.0	45.6	45.6	0.0
4	18.0	43.7	43.7	0.0	46.6	46.6	0.0
5	25.2	39.2	39.4	0.2	42.5	42.6	0.1
6	14.8	49.4	49.4	0.0	54.1	54.1	0.0
7	11.7	40.9	40.9	0.0	48.2	48.2	0.0
8	16.6	38.3	38.3	0.0	44.0	44.0	0.0

The impact resulting from the operation of the spent pot lining processing plant may be qualified as nil. The slight increases of noise anticipated at point 5 may be qualified as insignificant and non-perceivable. No inconveniences are anticipated for the whole urbanized area considered.

8.1.7.2 *Impacts of Noise of Transportation and Shipping of Raw Materials*

The supply of spent pot lining arriving by train accounts for 530 freight cars per year, i.e. less than 1.15% of the railway traffic generated by the industrial complex. There will no specific train designated to the transportation of spent pot lining, it will arrive to the processing plant in a regular fashion in the existing trains. The increase of noise anticipated for the transportation by train will therefore be less than 0.1 dBA and will not be perceivable. The additional activities associated with the coupling/uncoupling of these freight cars should not represent a significant noise source either.

There will two trucks per day, i.e. 4 runs, with material from outside the site during peak and normal periods. The roads used to access the Alcan property are the Saguenay Boulevard and Drake Street. The addition of four trucks per day on the Saguenay Boulevard represents an insignificant amount compared to the existing traffic on this main road. The increase in noise level will therefore be insignificant.

8.1.7.3 *Noise Impacts Linked to the Storage Site and to Transportation Activities Inside the Property*

DEVELOPMENT OF THE STORAGE SITE AND TRANSPORTATION OF MATERIALS

During the development period of the storage site, all the equipment will be used for construction work, and trucking will be at its peak period. These activities will only be accomplished during the diurnal period between 7 am to 5 pm.

Table 8.1.12 shows the noise levels Leq_{1h} resulting from the sources linked to the development of the storage site and to the transportation of materials for this purpose. According to these results, no impact will be felt at these points or at the nearest home.

OPERATION OF THE STORAGE SITE AND TRANSPORTATION

The impact of noise from transportation inside the property (carbon and inert materials and wastes) was assessed for the regular and peak Operating periods that reflect the intensive periods of transportation of carbon and inert materials to the temporary storage site, which will take place twice a year (see Section 3.3.3).

Table 8.1.13 shows the noise simulation results for the eight points of reference located alongside of residential districts the closest to the waste storage site. According to these results, no impact will be felt at these points or at the nearest home.

Table 8.1.12 Noise Levels (Leq_{1h}) Resulting from the Development of the Storage Site and the Transportation of Materials (dBA)

Measurement Point	Noise Level Site Construction	Noise Level Transportation During Construction	Current Equivalent Level	Total Anticipated Level *	Increase of Noise Level
1	17.2	8.4	54.5	54.5	0.0
2	14.0	6.5	48.5	48.5	0.0
3	15.7	8.0	47.0	47.0	0.0
4	13.1	5.9	45.9	45.9	0.0
5	25.0	13.1	51.1	51.1	0.0
6	7.4	2.2	53.5	53.5	0.0
7	7.6	2.6	53.1	53.1	0.0
8	8.4	3.2	50.6	50.6	0.0

* Resulting Leq_{24h} levels will be 3.8 dBA lower.

Table 8.1.13 Noise Levels (Leq_{1h}) Resulting from the Operation of the Storage Site and Transportation (dBA)

Measurement Point	Maximum Noise Level for Site Operation	Noise Level Transportation per Period		Current Diurnal Level	Total Anticipated Level per Period*		Increase of Noise Level	
		Regular	Peak		Regular	Peak	Regular	Peak
1	17.7	10.6	19.3	54.5	54.5	54.5	0.0	0.0
2	14.5	8.7	17.4	48.5	48.5	48.5	0.0	0.0
3	16.2	10.2	18.9	47.0	47.0	47.0	0.0	0.0
4	13.6	8.1	16.8	45.9	45.9	45.9	0.0	0.0
5	25.5	15.3	24	51.1	51.1	51.1	0.0	0.0
6	7.9	4.4	13.1	53.5	53.5	53.5	0.0	0.0
7	8.1	4.8	13.5	53.1	53.1	53.1	0.0	0.0
8	8.9	5.4	14.1	50.6	50.6	50.6	0.0	0.0

* Resulting Leq_{24h} levels will be 3.8 dBA lower .

8.1.8 Wetlands

Since there are no wetlands on the space affected by this project, no impacts are anticipated.

8.1.9 Biological Environment

8.1.9.1 *Vegetation*

The construction of the plant and the development of the temporary storage site for carbon and inert materials will not affect the vegetation considering their location inside the industrial complex.

8.1.9.2 *Fish, terrestrial and avian fauna and wildlife habitats*

The impact on fauna and their habitats is deemed negligible owing to the near absence of this component in the terrestrial habitat and the insignificant amount of liquid waste generated by the project.

8.1.9.3 *Endangered species*

The construction of the plant and temporary storage site for carbons and inerts will not affect endangered species because the plant and storage site are inside the industrial complex and the project will generate very little liquid waste.

8.2 Human Environment

8.2.1 Transportation and Traffic

8.2.1.1 *Impact of Resulting Traffic on General Traffic*

Transportation of material and equipment as well as the comings and goings of workers constitute a source of traffic increase in the area, as described in Section 3.3.

Since most of the pot lining that will be processed at the plant is kept near the Jonquière complex or will be moved to the plant by railroad, the project will generate very little additional traffic (due to the transportation of pot lining) on the roads compared to the present.

Workers and visitors of the plant will also generate traffic because of their personal comings and goings, about 50 vehicles per day will be accessing and leaving the plant.

As indicated in Section 3.3, carbon and inert materials will be transported twice a year to the temporary storage site and this will generate the highest volume of traffic. The vehicles will only use roads inside the Jonquière complex. There will therefore be no impact on general traffic.

The resulting traffic is always very light for the most part and will be easily accommodated by the road network capacity. We can therefore conclude that the traffic resulting from the pot lining processing plant will not have a significant impact on the general traffic in the area.

8.2.1.2 *Road Safety*

Because of the nature of the products transported, it is important to assess the accident risk implicating a truck with containers of pot lining or other products. Thus, hypothetically, if trucks are implicated in accidents in proportions that are about equal to the traffic they generate on a given road, we can deduce that, if the traffic resulting from the plant constitutes at best 1% of the global traffic, this same traffic could be implicated in approximately 1% of accidents. At a given intersection where the rate is equal to the average rate measured on provincial road networks (1.38 accidents per million vehicles that access an intersection per year) and where the flow reaches let's say 10,000 vehicles accessing the intersection per day (as for the Mellon/route 170 intersection), we can expect to have an average of 4 to 5 accidents per year. At this rate, considering the percentage of additional truck traffic compared to global traffic, we could expect one accident implicating one of the trucks transporting pot lining from the North Shore approximately every 992 years. On the local road network, the speed limit is theoretically reduced so that the seriousness of accidents is significantly lower than on national roads. It would be the same for consequences of an accident, they would be limited.

8.2.2 <u>Aesthetics and Landscape</u>

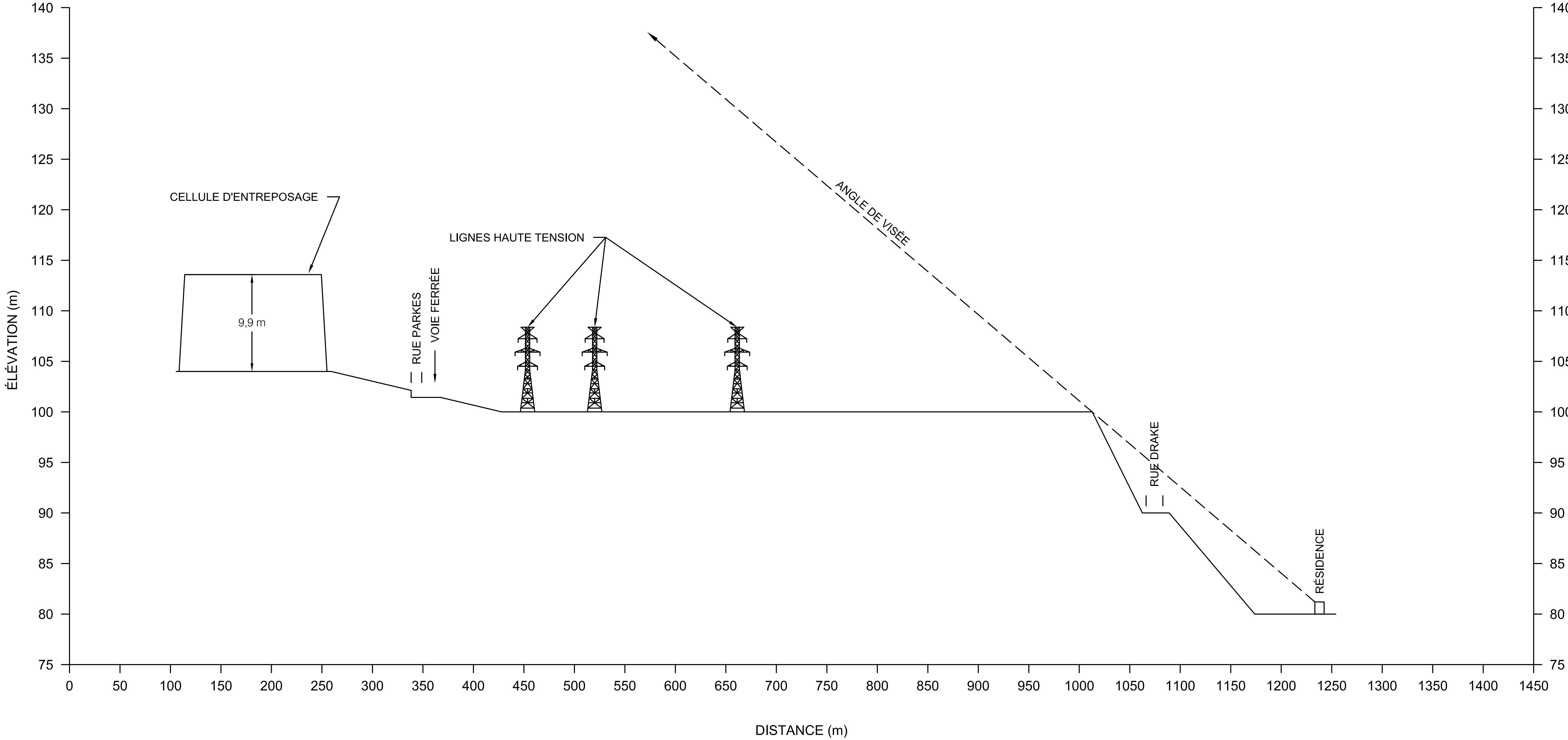
8.2.2.1 *Pot Lining Processing Plant*

Changes to the landscape could affect the neighbouring urban areas. In the case of the spent pot lining processing plant, since it would be located inside the industrial complex, to which it is similar, and as height of the chimneys will be comparable to the existing chimneys in the neighbourhood, the impact on the general quality of the landscape, as perceived in its urban environment, will be low or nil.

8.2.2.2 *Carbon and Inert Temporary Storage Site*

The location adjacent to the Vaudreuil plant ensures that the storage site is located in a landscape clearly dominated by industrial components. In fact, the site is located at the end of a line of buildings of more than 1 km. This industrial landscape therefore has an absorptive capacity of a new source of visual disturbance, even if it is very high.

Moreover, the height of the waste pile will reach at the most 11.3 m, while surrounding buildings on the southern and western sides are 15 m high or more. These buildings serve as screens for observers located on the southern and western sides and also act as background components that conceal the silhouette of the pile for observers located on the north and east sides.



ÉCHELLE HORIZONTALE : 0 40 80 120 160 200 m

ÉCHELLE VERTICALE : 0 4 8 12 16 20 m

EXAGÉRATION VERTICALE : 10x

PRÉLIMINAIRE

ALCAN - COMPLEXE JONQUIÈRE

TECSULT — Tecsult Inc. experts-conseils/consultants MONTRÉAL, CANADA

Site d'entreposage temporaire des résidus inertes Impact sur le paysage

Dessiné par	Vérifié par	Échelle	Date	N° contrat	
D. Sobierajski	J. Marcotte	Indiquées	Sept. 2005	1 4 0 4 1	FIGURE 8-2-1

14041_Figure_8.2.1_2005-09_fm.dwg

8.2.1 Correspondence Table

Élévation	Elevation
Cellule d'entreposage	Storage Cell
Rue Parkes	Parkes Street
Voie ferrée	Railroad
Lignes haute tension	High Voltage Lines
Angle de visée	Look Angle
Rue Drake	Drake Street
Résidence	Residence
Distance	Distance
Échelle horizontale	Horizontal Scale
Échelle verticale	Vertical Scale
Exagération verticale	Vertical Exageration
Préliminaire	Preliminary
Alcan – Complexe Jonquière	Alcan –- Jonquière Complex
Dessiné par	Drawing by
Vérifié par	Verified by
Échelle	Scale
Indiquées	As indicated
Date Sept. 2005	Date Sept. 2005

The nearest residences are located on the eastern side in the Saint-Jean-Eudes district, approximately 1 km from the site. Since they are located below the chosen location, they will not see the site (see Figure 8.1.2).

In fact, the only observers that will see the site are the ones that are circulating on the Saguenay Boulevard and on the adjacent bicycle path. The impact is considered minor and no mitigation measures seem necessary, because these observers will see the site elusively and in continuity with the industrial complex.

8.2.3 Psychosocial Impact

We can assume that there will be a psychosocial impact on the residents that live next to the site or those who use the transportation corridor. This impact, associated with the fear of the hazardous material that is the pot lining and particularly its explosive potential, is not unknown to the incident of the ship Pollux in Ville de la Baie in 1990. The significance of this impact could be major, depending on the level of concern expressed by the public.

However, the promoter initiated consultation and information activities in order to inform the public and the various groups and organizations about the project, as well as its issues. This information program should help the public better understand the risks associated with spent pot lining (conditions in which pot lining is likely to pose a danger) and the measures planned as part of the project to minimize these risks while performing pot lining transportation, handling and storing activities.

8.3 Health

8.3.1 Direct Effects

The health theme was discussed in January 2004 during public hearings (organized by the Bureau d'audiences publiques sur l'environnement (BAPE)) on the pot lining processing plant project. Dr Léon Larouche, medical examiner in environmental health at the Direction de la Santé publique of the Régie régionale de la Santé et des Services sociaux in Saguenay - Lac-Saint-Jean, acted as contact for the BAPE board for the first part of the hearings, which was held on January 19 and 20, 2004. Transcripts of these sessions are available on the BAPE Internet site at the following address:
http://www.bape.gouv.qc.ca/sections/mandats/alcan-brasque/documents/liste_cotes.htm

Transcriptions are marked DT1, DT2 and DT3.

As for certain pathologies, the statistics for the 1994-1998 periods provided by Dr Larouche indicate the effect rates summarized in Table 8.3.1.

Table 8.3.1 Effect Rate of Certain Pathologies (per 100,000 Inhabitants)

	Québec	Saguenay-Lac-Saint-Jean	Jonquière
Cancers (all sites)	453	493	523
Lung Cancer	76	89	102
Bladder Cancer	21	26	31
Respiratory Disease	65	74	78

According to Dr Larouche, among the atmospheric pollutants associated with the project, [translation] “only the suspended particulates in the air are of particular interest for the protection of public health”. Among those particulates, MP $_{2,5}$ is especially interesting, that is the particulates, which are smaller in diameter than 2.5 microns. These are the smallest particulates and therefore likelier to penetrate more deeply in the respiratory system.

As illustrated in Table 8.1.4, simulations and calculations show that the project is likely to induce an increase of 0.6% of fine particulates in the ambient air. It is as if to say that the project will practically not have any effects on the concentrations of fine particulates around the Jonquière industrial complex.

Considering the suspected relation between the concentrations of fine particulates and certain effects on health, there is every reason to think that the project should not have any effects on public health.

8.3.2 Incidences from Cumulative Effects

Despite the fact that the project itself will have negligible effects on the concentrations of fine particulates, the total concentration in the study area exceed nonetheless the recommended criterion set by the Canadian Council of Ministers of the Environment (CCME), which is 30 micrograms per cubic metre. There is therefore cause to verify within which type of trend the project lies in order to ensure that the project does not contribute to cumulative effects.

Figures 8.1.2 and 8.1.3 show that, since the 80’s, air quality in relation with the total suspended particulates and to MP $_{2,5}$ has greatly improved and there is good reason to believe that the improvement is continuing because of the closing of the Söderberg potrooms. We can therefore expect that the additional emissions generated by the project do not change the improvement trend of air quality nor cancel the positive cumulative impact noticed in the region.

Where a relation would exist between the concentrations of fine particulates and health effects, we can put forward that the regional trend would be improved population health, but that the project would have a negligible effect on this trend.

8.4 Safety

This section shows a review and an analysis of accident risks caused by the spent pot lining processing plant project. The accident risk analysis method used as part of this study is based on the method described in the *Guide – Analyse de risques d'accidents technologiques majeurs* (MENV, 2000) and the method advocated in the *Analyse et gestion d’accidents industriels majeurs* (CMMI, 1999). In the case of the spent pot lining processing plant, the method applied includes the following steps:

- Identification of danger;
- Identification of sensitive elements;
- Review of passed accidents;
- Elaboration of a standardized accident scenario and assessment of its consequences;
- Elaboration of other accident scenarios and assessment of the consequences of these other scenarios;
- Discussion on external dangers.

8.4.1 Identification of Danger

This step aims at recognizing the presence of danger and defining its characteristics in order to identify the phenomenon that can cause accidents. To do so, the materials used and the various plant components are reviewed.

None of the material stored, produced or used on the plant site are listed in the *Liste de matières dangereuses avec quantités seuils et concentrations de références toxicologiques retenues pour fins de gestion de risques d'accidents industriels majeurs* shown in appendix 6 of the Guide – Analyse de risques d'accidents technologiques majeurs (MENV, 2000). This list was drawn up using the lists compiled by the Major Industrial Accidents Council of Canada (MIACC), the *Risk Management Programs* regulation of American EPA (40 CFR, part 68, 68.130), the regulation of OSHA (Federal Register, vol.57) and the list of substances of the NFPA 325 standard (MENV, 2000).

The main source of danger that poses the spent pot lining processing plant is the spent pot lining itself. When it comes in contact with water, toxic (ammonia) or inflammable (hydrogen and methane) gases are generated. The material safety data sheet for spent pot lining is found in Appendix C.

Where gases would be generated and confined, there could be an explosion if there is an ignition source. However, for an explosion to occur, the gases generated must be contained so that the concentration of gas be sufficient to obtain and explosive mixture.

At the pot lining processing plant, the elements that could potentially generate and accumulate gas are as follows:

- Crushed pot lining storage silos: After the grinding process, the spent pot lining is placed in silos. These silos contain the largest quantity of spent pot lining per container that will be found on the plant site (capacity of 200 tons compared to containers with a capacity of 20 tons each). Usually, the ventilation system will enable the evacuation of gases from the silos that could be generated while in storage. If there were a ventilation system failure, gas, which would be generated when spent pot lining came into contact with the humidity in the air, could accumulate in the silos.
- Leachate gas: Gases generated by water and caustic soda leaching activities will be evacuated by a ventilation system. If there were a ventilation system outage, the gas would escape without the dilution normally provided by the ventilation system; the concentration would therefore be higher.

The storage of spent pot lining in containers used for transportation is not considered as a danger because, first, they contain less spent pot lining than the crushed spent pot lining storage silo and, secondly, the storage in containers does not pose a risk of gas accumulation.

The spent pot lining containers used for transportation of pot lining to the plant will be stored inside a ventilated building. These airtight containers are specially designed for the transportation of hydro-reactive hazardous materials. They are designed in such a way to prevent the infiltration of rain while enabling the circulation of air, so that there can be no accumulation of gas inside the container.

Since spent pot lining contains carbon, spent pot lining dust may pose a risk of explosiveness. Tests have been conducted on two samples in order to assess the explosiveness of this dust (Amyotte, 1994).

The first sample was dust taken from a dust extractor during dry removal of pot lining. The tests showed that the dust from the first sample was not explosive. The second sample was produced when crushing (under 400 mesh (37 µm)) pot lining from the carbon portion. The test results proved that this dust could be explosive in a certain concentration interval. In the pot lining processing plant equipment design criteria, this characteristic is taken into account in order to maintain the dust concentration outside the explosive level.

To elaborate the standardized scenario, the explosiveness of spent pot lining dust in the storage silo was not considered since the excess pressure generated by the dust explosion would be less than the pressure produced by an inflammable gas explosion in the silo.

If there were a fire in the pot lining processing plant, the pot lining could combust because of its carbon content. However, the combustion would be rather slow (like a smouldering coal fire) and the consequences (thermal radiations) rather limited in the area. As for the products that can be generated because of pot lining combustion (carbon dioxides, nitrogen oxides, fluoride, hydrogen fluoride and cyanide), the quantities generated depend on the pot lining in question. The fact remains that the scenario where the toxic gas is released from the crushed pot lining storage silo is still the one that poses the most significant consequences. If there were a fire implicating pot lining, water cannot be used to extinguish the fire to prevent the formation of explosive gas.

8.4.2 Identification of Sensitive Elements

Sensitive elements are components of the environment that could be affected by the consequences of an accident, that is to say:

- the first houses (on Juchereau Street) located at approximately 900 metres from the future plant;
- the industrial facilities of the Jonquière complex, i.e.:
    - chlorine car (82 tons) located in building 342-A, i.e. at approximately 300 metres from the pot lining processing plant;
    - dead oil tanks (715 m^3) located in building 302, i.e. at approximately 320 metres from the pot lining processing plant.

The elements are shown in figures 8.4.1 and 8.4.2.

8.4.3 Review of Passed Accidents

There was an accident implicating spent pot lining in 1990. This accident occurred at the Alcan's harbour facilities, in Ville de la Baie, when loading spent pot lining in a ship that had three holds (Miron, 1990). Hold #1 had been partially filled with spent pot lining. While loading hold #2, the hatch covers of hold #1 were closed since it was raining and the cargo was releasing ammonia emanations that bothered the crew members. After fully loading hold #2 and partially loading hold #3, crew members opened the hatch covers of hold #1 to finish loading it. This is when the explosion that cost the lives of two crew members of the ship occurred.

According to the coroners report (Miron, 1990), the explosion was caused by the generation of a spark when the crew members opened the hold, this enabled the ignition of inflammable gas formed by the hydrolysis (contact with the rain) of the spent pot lining accumulating in the hold. The hatch covers of the hold were designed in such a way to make it waterproof, so gas accumulated in the hold. Also, the holds' ventilation system was blocked up at each end in order to offer protection from dust.

This accident shows that the risk associated with spent pot lining is mainly related to the containment of gas generated by the contact of pot lining with water or high humidity. If there is no water, the risk does not exist, and if, after touching water, gases are generated but are not contained, they cannot accumulate and reach a level of concentration forming an explosive mixture.

8.4.4 Standardized Scenario

8.4.4.1 *Definition of a Standardized Scenario*

A standardized scenario or the worst-case scenario is defined as the containment loss of the largest amount of a matter that would result in the rupture of a container or a process line. For toxic gas emissions, the standardized accident scenario implicates a total containment loss in 10 minutes under the worst meteorological conditions (CRAIM, 2000). The standardized scenario assumes there is a breakdown of existing safety and prevention systems.

From the two potential dangers identified in Section 8.4.1, the case related to the accumulation of gas in crushed pot lining storage silos was held as a standardized scenario since it would implicate the highest volume of gas that could potentially be generated.

This scenario is based on the assumption that a ventilation system had failed and that all the gas in the silo (when it is almost empty) is released outside over a period of 10 minutes. We assume that the silo is filled with a gas similar to the gas produced during leaching, i.e. 11% ammonia, 13% methane and 76% hydrogen (in volume). Note that ammonia is not stored on the plant site. The scenario is based on the assumption that a sufficient amount of water (humidity) has come into contact with the crushed pot lining so that a gas volume equal to the volume in the storage silo is generated.

8.4.4.2 *Assessment of the Consequences of a Standardized Scenario*

RELEASE OF A TOXIC GAS

The consequences of a standardized scenario for toxic gas release were assessed through the PHAST software (version 6,0, DNV Technica) used to assess the distances at which ammonia concentrations reflecting the ERPG-1 (25 ppm), ERPG-2 (150 ppm), ERPG-3 (750 ppm) values could be found.

The assessment of consequences helps establish the area where potentially toxic concentrations of gas would be found, ammonia to be specific. As for the dispersion of ammonia, three thresholds were established by the AIHA (American Industrial Hygiene Association) in a document entitled "Emergency Response Planning Guidelines" (ERPG), in which one of the goals is to anticipate the effects of an accidental exposure to certain substances. These three thresholds are described as follows:

- ERPG-3: Maximum concentration to which most individuals can be exposed for up to one hour without any effects on their health likely to threaten their life. For ammonia, this concentration is **1 000 ppm.**
- ERPG-2: Maximum concentration in the air to which most individuals can be exposed for up to one hour without showing or developing irreversible or serious health effects or symptoms that could affect their ability to protect themselves. For ammonia, this concentration is **150 ppm.**
- ERPG-1: Maximum concentration to which most of individuals can be exposed for up to one hour without feeling any effects other than a slight discomfort. For ammonia, this concentration is **25 ppm**.

According to the method proposed by the EPA, if the release occurs inside the building, the assumption is that 55% of the amount is released directly outside (EPA, 1999). However, the modelling was conducted without considering the mitigation factor of 0.55. The standardized scenario for toxic gas release that was assessed is based on the following assumptions:

- The ventilation system of the storage silos has failed.
- The stored pot lining was in contact with enough humidity contained in the air to generate a gas volume equal to one silo (245 m^3).
- The silo is almost empty and it is filled with the gas generated by the contact of pot lining with the humidity (no dilution with air).
- The composition of the gas generated is the same as the composition of the gas produced by leaching, i.e. 76% hydrogen, 11% methane and 13% ammonia.
- The gas temperature is 25°C.
- The amount of ammonia (22,1 kg) that would be in this silo is released within 10 minutes (total loss of containment).

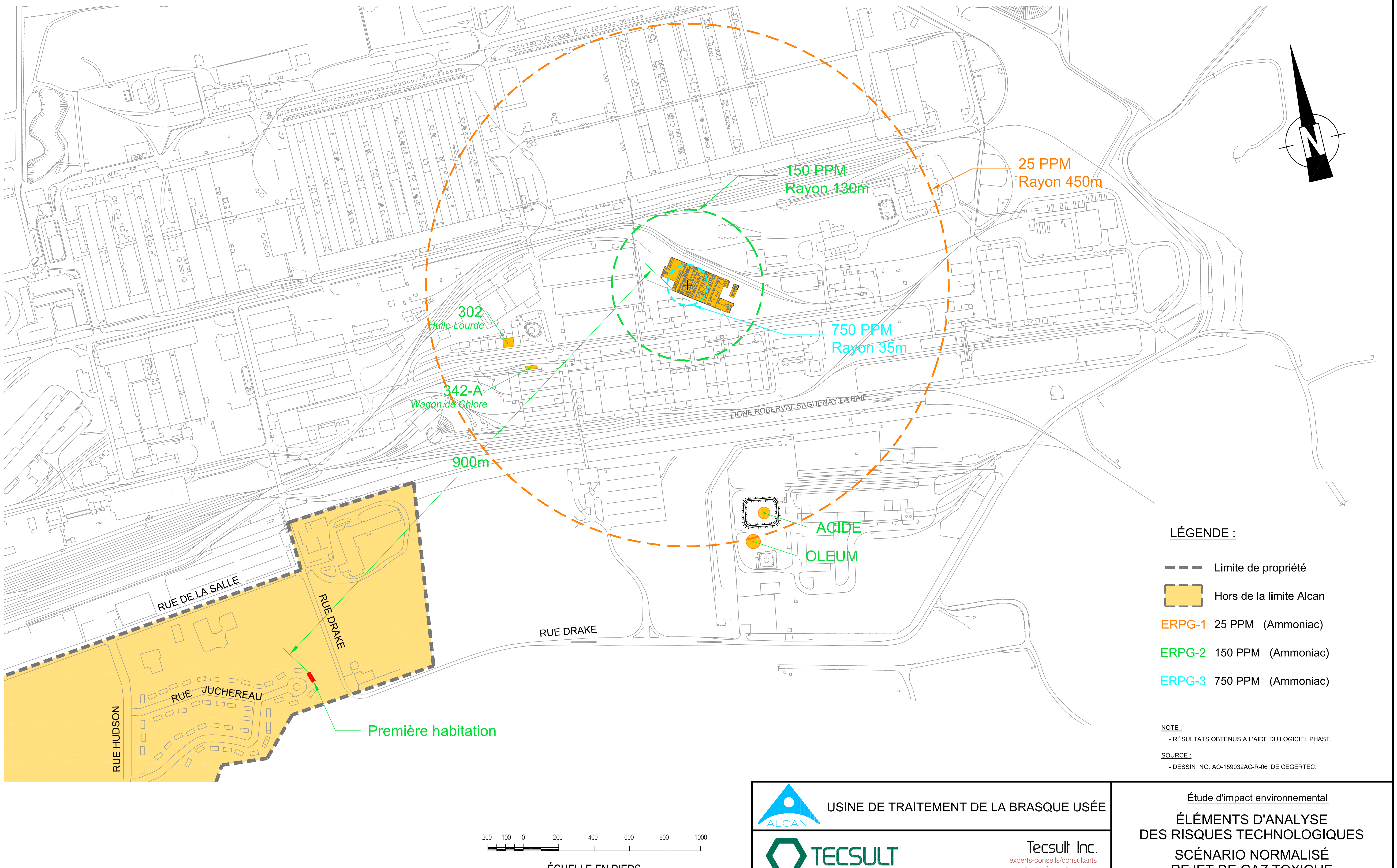
For this modelling, the air temperature was established at 25 °C, humidity rate at 50%, wind speed at 1.5 m/s and atmospheric stability at F. The modelling results are shown in Table 8.4.1.

The results show that if the scenario would occur, the area where concentrations of ammonia superior to 25 ppm would be found is inside the property limits of Alcan and would not come into contact with any of the sensitive elements identified previously.

Table 8.4.1 Results – Toxic Gas Release

	Concentration	Distance from the Release Point	Height Where this Concentration is Found in the Plume
ERPG-1	25 ppm	450 m	28 m
ERPG-2	150 ppm	130 m	17 m
ERPG-3	750 ppm	35 m	8 m

Modelling results are also shown in Figure 8.4.1.



ALCAN

USINE DE TRAITEMENT DE LA BRASQUE USÉE

TECSULT — Tecsult Inc. experts-conseils/consultants MONTRÉAL, CANADA

Étude d'impact environnemental

ÉLÉMENTS D'ANALYSE DES RISQUES TECHNOLOGIQUES

SCÉNARIO NORMALISÉ REJET DE GAZ TOXIQUE

Dessiné par	Vérifié par	Échelle	Date	N° contrat	FIGURE:
D.M.	L.B.	1 : 20	Sept. 2005	1 4 0 4 1	8.4.1

14041_Figure_8.4.1_2005-09_fm.dwg

8.4.1 Correspondence Table

Rayon	Radius
Première habitation	First House
Acide	Acid
Oléum	Oleum
PPM	PPM
Échelle en pieds	Scale in Feet
Légende	Legend
Limite de propriété	Property Limits
Hors de la limite Alcan	Outside Alcan's Property
ERPG-1 25 PPM (Ammonia)	ERPG-1 25 PPM (Ammonia)
ERPG-2 150 PPM (Ammonia)	ERPG-2 150 PPM (Ammonia)
ERPG-3 750 PPM (Ammonia)	ERPG-3 750 PPM (Ammonia)
Note	Note
Dessin No. AO-159032AC-R-06 de CEGERTEC	Drawing # AO-159032AC-R-06 from CEGERTEC
Source	Source
Results obtained using the PHAST software	Résultats obtenus à l'aide du logiciel PHAST
USINE DE TRAITEMENT DE LA BRASQUE USEÉ	SPENT POT LINING PROCESSING PLANT
Étude d'impact environmental	Environmental Impact Assessment
Élément d'analyse des risques technologiques	Technological Risk Analysis Components
Scénario normalize	Standardized Scenario
Rejet de gaz toxique	Toxic Gaz Release
Dessiné par D.M.	Drawn by D.M.
Vérifié par L.B.	Verified by L.B.
Échelle 1:20	Scale 1:20
Date Sept. 2005	Date Sept. 2005
Nº contract	Contract #

Explosion

Considering that the gas generated by pot lining is also composed of inflammable matters, the consequences of an explosion of the gas that would be in a silo were also assessed. The standardized scenario for an explosion is based on the following assumptions:

- The ventilation system has failed.
- The stored pot lining was in contact with enough humidity contained in the air to generate a gas volume equal to one silo (245 m^3).
- The silo is almost empty and it is filled with the gas generated.
- The composition of the gas generated is the same as the composition of the gas produced by leaching, i.e. 76% hydrogen, 11% methane and 13% ammonia.
- The standardized scenario implies that there is a complete loss of confinement and that the gas comes into contact with an ignition source and explodes. According to the EPA method (EPA, 1999), an efficiency rate of 10% is implied. For this assessment, an efficiency rate of 100% was considered.

From the gas composition, the combustion heat from the mixture was assessed using the following data:

- Combustion heat of hydrogen: 119,950 kJ/kg (EPA, Table C-1);
- Combustion heat of methane: 50 029 kJ/kg (EPA, Table C-1);
- Combustion heat of ammonia: 22 500 kJ/kg (Felder, Rousseau, 1986)[17];
- Mass of hydrogen: 15,2 kg;
- Mass of methane: 17,6 kg;
- Mass of ammonia: 22,1 kg;
- Combustion heat of the mixture is therefore: 58 305 kJ/kg.

The considerable damages of an explosion are defined as damages resulting from an excess pressure of 6,8 kPa (1 psi). These damages (broken windows, damages to houses) could cause injuries to individuals (EPA, 1999). Using the equation C-1 from the EPA method (based on the TNT equivalent) (EPA, 1999), and an efficiency factor of 100%, the distance obtained at which there could be an excess pressure of 6,8 kPa (1 psi) due to the explosion of this mass of gas is 150 m from the source.

Thus, the consequences (damages) of an explosion would not affect the sensitive elements defined previously.

<u>Contained Explosion</u>

PHAST software modellings were conducted in order to assess the consequences, for excess pressures other than 1 psi, of an explosion of gas contained inside a silo. In this case, it was considered that the entire silo was filled with a mixture of air and gas formed by the contact of humidity in the air with pot lining; the concentration of gas in the air being at its highest inflammable limit. The highest inflammable gas limit was established from the composition of gas, using the PHAST software; the result is that the highest inflammable limit for this gas is 44.12%.

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[17] Felder, Rousseau, Elementary Principles of chemical Processes 2nd Edition, 1986.

PHAST software modellings were conducted with the following data:

- The volume is filled with 44.12% of gas composed of hydrogen, methane and ammonia, the rest is air;
- The efficiency of the explosion is 100%;
- The air temperature is 25°C;
- The ambient humidity is 50%;
- The atmospheric stability is F and wind speed 1.5 m/s.

Results show that a level of excess pressure of 1 psi could be found up to 110 metres from the source. This area is inside the property limits. Figure 8.4.2 shows the results of the assessment of the standardized scenario for an explosion.

Table 8.4.2 Results – Explosion in the Silo

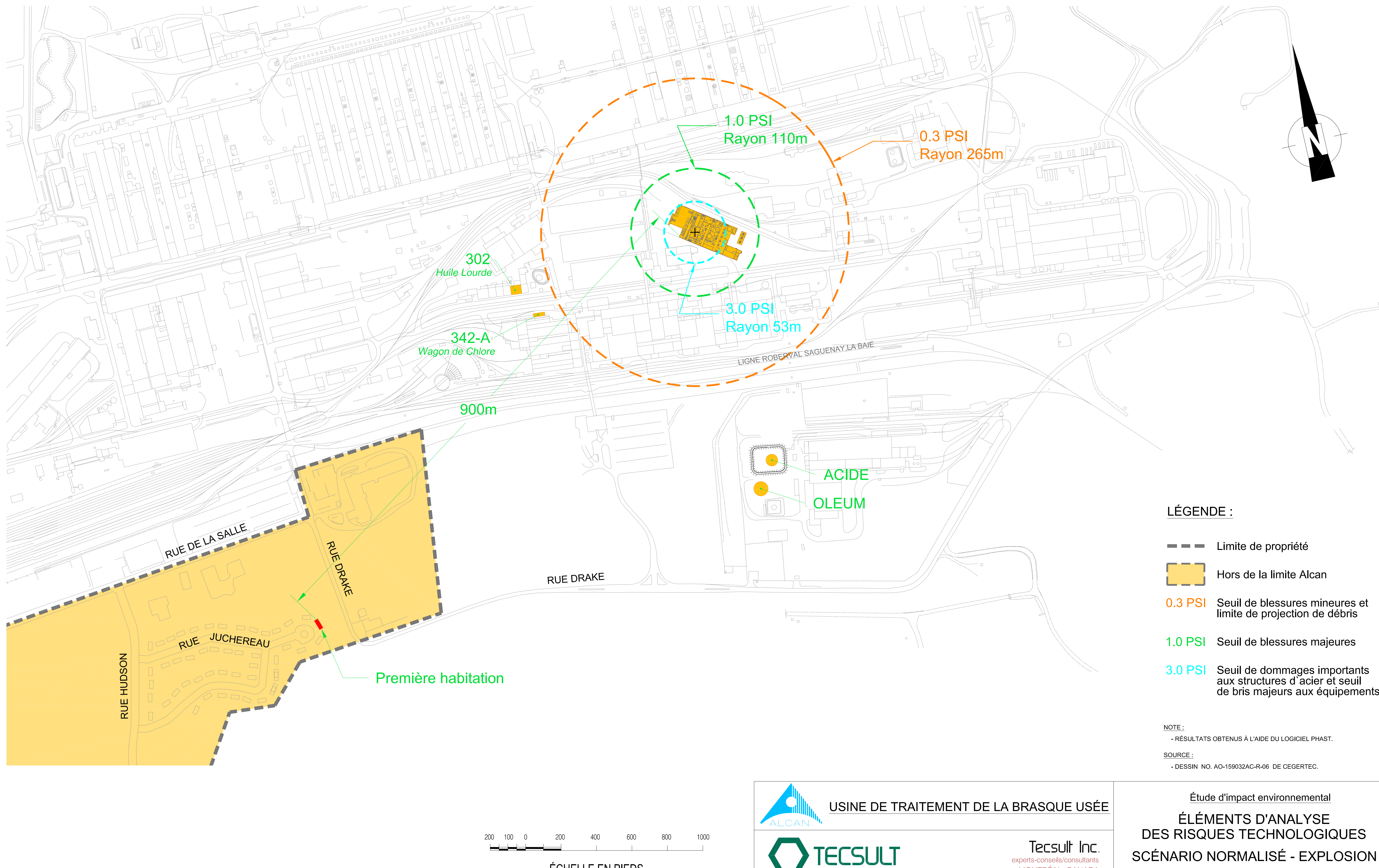
Excess Pressure Level	Distance from the Source
0.3 psi (0.021 bar)	265 m
1.0 psi (0.069 bar)	110 m
3.0 psi (0.207 bar)	54 m

8.4.5 Other Scenarios

The assessment of consequences of the standardized scenario proves that the sensitive elements would not be affected. However, for the purposes of planning emergency measures, the consequences of other scenarios were also assessed.

While the standardized scenario suggests a standardized approach for assessing consequences, the assessment of other scenarios is based on a more thorough analysis of the situation for each project. Thus, actual parameters for project implementation (for example, the height of emission sources) will be considered to calculate the dispersion of a cloud of ammonia due to an accidental release.

Two other accident scenarios were assessed, based on the two sources of danger identified in section 8.4.1. A third scenario based on the contact of pot lining stored in a container with water was also discussed. Moreover, the consequences of a defect of the sulphuric acid supply system were also assessed.



ALCAN

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experts-conseils/consultants
MONTRÉAL, CANADA

Étude d'impact environnemental

ÉLÉMENTS D'ANALYSE DES RISQUES TECHNOLOGIQUES
SCÉNARIO NORMALISÉ - EXPLOSION

Dessiné par	Vérifié par	Échelle	Date	N° contrat	FIGURE:
D.M.	L.B.	1 : 6000	Sept. 2005	1 4 0 4 1	8.4.2

14041_Figure_8.4.2_2005-09_fm.dwg

8.4.2 Correspondence Table

Huile lourde	Dead Oil
Wagon de chlore	Chlorine Car
Acide	Acid
Oléum	Oleum
PSI	PSI
Rayon	Radius
Première habitation	First House
Échelle en pieds	Scale in Feet
-LÉGENDE	LEGEND
Limite de propriété	Property Limits
Hors de la limite Alcan	Outside Alcan's Property
Seuil de blessures et limites de projection de débris	Minor Injury Threshold and Limits of Debris Projection
Seuil de blessures majeures	Major Injury Threshold
Seuil de dommages importants aux structures d'acier et seuil de brie majeure aux equipements	Significant Damages Threshold on Steel Structures and Major Equipment Failure Threshold
NOTE:	Note:
Résultats obtenus à l'aide du logiciel PHAST	Results obtained using the PHAST software
Source:	Source:
Dessin No. AO-159032AC-R-06 de CEGERTEC	Drawing # AO-159032AC-R-06 from CEGERTEC
USINE DE TRAITEMENT DE LA BRASQUE USÉE	SPENT POT LINING PROCESSING PLANT
Étude d'impact environmental	Environmental Impact Assessment
Élément d'analyse des risques technologiques	Technological Risk Analysis Components
Scénario normalize	Standardized Scenario
Explosion	Explosion
Dessiné par	Drawn by
Vérifié par	Verified by
Échelle 1:8000	Scale 1:8000
Date Sept. 2005	Date Sept 2005
Nº contract	Contract #
Figure 8.4.2	Figure 8.4.2

8.4.5.1 *Crushed Pot Lining Silo*

In the case of crushed pot lining storage silos, the accident scenario assessed is based on the following assumptions:

- the silo's ventilation system and the emergency generator have failed (trigger);
- the rate at which the gas is generated in the silo is 1 cm^3 per gram of crushed pot lining supplied to the silo;
- the rate at which the crushed pot lining is supplied to the silo is 16,5 MT per hour;
- the gas is released through the chimney (height of 24 m);
- the temperature of the gas is 20 °C;
- the composition of the gas is: 11% ammonia, 13% methane and 76% hydrogen (without considering the dilution with the air contained in the silo).

The consequences of this accident scenario were assessed using the PHAST software (version 6.0, D.N.V. Technica) and the effect of dispersion of the gas released by the chimney for various combinations of meteorological data (wind speed and stability) was considered. The results show that the ground-level concentration of ammonia would never reach the toxic level of 150 ppm (ERPG-2). The maximum concentration on the ground obtained is less than 1 ppm (at wind speeds of 1.5 m/s and with an atmospheric stability of B). This concentration would be reached at 128 m from the release point.

Also, the modelling results show that the ground-level concentration of gas would not reach an explosive concentration.

8.4.5.2 *Leaching Gas*

The consequences of leaching gas emissions were also assessed in cases where the ventilation system that releases and dilutes gas generated by water and caustic leaching would fail.

This accident scenario is based on the following assumptions:

- the ventilation system and the emergency generator have failed (trigger);
- the rate at which the gas is generated in the leaching tanks is 1,500 m^3 per hour;
- the gas is released through the chimney (height of 30 m);
- the temperature of the gas is 87 °C;
- the gas release rates are:
  - ammonia: 13.36 kg/hr
  - methane: 11.4 kg/hr
  - hydrogen: 9.36 kg/hr
  - water: 625 kg/hr

The consequences of this scenario were assessed using the PHAST software (version 6.0, D.N.V. Technica). The results show that the ground-level concentration of ammonia will not reach the toxic concentration of 150 ppm (ERPG-2). The maximum concentration on the ground obtained is 2 ppm (at wind speeds of 1.5 m/s and with an atmospheric stability of B). This concentration would be obtained at approximately 300 m from the release point. The results show that the ground-level concentration of gas would be less than the threshold inflammability limit.

8.4.5.3 *Pot Lining Container*

Spent pot lining will be transported by trucks or trains in containers especially designed to transport hydro-reactive materials. On the plant site, the containers are stored inside the building in order to prevent any contact with water. Despite all these precautions, there is still a risk that pot lining will come into contact with water due to an accident during transportation or due to a flood in the spent pot lining container warehouse.

If there is an accident while transporting spent pot lining by truck or by train to the processing plant, the containers may be damaged and pot lining may leak completely or partially. If pot lining is discharged on the ground, there will be no specific impact. If pot lining is discharged in a stream, there would be a gas formation (ammonia, hydrogen and methane). However, these gases would not be contained and would be released in the atmosphere. There would be a local environmental impact (ammonia, fluorides and cyanide dissolved in water and pH). The emergency response crew would take the appropriate emergency measures.

Following an accident where the container would be intact but end up in a stream, water could infiltrate the container by its air vents. Gas would then be produced. Normally, the gas could leak through the openings where the water infiltrated in the container while floating.

In such a case, the response crew will have to assess the situation and take appropriate measures in order to, for example, prevent the containment of gas, limit the possible sources of ignition and protect the response crew against the ammonia emanations.

8.4.5.4 *Defect of the Acid Supply System*

A defect of the sulphuric acid supply system that would result in too much sulphuric acid at the activation washing stage could provoke an elaborate acidification of the activation solution and generate hydrocyanic acid (HCN) and hydrofluoric acid (HF). The possible impacts of this situation were assessed and it was determined what would be the ambient concentrations of HCN and HF due to a defect. Note however that, in normal operation conditions, at the activation washing stage, the pH would be approximately 8. This condition in a basic environment helps prevent the formation of HF or HCN.

What is left of the fluorides and cyanides that could still be found in the residual part of the pot lining before the activation stage was assessed using LCLL process simulation data. Considering that the remaining fluoride could, in acid conditions, be released as HF and that all CN^{-1} ions remaining would be released as HCN, we estimate that the maximum release rate would be 172 kg/hr for HF and 0.23 kg/hr for HCN.

From the assessment of maximum amounts of HCN and HF that could be produced due to a malfunction of the sulphuric acid supply system at the activation stage, modellings of the atmospheric dispersion of HCN and HF were conducted in order to assess what would be the concentrations in the ambient air. For the ISCST3 software modellings, the release was considered as continuous.

The results show that the concentration of HCN in the ambient air at the maximum point of impact outside the property limits, over a period of one hour, could reach 5.4 $\mu g/m^3$. Considering that the gas would be released over a very short period due to a mal function, we can compare this value to the ERPG (Emergency Response Planning Guidelines) values defined by the AIHA. For HCN, the ERPG-2 value is 10 ppm, i.e. 11,050 $\mu g/m^3$. There is no ERPG-1 value defined for HCN. However, the TEEL-1 (Temporary Emergency Exposure Limits) value for HCN is 4.7 ppm (5,200 μg/m^3).

For HF, the modelling results show that the concentration of HF in the ambient air at the maximum point of impact outside the property limits could reach 4,100 μg/m^3. The ERPG-2 value for HF is 20 ppm (16,350 μg/m^3) and the ERPG-1 value is 2 ppm (1 635 μg/m^3). The ERPG-2 value is the concentration in the air to which most individuals can be exposed for up to one hour without showing or developing irreversible or serious health effects. The ERPG-1 value is the concentration to which most of individuals can be exposed for up to one hour without feeling any effects other than a slight discomfort.

As part of the safety reviews conducted at the detail engineering stage of the project, precise measures (as, for example, redundancy of measurement or control elements, alarms, detectors, use of safely-positioned components in case of failure) can be identified in order to reduce the probability of a sulphuric acid injection system defect resulting in the release of HF and HCN.

8.4.6 Discussion on External Dangers

8.4.6.1 *Natural Phenomenons*

FLOOD

Flooding of the warehouse where pot lining containers would be completely submerged seems unlikely. In July 1996, there were heavy rainfalls and the Jonquière complex area was not flooded. If the level of water would reach the pot lining containers, proper ventilation of the warehouse would have to be maintained to prevent a gas accumulation or containers would have to be moved in a secure area. The appropriate measures are described in the emergency response plan.

EARTHQUAKE

The pot lining processing plant's structures and buildings will be designed according to the National Building Code standards. These standards are established based on the areas and the analysis of earthquakes recorded in this area according to a statistical method that gives weight to the geologic and historic data to corroborate the seismic data. They are revised regularly to take into account the most recent data of earthquakes recorded. The application of the National Building Code ensures that the structures or facilities will not be affected by an earthquake causing damages that could cause the loss of a life.

8.4.6.2 *Industrial Activities*

In the risk analysis of accidents that could occur while operating the pot lining processing plant described in the previous sections, it was showed that the consequences of accidents that could occur at the pot lining processing plant would not affect any sensitive elements identified both inside and outside the Alcan property limits.

Therefore, if there were an accident near the pot lining processing plant that would cause an accident in these facilities, the consequences would be limited and there would be no risk of affecting other sensitive elements and thereby increasing the extent of this accident.

8.4.7 Conclusion

The assessment of the consequences of the accident scenarios considered for the spent pot lining processing plant showed that these accidents would not have any serious consequences outside and inside the plant perimeters.

8.5 Safety Measures

This section describes the safety measures included in the project. These measures aim at preventing fires, explosions and release of toxic substances.

8.5.1 General Design Parameters

Generally, the pot lining processing plant will be designed according to the limits, standards and regulations in effect. The specific aspects related to the chemical and physical characteristics of spent pot lining and other products that will be used at the plant, including hot caustic soda liquid, will also be taken into consideration in the detailed design of the plant.

The plant will be designed in various sections so that the pot lining crushing and storage activities are isolated (in a building) from the leaching section (wet process).

The plant design will be drawn using a computer-assisted design (CAD – 3D) system that allows for a three-dimensional view of the equipment. This system helps optimize the general layout of the equipment and, at the design stage, allows for the review of the work environment to minimize limited spaces and potentially dangerous situations. Moreover, the use of this system helps position both process and security equipment, such as emergency showers.

The process and instrumentation diagrams (P&ID) will show the process control system elements and lock sets required for the start-up, and the regular and emergency shutdown. Operation safety will be maintained by applying redundancy techniques or by using emergency components.

8.5.2 Access Restriction to the Site

The spent pot lining processing plant will be located inside the Jonquière complex, which is completely fenced and where there is controlled access.

8.5.3 Receiving and Handling Spent Pot Lining

Spent pot lining will be received exclusively in containers designed for transportation of hydro-reactive materials (waterproof and ventilated). Spent pot lining containers will be stored in a dedicated storage facility. Access to this area will be limited and controlled in order to ensure secure operation of truck or freight car unloading equipment and container transportation to the storage site, as well as transportation of containers from the storage site to the pot lining crushing building. Most spent pot lining containers will be inside the building; if there were spillage of the content of a container, the content will not be exposed to inclemency.

The total number of spent pot lining containers will be limited to minimize the spent pot lining inventory on the plant site.

The equipment and ducts containing dry or liquid pot lining will be ventilated at all times in order to disperse gases and maintain low concentration levels. An atmospheric dilution will be used in various areas in order to prevent the formation of an explosive mixture. Dust collecting systems as well as vacuum cleaning systems will be used to maintain a clean work environment.

The container tippler and the racks made to receive pot lining will be located in the crushing building but will be directly accessible from the container storage building. The receiving hopper as well as the dust removal compound will be insulated in order to prevent condensation and thus the possible contact of water with dry pot lining.

Charge cells on the container tippler will help verify that the container was completely emptied.

Water coming from the plant's dry sprinkler system used for the pressure feed of pot lining will be dried in order to limit the contact of pot lining with humidity.

All devices and equipment in the pot lining crushing and storage area will be grounded in order to prevent the generation of static electricity.
Pot lining will be stored in silos between the two crushing stages. Following the first crushing stage, pot lining will be 5 mm. This particulate-size distribution allows for the prevention of agglomeration of pot lining in the silos and helps obtain sufficient porosity to let air go through the material.

The pot lining crushing and storage building will be designed so that the possibility of contact of pot lining with water be minimized; no water washing units will be installed in this area of the plant and no water ducts will be installed near the crushing equipment and the storage silos.

Also, special attention will be given to the positioning and routing of roof drainage lines, both for the pot lining container storage building and the pot lining crushing and storage building, in order to prevent water infiltrations in the building.

8.5.4 Leaching

All leaching tanks will be watertight and a ventilation system will scavenge inert gas or air to disperse the gases generated by the reaction. The leaching tanks will be covered and insulated to protect the staff and to minimize heat loss.

8.5.5 Safety Installations

Combustible gas detectors will be installed in various areas of the plant. The system will include detectors and alarm pulls linked to a central panel located in a control room where the position of the alarm pulls is indicated.

A diesel emergency power system will be installed to ensure that critical services and equipment remain in working order in case of a power failure. The emergency generators will power the ventilation systems of dust extractors and those used to disperse gas from the leaching tanks. Also, for each of these systems, an additional ventilator will be installed in case of a mechanical breakdown of the main ventilator. These measures are taken to ensure that explosive gases cannot accumulate in these areas.

Emergency lights as well as computerized controls will be connected to an emergency storage battery-powered system.

Electrical rooms, the mechanical workshop, control rooms as well as the heating, ventilation and air-conditioning unit rooms will be maintained under positive pressure to prevent any potential infiltration of gas produced by the process in these rooms.

Because of the potential explosion risk, the electrical classification of the crushing building will be Class 1, Division 2 except for the electrical room, the mechanical workshop, the control room and the heating, ventilation and air-conditioning unit rooms. Staircases of the crushing building will be equipped with explosion-proof heating units.

Lye solution and sulphuric acid tanks will be placed inside the building and inside a dike area to retain any spill.

8.5.6 Emergency Shutdown

Certain conditions will cause an emergency shutdown of spent pot lining processing plant operating activities. The specific conditions that will cause an emergency shutdown will be determined at the detail engineering phase of the project. HAZOP-type safety reviews will be carried out at different stages of the project development in order to identify the specific situations that could entail risks both at the security level and at the plant operation level.

Here is the list of typical conditions that could cause an emergency shutdown:

- Ventilation shutdown;
- Detection of combustible gas;
- Very low level in the tanks or reactors;
- Very high level in the tanks or reactors;
- Shutdown of extraction pumps;
- Detection of very high temperatures during one of the processes (leaching, cyanide destruction, evaporation);
- Non-availability of filter presses;
- Loss of electrical power;
- Breakdown of essential equipment that has no duplicates (cage crusher, bucket elevators, infeed conveyor). Equipment breakdown during the process of crushing and handling pot lining will only cause the emergency shutdown of that process. Moreover, the breakdown of wet process equipment will only cause the shutdown of that process;
- Shutdown using an emergency stop pull along the belt conveyors or an emergency stop button. Emergency stop buttons will be placed in various areas of the plant and will be easily accessible;
- Fire alarm.

8.5.7 Fire-Control Systems

The plant will be protected by a fire protection loop with fire hydrants. The fire-control systems needed will be specified in the detail engineering stage of the project. These systems will be designed so that contact of water with spent pot lining will be prevented.

8.5.8 Preliminary Risk Management Program

8.5.8.1 *Staff Protection*

The spent pot lining processing plant workers will receive the individual protective equipment (IPE) required for their protection.

The health and safety committee at the Vaudreuil plant, who will be responsible for managing the pot lining processing plant, will be consulted and risk analyses specific to this new work environment will be conducted in order to identify the potential risks, the nature of the risks, the appropriate work methods and the necessary protection equipment for workers.

The staff appointed to this new installation will be trained and informed of work techniques, the risks inherent to the work environment, and the Emergency Response Plan (ERP) that concerns them, and the safety and fire service of the Jonquière complex will organize and perform periodical simulations.

8.5.8.2 *Health and Safety Management Program*

In order to ensure the safety of individuals and premises while the plant is in operation, the Vaudreuil plant's general health and safety program will be updated to take into account this new manufacturing unit.

Human, material and financial resources will be allocated to this new manufacturing unit to implement and manage the prevention program.

Safety training will be given to all employees and will deal with the following main items:

- Operation and layout of the spent pot lining processing plant;
- Awareness of risks inherent to plant activities;
- Information and training on appropriate safety work methods;
- Awareness of individual protection using means made available to them.

The Vaudreuil plant prevention program, for workers of the facilities, is pursuant to section 58 and following sections of *An Act Respecting Occupational Health and Safety (L.R.Q., c. S -2.1)* and was tabled to the C.S.S.T. in accordance with the Act.

This prevention program covers the following items and chapters:

- A program to adapt the establishment to the standards;
- Measures to control the quality of the work environment;
- Specific occupational health and safety standards;
- Implementation methods of health and safety regulations;
- Identification of individual and collective means and protection equipment;
- Occupational health and safety training and information programs.

8.5.8.3 *External Services Interventions (Contractors)*

All contractors (maintenance, construction, various services and delivery) must obtain specific access rights to the facilities and will have to comply with security guidelines for the Jonquière complex facilities.

The staff responsible for the plant area in question ensures that everyone is informed of and respects the safety procedures.

Moreover, a policy for contractor activities exists; it deals especially with the following:

- Contractor certification in terms of qualifications, quality, health and safety, and finances;
- Verification of the qualifications of the workers;
- Verification of the courses taken by the workers (safety code);
- Application of and follow-up on the main contractor framework prevention program for the plant sites;
- Application of and follow-up on specific contractor prevention program for the affected activities;
- Inspection of construction sites.

8.5.8.4 *Critical Review Program*

As part of this program, critical health, safety and environment reviews will be conducted during the entire development of a project. This program is applied strictly during the following phases:

- Basic engineering and detail engineering;
- Pre start-up phase.

8.5.8.5 *Preventive and Predictive Maintenance Program*

All the spent pot lining processing plant equipment, including the containers used to transport and store spent pot lining, will be subject to and integrated into the Vaudreuil plant maintenance program.

8.5.8.6 *Health and Safety Auditing Program*

A compliance verification program for safety management on plant sites (contractors) is in place. Such a review is conducted every two years in all Alcan facilities located in Quebec. Also, the corporative service of Santé et Sécurité Alcan implemented, in 2002, an assessment program to ensure compliance with the various legislations in effect in Quebec. These assessments are done every three years.

A periodical installation inspection is carried out as part of the prevention program, for each installation. A corrective measures tracking system (CMTS) is in place and operational, to ensure that all shortcomings recorded during these inspections are resolved in a reasonable timeframe according to the hazard potential scheme, A, B or C.

8.5.9 List of Regulations and Codes

The following acts, regulations and codes, but not limited to, will be taken into consideration when defining safety measures that will be implemented at the spent pot lining processing plant.

Acts:

- An Act Respecting Occupational Health and Safety - S-2.1;
- An Act Respecting Industrial Accidents and Occupational Diseases;
- Hazardous Products Act;
- Environment Quality Act - LRQ, chapter Q-2;
- Public Buildings Safety Act;
- An Act Respecting Pressure Vessels.

Regulations and Codes:

- Règlements sur le Programme de prévention cadre;
- Regulation respecting elevators, dumbwaiters, escalators and moving walks - S-3, r.1;
- Safety Code for the Construction Industry - L.R.Q., c.S-2.1, r.6;
- Regulation respecting industrial and commercial establishments - S-2.1, r.9;
- Regulation respecting the handling and use of explosives - S-2.1, r.11;
- Regulation respecting forestry operations - S-2.1, r.22;
- Regulation respecting solid waste - Q-2, r.14 (Q-2, r.3.2);
- Regulation respecting the quality of the work environment - S-2.1, r.15;
- First-Aid Minimum Standards Regulation - A-3, r.12;
- Occupational Safety Code for Diving Operations - CAN/CSA - Z275.2-92;
- National Fire Code of Canada 1995 (article 2.15);
- National Building Code of Canada 1995;
- Regulation respecting the protection of compressed air workers;
- Regulation respecting work carried out in the vicinity of electric power lines;
- Regulation respecting the use of explosive actuated tools;
- Hazardous Materials Regulation- Q-2, r.15.2;
- Regulation respecting safety in public buildings;
- Controlled Products Regulations - S-3, r.4;
- Code for the Construction and Inspection of Boilers and Pressure Vessels -ACNOR B51-95;
- Plumbing Code;
- Quebec electrical code - C22.10;
- Rigger’s Guide;

- American National Standard for Emergency, Eye wash and Shower Equipment – ANSI-Z358.1.

8.6 Emergency Response Plan

Note that the spent pot lining processing plant will be built inside the Jonquière complex of Alcan in Saguenay and more precisely on premises managed by the Vaudreuil plant, large manufacturer of various chemical products: metallurgical–grade alumina, commercial alumina, hydrates and fluorine-based products. This plant manages a general emergency response plan (*Plan des mesures d'urgence* – Vaudreuil), which is reviewed each year, in accordance with the ISO Standard 14001. The spent pot lining processing plant will be integrated into this emergency response plan.

Moreover, each manufacturing centre or unit of the Vaudreuil plant has its own specific emergency response program, which takes into account the specific and distinctive risks of each one of these centres. Thus, for the spent pot lining processing plant, a specific program will also be developed to take into account the reality of this new manufacturing centre.

The general emergency response plan deals with the following items:

- Roles and responsibilities of the stakeholders;
- Internal and external communication network;
- Specific procedures for the Vaudreuil plant;
- Check list for the stakeholders.

The specific plans or programs for each of the manufacturing centres of the Vaudreuil plant deal with the reality of each of these centres as well as the following various scenarios:

- Fire;
- Spill of environmentally harmful materials;
- Explosion;
- Gas leak;
- Earthquake;
- Electrical failure;
- Bomb threat;
- Aircraft crash;
- Floods/downpours;
- Ice storms/snow storms;
- Death of a worker.

The interface between the emergency response plan (ERP) and the emergency preparedness and municipalities is carried out by the director of ERP-Vaudreuil in cooperation with the officer in charge of the multidisciplinary team (head of safety/fire department). The communication procedure (hunters' radio call procedure) is tested every three months to ensure it is in good working order.

8.7 Economic Spinoffs

The economic impacts resulting from the construction and operation of the spent pot lining processing plant are three-fold:

- Direct impacts: These are the economic effects of the project on employment and businesses directly attributable to the initial expenses. These effects translate into jobs, wages payment (gross) and other gross income before tax.
- Other gross income before tax includes contractor's pay, return on capital, various interests as well as employer costs, fringe benefits, municipal taxes and school taxes, etc.
- Indirect impacts: These are the economic effects of the project on first suppliers and subsequent suppliers for project inputs. These impacts translate into jobs, revenues for businesses and other gross income before tax.
- Spill-over effects: These are the result of the increase of economic activity because of the increase in income that was generated by the project.

These impacts were assessed for the province of Quebec and Saguenay - Lac-Saint-Jean region. The project impact on government revenue is also shown.

8.7.1 Economic Impacts Resulting from Construction Activities

Table 8.7.1 indicates the main expenditure items as well as their importance in the global construction budget of the spent pot lining processing plant. This data was allocated according to the origin of the workers and where the goods are manufactured and services offered.

Table 8.7.1 Plant Construction – Main Expenditure Items (in Millions of Dollars)

Items of Expenditure	Saguenay - Lac-Saint-Jean Region	Elsewhere in Quebec	Canada (Except Québec)	Outside Canada	Total
Salaries and Pay Before Taxes (Person-Year)	32.0 (295)	2.5			34.5
Purchase of Goods and Other Direct Costs	74.2	23.5	14.7	29.2	141.6
Services and Other Expenses	36.3	13.3	4.9	1.7	56.2
TOTAL	142.5	39.3	19.6	30.9	232.3

8.7.1.1 *Impacts for the Province of Quebec*

In 2001, Alcan hired the Institut de la statistique du Québec to assess the economic impacts of its project. Since then, project costs were revised upwards from 130 to 230 million dollars, which translates necessarily into an economic impact increase. Impact data was not updated. The following figures are therefore minimums.

Direct and indirect impacts resulting from the plant construction are described as follows:

- The project provides work directly and indirectly for 1,035 persons-year (employees and other workers): 295 persons-year directly related to plant construction work and at least 740 persons-year (employees and other workers) related to the input demand from different suppliers. For each person-year created directly by the plant construction, the project creates jobs for 2.5 other persons-year in the Quebec economy.

- The added value of the project to the Quebec economy would be at least 76.3 million dollars distributed as follows: 60% in wages (gross) paid to the workforce directly and indirectly hired, almost 5% in salaries for other workers (mostly independent) and more than 35% in other gross income before tax.
- The added value to wage costs represents a domestic production value measure of the Quebec economy. Thus, the Quebec content is 63% for this project.
- According to the results of the simulation conducted in 2001, procurement for good and services required by the project will call for the import of goods and services valued at 44 million dollars.
- Quebec government revenues are approximately 6.9 million dollars, from which 95% comes from income taxes on salaries and pay.
- Federal government revenues are more than 4.8 million dollars, resulting almost all from income taxes on the workers' salaries.
- Incidental taxation amounts that the Quebec and federal governments will earn adds up to more than 6.5 and 1.9 million dollars, respectively.

As for the spill-over effects, they come from the economic agent expenses that were paid as part of the project. These economic agents are the employees, workers and businesses.

The following are the spill-over effects from the plant construction:

- Employment level: At least 303 persons-year (employees and other workers).
- Added-value level: At least 17.8 million dollars (1999 $)[18] equally stemming from salaries and pay before tax and other gross income before tax.
- Government revenues respectively valued at more than 2.6 and 2.1 million dollars for the government of Quebec and the federal government.

These effects cannot be added to the direct and indirect impacts since they cannot be attributed directly to the plant construction project. In fact, in the absence of the project, the workers would have undoubtedly earned income from other employments or social programs, income that they would have spent in their community or elsewhere.

8.7.1.2 *Impacts for the Saguenay - Lac-Saint-Jean Region*

The direct and indirect economic impacts generated by the plant construction in the Saguenay - Lac-Saint-Jean region constitute a subset of impacts assessed previously for the whole province of Quebec (see Table 8.7.2).

The majority of workers hired for the plant construction and the deployment of various equipments will come from the Saguenay - Lac-Saint-Jean region. Almost 93% of salaries and pay before tax given to Quebec workers will be to workers from the Saguenay - Lac-Saint-Jean region and the amount will total 16.5 million dollars.

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18 Results from the last available simulation in 2001 (at the Institut de la statistique du Québec) with regard to the economic impact of household spending in Quebec are shown in 1999 dollars.

Goods and services expenses in the Saguenay - Lac-Saint-Jean region will total 43.8 million dollars. Thus, according to the method established to calculate regional impacts, the indirect impacts, i.e. added value, corresponds to 15.5% of the purchase of goods and services in the region. So the indirect impacts in terms of income in the region total more than 6.8 million dollars.

The spill-over effects, i.e. the income multiplier effect generated by the project in the region, are estimated at least at 7.0 million dollars.

Table 8.7.2 Regional Economic Impacts Related to the Plant Construction (in Millions of Dollars)

IMPACTS	AMOUNT ($M)
Direct ➢ Salaries paid to local workers	16.5
Indirect ➢ Added value from the purchase of regional goods and services	6.8
Spill-over ➢ Spill-over effects	7.0
TOTAL ➢ Regional economic impacts in terms of revenues	30.3

Regional economic impacts in terms of revenues total at least 30.3 million dollars.

8.7.2 Annual Impacts resulting from Operating Activities

8.7.2.1 *Impacts for the Province of Quebec*

This is a description of annual direct and indirect impacts for the province of Quebec:

- At the employment level, the operation of the plant provides employment for at least 195 persons-year, 40 persons-year directly, and at least 155 persons-year for employees and workers hired by suppliers.
- The added value resulting from the plant operation is distributed as follows: 56% in salaries (gross) paid to the workforce directly or indirectly hired by the project, less than 4% in income for other workers and 40% in other gross income before tax.

As for job creation, spill-over effects related to the operation of the plant are estimated at 53 persons-year (employees and other workers).

8.7.2.2 *Impacts for Saguenay - Lac-Saint-Jean*

The majority of workers hired for the operation of the plant will come from the Saguenay - Lac-Saint-Jean region. The regional economic impacts in terms of income (salaries) total at least 5.8 million dollars, not to mention approximately $544,000 in municipal and school taxes.

8.7.3 Economic Impact Maximisation Strategy

Alcan proposes to take several measures in order to contribute to regional economic spinoffs. The exact formula that Alcan intends to follow will be established when the construction contract terms for engineering, supply and management will be defined for the project. Moreover, Alcan intends to form an association with a regional partner to establish and implement this formula.

These are the measures considered at this stage:

- The promoter will communicate in advance the nature of the goods and services that will be required during the project delivery;
- At competitive costs, regional businesses will be favoured; they will be chosen from the Alcan directory of construction contractors.

8.8 Heritage, Cultural, Historic, Archaeological, Paleontological Resources

Since there are no heritage, cultural, archaeological and paleontological resources on the sites affected by the project, no impact is foreseen at this level.

8.9 Land and Resource Use by Aboriginals and Land Claims

Considering the absence of use and claims, to Alcan's knowledge, on the land affected by the project, no impact is foreseen at this level.

8.10 Renewable resources

This section outlines the impact on the capacity of renewable resources to meet the needs of current and future generations.

8.10.1 Use of the space

The reuse of a site within the Jonquière Complex to set up the spent pot lining treatment plant will prevent the expansion of industrial activities in the area and leave space available for future requirements. Instead of building on new space, a parcel of industrial land is being recycled for industrial purposes.

8.10.2 Upgrading of materials

Energy (steam produced by a natural gas boiler) is required to treat spent pot lining. However, the project will help provide a final solution for the management of hazardous materials that would otherwise be left for future generations.

By facilitating better management of spent pot lining resulting from aluminum production, this project is consistent with improved aluminum production methods to make aluminum production more environmentally friendly. Moreover, the selected technology offers the potential for better use and upgrading of resources.

9 SIGNIFICANCE OF IMPACTS

9.1 Impact Identification and Assessment Method

Identification and assessment of impacts link project activities with components of the environment disturbed by the project. Mitigation measures to reduce impacts on the environment are also considered at this stage of the study. Depending on the efficiency of the measures, the impacts that are left are called residual impacts and are assessed. The methodology used to assess residual impacts is described in the following.

Identification and assessment of anticipated impacts are expressed according to their nature and significance. The **nature** of the impact refers to the changes undergone by a component of the environment because of construction activities, plant operation or the existence of the project. The **significance** of the impact, established using indicators (intensity, scope, duration and value of the affected component of the environment), is the parameter that allows for formulating a general opinion about the impact sustained by a component of the environment. Below are the established indicators, which are used jointly to express this opinion.

- **Intensity** of the impact: level of disruption of a component of the environment. A **high-**intensity impact destroys, questions the integrity or highly reduces the quality of a component of the environment. An impact of **moderate** intensity changes the component of the environment or somewhat reduces its use or quality. If the component is not disturbed in any way, the intensity of the impact is negligible. An impact of **low** intensity changes somewhat the component of the environment without noticeably altering its balance or quality. If the impact is **positive**, we then refer to it as an improvement level, and the same levels are used to assess the improvement brought about by the project on the components of the environment.
- **Value** set on a component of the environment: relative significance of a component in its environment. On the one hand, the specialists who assess the intrinsic value defined by the quality of the component and the interest it generates are the ones that determine the value. On the other hand, popular, legal and political interests aimed at the protection and emphasis of the environment are considered. The rarity or abundance of a component in the region and its ecological, economical or social value are as much contributing factors to the determination of its value. Three levels are considered for this indicator, **high, moderate** and **low**.
- **Scope** of the impact: qualifies the space dimension of the impact or the number of users of the component in question. The scopes of the impact are limited, local or regional. The impact that is **limited** in scope is not felt beyond the work area, or the impact affects a component used or it is felt by a limited group of persons. An impact that is **local** in scope is felt beyond the work area or affects a local community or part of it. A **regional** impact is felt much farther than the work area and affects a whole region or even a high percentage of the Quebec community.

- **Duration** of the impact: relatively conveys the period of time where the repercussions of an intervention will be felt by the affected component. An impact will be deemed **short** in duration if the component is expected to go back to its initial state in less than one year. The duration of an impact is considered **moderate** if the balance is restored within one to five years and **long** if the effects persist for more than five years.

The integration of these four indicators helps assess the significance of the impact, either **major** or **minor**, according to the results obtained from the matrixes shown in tables 9.1.1 and 9.1.2. The first matrix associates the value of the component with the intensity of the impact, which helps assess the **resistance** of the element to project activities. The result obtained in this first matrix (Table 9.1.1) is carried to the second matrix (Table 9.1.2), which takes into account the scope and the duration of the impact to determine its significance. In cases where the intensity of the impact is deemed negligible, it is not necessary to determine the other indicators because the extent of the impact will be nil. The words “Not applicable” (N/A) are therefore entered in the summary table.

Table 9.1.1 Environmental Resistance Estimation Matrix

INTENSITY	ENVIRONMENTAL VALUE		
	High	**Moderate**	**Low**
High	High	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Low

For example, a high-intensity impact on a component of the environment of high value would suggest a high resistance (objection to the project or major remediation), while a low intensity impact on a component of the environment of low value would suggest a low resistance to the project, even nil. Notwithstanding, from the scope of these impacts and their duration, considered by the matrix in Table 9.1.2.

Table 9.1.2 Impact Significance Estimation Matrix

ENVIRONMENTAL RESISTANCE	SCOPE	DURATION	SIGNIFICANCE OF THE IMPACT
High	Regional	Long Moderate Short	Major Major Minor
	Local	Long Moderate Short	Major Major Minor
	Limited	Long Moderate Short	Major Minor Minor
Moderate	Regional	Long Moderate Short	Major Major Minor
	Local	Long Moderate Short	Major Minor Minor
	Limited	Long Moderate Short	Major Minor Minor
Low	Regional	Long Moderate Short	Major Minor Minor
	Local	Long Moderate Short	Minor Minor Minor
	Limited	Long Moderate Short	Minor Minor Minor

To complete the examples provided above, the high resistance of the first example, if it is limited and of short duration, would lead to eventually qualify the impact as minor. And, conversely, the low resistance of the second example, if it would affect an entire region for a long duration, would lead to qualify the impact as major.

9.2 Impact Summary

Table 9.2.1 summarizes, in a format similar to Table 5.3.1 concerning the scope of the study, the conclusions from the assessment conducted, in Chapter 8, for each component of the environment. Table 9.2.1 also shows the mitigation or control measures planned as part of the project for potential impacts found during the assessment.

The analysis proves that, as proposed, the project does not bring about significant negative effects following the implementation of the mitigation measures.

Table 9.2.1 Impacts and Mitigation Measures Summary

ELEMENT OR ENVIRONMENAL COMPONENT – DESCRIPTION OF THE IMPACT	MITIGATION OR CONTROL MEASURES	ASSESSMENT OF THE SIGNIFICANCE OF THE RESIDUAL IMPACT				
		Intensity	Value	Scope	Duration	Significance
Physical Environment						
Hydrology and water quality (surface and groundwater) – Spills during the construction	Ensure the availability of the recovery equipment and use it as needed	Nil	n/a	n/a	n/a	Nil
Hydrology and water quality (surface and groundwater) – Spills during the transportation of raw materials and by-products	Authorized carriers Emergency response plan	Nil	n/a	n/a	n/a	Nil
Hydrology and water quality (surface and groundwater) – Operation – Spills at plant site	Design of plant buildings (recovery and recycling of any spills)	Nil	n/a	n/a	n/a	Nil
Hydrology and water quality (surface and groundwater) Operation – Water resources	Reused in the wash liquor and condensates process	Low	Moderate	Local	Long	Minor
Hydrology and water quality (surface and groundwater) Operation – Discharges of water flushed from the processing plant (boiler water and cooling system) to the Saguenay River (including the cumulative effects)	Plant designed so there is no liquid discharge from the process Water from the flushes is sent to the Jonquière Complex's wastewater treatment system	Low	Moderate	Local	Long	Minor
Hydrology and water quality (surface and groundwater) – Operation – Waste storage site	Storage site designed waterproof Recovery and recycling of leachates	Nil	n/a	n/a	n/a	Nil
Geology, geomorphology and seismology – Impact of an earthquake	Design of the buildings and storage site takes into account seismic data from the NBC	Nil	n/a	n/a	n/a	Nil
Meteorology, climatology – Impact of flooding	Emergency response plan	Nil	n/a	n/a	n/a	Nil
Climate changes - CO_2 and methane emissions (including the cumulative effects)	Alcan's global approach helped to offset GHG emissions associated with the project	Positive-Low	Moderate	Local	Long	Positive – Minor
Management of by-products – Upgrading of materials	Recycling of metallic fractions found in spent pot lining Carbon and inert by-products stored for upgrading Reuse of Bayer liquor at the hydrate plant	Nil	n/a	n/a	n/a	Nil
Waste management – Waste disposal at the red clay disposal site	Characteristics and design of the existing disposal site	Low	Moderate	Limited	Long	Minor
Options for managing pot lining and technological choices	Source reduction by extending the life of the tanks and changing the technology used to electrolyse aluminium LCLL process, which is a pot lining upgrading option (recovering the chemical and calorific value)	n/a	n/a	n/a	n/a	n/a

ELEMENT OR ENVIRONMENAL COMPONENT – DESCRIPTION OF THE IMPACT	MITIGATION OR CONTROL MEASURES	ASSESSMENT OF THE SIGNIFICANCE OF THE RESIDUAL IMPACT				
		Intensity	Value	Scope	Duration	Significance
	Characteristics of by-products to ensure a strong upgrading potential LCLL process based on the known processes and techniques					
Noise related to operating the plant and transportation: an increase varying from nil to 0.1 dBA	None	Nil	n/a	n/a	n/a	Nil
Noise from the waste storage site operation: increase is nil	None	Nil	n/a	n/a	n/a	Nil
Change in air quality due to dust emissions during construction	Spreading of dust depressants when required	Low	Moderate	Local	Short	Minor
Air quality during plant operation Emissions of suspended particulates, ammonia, SO_2, CO, NO_2 (Including cumulative effects)	Installation of dust extractors and staged mixing burners included in the plant's design Installation of an incinerator to reduce ammonia emissions	Nil to Low	Moderate	Local	Long	Minor
Odours (potentially associated with ammonia emissions)	Installation of an incinerator to reduce ammonia emissions	Nil	n/a	n/a	n/a	Nil
Biological Environment						
Loss of habitat– No habitat will be disturbed by the project	Site selected inside the industrial complex	Nil	n/a	n/a	n/a	Nil
Vegetation – No natural landscape will be affected by the project	Site selected inside the industrial complex	Nil	n/a	n/a	n/a	Nil
Species at risk or of special status and their habitat – No impacts	None	Nil	n/a	n/a	n/a	Nil
Fish and fish habitat– No impact	Reused in the wash liquor and condensates process (no liquid discharges from the process)	Nil	n/a	n/a	n/a	Nil
Fauna and wildlife habitats (including migratory birds) – No impact	None	Nil	n/a	n/a	n/a	Nil
Human environment						
Health and safety of workers	Design of various plant components Risk analysis specific to the work environment Training Individual protective equipment	n/a	n/a	n/a	n/a	n/a
Public health – No impact anticipated since the project has very little effect on the levels of fine particulates found in the ambient air and given the air quality improvement trend in the study	Dust extractors	Nil	n/a	n/a	n/a	Nil

ELEMENT OR ENVIRONMENAL COMPONENT – DESCRIPTION OF THE IMPACT	MITIGATION OR CONTROL MEASURES	ASSESSMENT OF THE SIGNIFICANCE OF THE RESIDUAL IMPACT				
		Intensity	**Value**	**Scope**	**Duration**	**Significance**
area						
Public safety – Worst-case scenarios will not have any impacts on the public	Design of various plant components Safety measures Emergency response plan	Nil	n/a	n/a	n/a	Minor
Aesthetics and landscape	Site selected inside the Jonquière complex	Nil	n/a	n/a	n/a	Nil
Local population and neighbourhood Psychosocial impact: fear associated with the presence of hazardous materials	Information and consultation activities organized by Alcan	Low	Moderate	Local	Long	Minor
Transportation and traffic	None	Low	Moderate	Local	Long	Minor
Use of the land and resources for traditional purposes – No impact	None	Nil	n/a	n/a	n/a	Nil
Economic spinoffs and jobs resulting from construction and plant operation	Invitations from Alcan's directory of construction contractors. At competitive costs, regional businesses will be favoured		n/a	n/a	n/a	Impact Positive
Heritage, cultural, historical, archaeological and paleontological resources – No impacts	None	Nil	n/a	n/a	n/a	Nil

10 MONITORING AND FOLLOW-UP SYSTEM

A monitoring system will be put in place in order to ensure that the anticipated control measures are applied and standards and requirements are respected.

A follow-up program will help verify the validity and accuracy of the anticipated project repercussions and the efficiency of mitigation measures.

10.1 Work Monitoring

10.1.1 Processing Plant

Control and mitigation measures planned for the project will be included in the plans and estimates. Their application will be part of the work monitoring program objectives.

The contractor chosen for the project will have to comply with legislations, regulations and standards in effect during the construction. The contractor will make sure that all prescribed environmental protection measures are taken.

Work will be monitored particularly for plant runoff water drainage, minimization of dust and noise, waste management and excavated soil disposal.

10.1.2 Carbon and Inert Storage Cell

10.1.2.1 *Qualification of Stakeholders*

All work activities will be accomplished under the supervision of a team of professionals who have the required skills. This team will supervise landscaping projects and ensure the plans and estimates are followed.

10.1.2.2 *Quality of Other Materials Used*

Geomembranes, geotextiles and drains used to make the final waste covers watertight and the leachate collection will be subject to quality controls. The program include, among others:

- Manufacturers certificates that attest to their property and tests conducted to make sure the plans and estimates are complied with;
- Non-destructive tests to check the watertightness of all geomembranes solders and destructive laboratory tests to verify the shear and peel strength of solders.

10.2 Discharge Monitoring

A monitoring program for discharges in the environment will be implemented in order to make sure the applicable project standards and requirements are complied with.

10.2.1 Air Emissions

After installing dust extractors and when plant operations will start, actions will be taken in order to determine the concentration of particulates in the gas released from the dust extractors. This will help assess the efficiency of these equipments and ensure that their performance levels are appropriate. A preventive maintenance program for air purification equipment will also be implemented.

Ammonia concentrations in various plant gas sources will also be measured. These measures will help validate the hypothesis used for the ammonia atmospheric dispersion modelling.

An air emissions monitoring program will be applied throughout the operations of the treatment plant. Tableau 10.2.1 shows the control program proposed, indicating the parameters and frequency of sampling for each source.

For the natural gas boiler, the control program proposed is based on measurement requirements for combustion sources specified in the amendment project of the *Regulation respecting the quality of the atmosphere* (July 2002 version) sections 28.1 and 28.2). The first sampling of gas released by the boiler will be done less than six months after the commissioning of the boiler.

Table 10.2.1 Monitoring Program – Air Emissions

Sources	Parameters	Frequency *
1- Dust extractor – Pot lining handling	NH_3 Particulates	Once (1) every 24 months Once (1) every 24 months
2- Dust extractor –Pot lining crushing	NH_3 Particulates	Once (1) every 24 months Once (1) every 24 months
3- Dust extractor – Crushed pot lining silos	NH_3 Particulates	Once (1) every 24 months Once (1) every 24 months
4- Leaching gas (water and caustic)	NH_3	Once (1) every 12 months
5- Noncondensible gas (destruction of cyanides)	NH_3	Once (1) every 24 months
6- Incinerator emissions (air vent of the hot water tank)	NH_3	Once (1) every 12 months
7- Combustion gas from the boiler	O_2 CO NO_x	Continuous Continuous Continuous and sampling once (1) every 36 months

* The frequency could eventually be reviewed after recording initial results and, for particulate measurements, based on the inspection and maintenance program of dust extractors.

This proposed program will be discussed with the Quebec MDDEP when issuing the plant authorization certificate. The control program will also be reviewed when the plant will have been in operation for a few years in order to re-evaluate the relevance of the parameters assessed and the frequency of the measurements.

10.2.2 Liquid Discharges

Liquid discharges from the pot lining processing plant, i.e. water flushed from the vapour-raising boiler and the water flushed from the water cooling system, will be sent to the Jonquière Complex sewer treatment system. The runoff waters from the plant will also be sent to the

Jonquière Complex sewer treatment system. The effluent of this system (Outfall B) sent to the Saguenay River is regularly monitored.

Table 10.2.2 shows the liquid discharges monitoring program at the Jonquière Complex (Outfall B).

Table 10.2.2 Monitoring Program – Liquid Discharges

Description	Parameters	Frequency
Jonquière Complex Outfall B (including the water flushed from the spent pot lining processing plant's boiler and water cooling system)	Flow	Continuous
	pH	Continuous
	SS	Daily
	Total Fluoride	Weekly
	Total Cyanide	Weekly

10.2.3 Solid Discharges

When the treatment plant operations will start, all solid waste intended for landfill, i.e. iron oxides (produced when destroying cyanides) and descaling residues will be characterized according to the Quebec's *Hazardous Materials Regulation (Q-2, r.15.2).* On a regular basis, solid waste samples will be taken in order to ensure that the standards prescribed are respected.

10.3 Environmental Follow-up

10.3.1 Noise Environment

A noise environment verification campaign was put in place in order to ensure that the standards in effect are complied with. Although no potential impacts on the inhabited area are associated with the operation of the spent pot lining processing plant, the follow-up program will be conducted for the eight test points found during the noise impact study. These points are even more vindicated, since they are the limits nearest residential or inhabited district.

This noise follow-up will have to include samplings (statistical analyses) of noise over continuous one-hour periods for each of the test points identified. These analyses will provide usual indicators L1%, L10%, L50%, L90%, L95% and Leq, as well as a graphic of the time trend of noise, and be compared with impact assessment results. The measurements will have to be taken during calm periods, both day and night.

Noise samples will have to be taken during the summer, from the beginning of May until the end of September, i.e. when residents open their windows and are most likely to go outside.

Ideally, these measurements will have to be taken in order to establish noise levels for both periods (regular and peak) where trucks carry waste from operations to the carbon and inert storage site.

10.3.2 Atmospheric Environment

The assessment of impacts from the spent pot lining processing plant project on the atmospheric environment showed that impacts would be low. Also, this project is located in the heart of Alcan's operations in Jonquière. Several years ago, Alcan and the Quebec MDDEP implemented an air quality follow-up program. This follow-up program is adequate to evaluate the potential impact from the pot lining processing plant project.

10.3.3 Inert and Carbon Storage Cell

Observation wells will be installed on the periphery of the storage cell in order to track groundwater during the storage period. Four (4) wells will be installed, one (1) upstream and three (3) downstream. Groundwater samples will be taken from the four (4) observation wells twice a year, spring (May-June) and fall (September-October). Follow-up parameters will include cyanides, fluoride, sodium and pH, i.e. the parameters that are more likely to be found in inert materials. Installation of the observation well, and related sampling and chemical analyses, will be conducted under the Quebec MDDEP's *Guide d'échantillonnage à des fins d'analyses environnementales*.

Every three months, qualified staff will perform a visual inspection of the plant. This inspection will include the inspection channels, dykes and leachate recovery tanks.

10.3.4 Result Dissemination

The results from analyses and measurements conducted as part of the environmental follow-up will be kept in the registry for at least two years. Furthermore, the residual hazardous materials report will be sent annually to the ministère du Développement durable de l'Environnement et des Parcs du Québec within the prescribed timeframe.

An annual environmental report will show results from the follow-up program. This report will be available for citizens, the ministère du Développement Durable de l'Environnement et des Parcs du Québec, Technology Partnerships Canada and Industry Canada.

10.3.4.1 *Follow-up Committee*

Alcan commits to actively participate in a follow-up committee as recommended by the Quebec Bureau d'audiences publiques sur l'environnement (BAPE) in its report in order to follow the environmental performances of the pot lining processing plant.