Environment Canada
Quebec Region

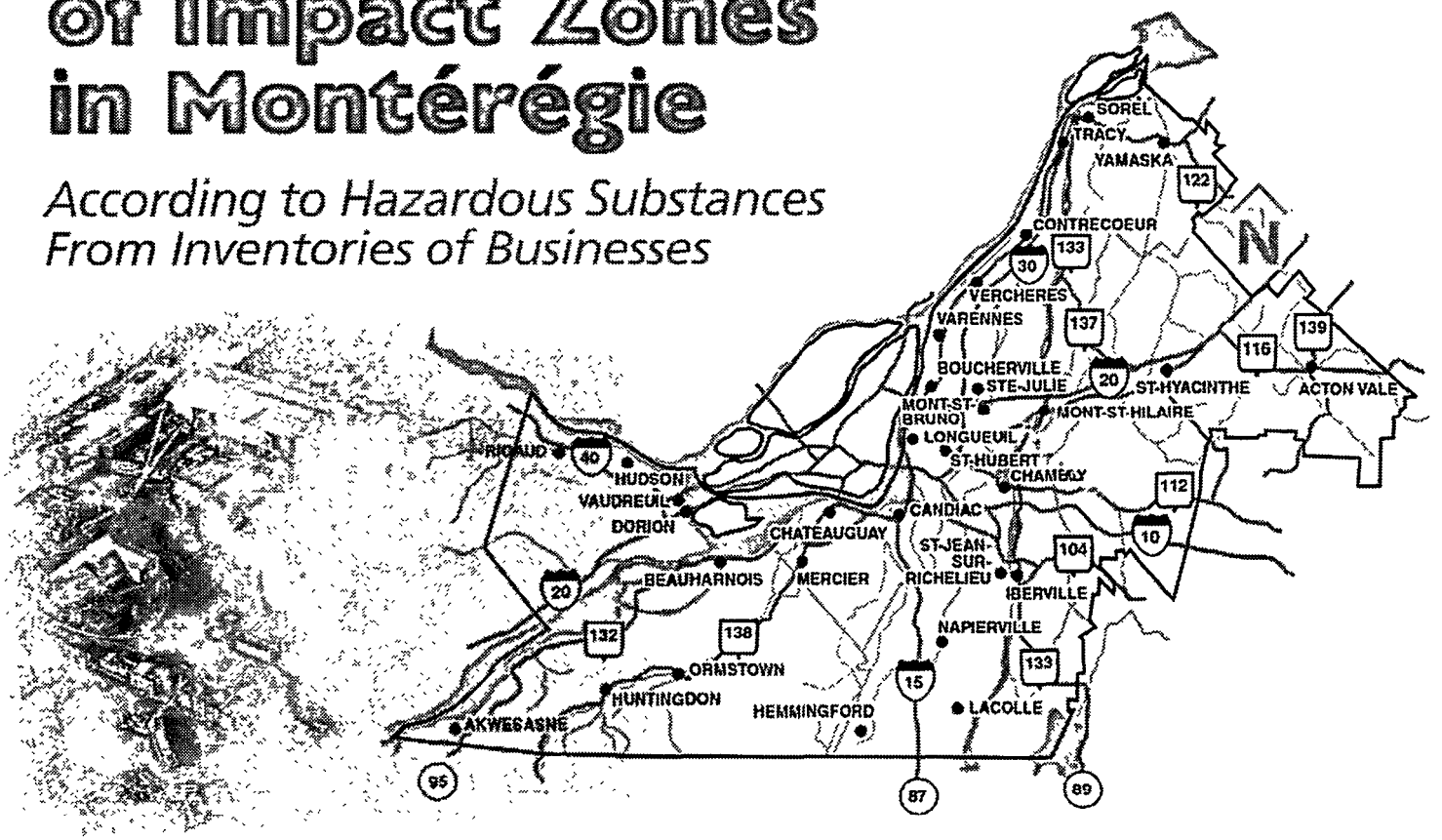
Environmental Protection Branch
Enforcement and Emergencies Division

Regional Health and Social Services Board
Montérégie

Public Health Planning and Evaluation Branch

Preliminary Analysis of Impact Zones in Montérégie

According to Hazardous Substances From Inventories of Businesses



Environnement Canada
Région du Québec

Environment Canada
Québec Region

RÉGIE RÉGIONALE DE LA SANTÉ ET DES SERVICES SOCIAUX
MONTÉRÉGIE

CAT EN 154-2/2002
ISBN 0-660-62192-4

Foreword

The *Canadian Environmental Protection Act, 1999* targets the prevention of pollution and the protection of the environment and human health. It comes under the jurisdiction of the Environment Canada and Health Canada.

One of Environment Canada's mandates is to promote risk management for establishments possessing hazardous substances. A risk management program fosters the reduction of the frequency and severity of industrial accidents by preparedness, preparation and response activities. The first step, prevention, aims to eliminate or reduce risks. To do this, it is important to know which sites are at risk and to evaluate the consequences of a potential accident at each site on the health of citizens and the environment. Another important mandate of Environment Canada is the enforcement of the pollution section of the *Fisheries Act,* which aims to protect fish habitat. The release of any hazardous substance in the water where fish may be found is prohibited. As such, prevention (elimination or reduction of risks) is important for the protection of the fish environment.

As for the Public Health Branch of the Regional Health and Social Services Board of Montérégie, among its many responsibilities is the identification of situations capable of affecting public health and the implementation of the necessary public protection measures. Given the potentially serious consequences of industrial accidents, the businesses at risk and the potential impacts of an accident on the public must be documented to allow a better understanding of the situation in case of an accident.

This study, which is the result of a healthy partnership among Environment Canada, the Public Health Branch of the Regional Health and Social Services Board of Montérégie and targeted municipal fire departments, thus responds to these prevention mandates by taking a preliminary look at the main sites at risk in Montérégie.

Summary

Industrial accidents can have major impacts on public health and the environment. This report improves our understanding of sites at risk of industrial accidents and their impacts on the public and the environment. It has been written with the goal of minimizing the risk of industrial accidents by preparedness and prevention activities. The inventory of at-risk sites and the preparation of this report were the result of a collaboration between the Public Health Branch of the Regional Health and Social Services Board of Montérégie and the Environmental Protection Branch of Environment Canada, with the cooperation of participating municipal fire departments and the target businesses. The inventory targets those businesses deemed a risk priority in Montérégie, most of which are located alongside the St. Lawrence River and the Richelieu River.

The businesses in the inventory are those holding chemical products in amounts that exceed the threshold quantities on the List of Hazardous Materials of CRAIM (Conseil pour la réduction des accidents industriels majeurs) and for which an uncontrolled or accidental release could have off-site consequences. The identification of at-risk sites and the evaluation of potential consequences of an accident on the health and well-being of the public or on the environment off-site are done by applying a worst-case release scenario. These worst-case scenarios are used as a starting point for identifying those establishments that require a more in-depth assessment. To help prepare response measures, alternative scenarios (for sites more likely to have accidents) must be identified and their consequences determined. The reports presents the list of establishments holding hazardous substances in amounts that exceed the threshold quantities.

This study has allowed us to identify several at-risk sites in Montérégie for which the potential consequences of an accident could be of concern for the neighbouring population or environment. We have also noted that the different municipal and business responders are not all at the same preparedness level regarding possible emergency situations.

Work Team

Claude Tremblay, Ph.D., epidemiologist in toxicology, Coordinator of the Environmental Program of the Public Health Planning and Evaluation Branch of Montérégie, and Robert Reiss, chemist and emergency responder, Environment Canada, both initiated and supervised the project.

Nathalie Brault, M.Sc. in environment, established contact with the Montérégie fire departments and participated in writing the report. The data collection and the database updates were done by Caroline Voyer and Mario Paquette, who are trainees at Environment Canada.

The scenario calculations and the drafting of the report were done by Robert Reiss. J.P. Lacoursière & Associates performed the scenario calculations in cases where Environment Canada did not have the proper software or where the Risk Management Program software of the U.S. Environmental Protection Agency was not functioning.

The layout of the document was done by Philippe Routier (infographyl@yahoo.ca)

Acknowledgments

- Municipal fire departments that really took the time to help us complete this study
- Representatives of establishments that agreed to provide us with all the information we asked for and supported our many requests for in-depth specifications
- Thérèse Drapeau, Environment Canada (French editor)

Note to Reader

This report presents a partial of list of Montérégie establishments that, according to a worst-case scenario, could have off-site impacts in the event of an accident. The alternative scenarios that must be used as a springboard for developing emergency and response measure plans are a matter of concern for these establishments, which must take the necessary measures to reduce or eliminate risks and minimize consequences in the event of an accident. They must also inform their municipalities of these alternative scenarios. The data used to prepare this report were gathered on a voluntary basis.

For obvious security reasons, the results of the impact analysis and the maps that have been developed as part of this analysis are available only if the request is accompanied by an official letter from municipal authorities, fire departments, environmental departments and all other agencies called to respond in an emergency situation or those responsible for prevention programs. These agencies must agree not to reproduce or distribute information to third parties. All requests must be sent to:

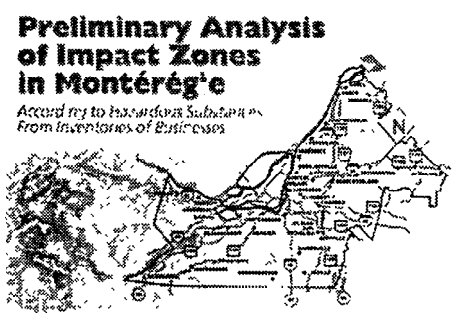
Robert Reiss

Emergency Responder
Environmental Protection Branch
Environment Canada, Quebec Region
105 McGill Street, 4th floor
Montréal, Québec
H2Y 2E7
Tel.: (514) 283-0822
Fax: (514) 496-1157

E-mail: robert.reiss@ec.gc.ca

Table of Contents

Introduction



Chapter

Since 1994, Environment Canada, Quebec Region, has participated with various partners in risk analysis and evaluating the consequences of major industrial accidents that could occur in the region. A document on the main ports of Quebec[1] was published in 1996. A study was also carried out as part of the "Canada-United States Joint Inland Pollution Contingency Plan," dealing with the boundary waters between Quebec and certain American states[2].

The public health branches of certain regions have also conducted inventories of hazardous substances in businesses potentially at major risk on their territories. This type of study was carried out on the territory of the (Regional County Municipalities) of Assomption d'Autray, Rouyn-Noranda and Bécancour, among others.

The Public Health Planning and Evaluation Branch of Montérégie wanted to obtain a realistic picture of the risks of major industrial accidents associated with the presence of hazardous substances on business sites in Montérégie. In fact, the Montérégie territory includes numerous industrial establishments that use and store hazardous chemicals. Several of these industries are found in the area surrounding the St. Lawrence River or its main tributaries and consequently are located near densely populated areas. Moreover, almost every year, the environmental health department of the Public Health Planning and Evaluation Branch of Montérégie responds to at least one emergency call following industrial accidents of different origins such as chemical fires, explosions, spills or leaks. The risks of industrial accidents are thus very real, and the potential consequences of such accidents on health and the environment can be major—hence the importance of minimizing these risks, and in such a way that front-line responders are well prepared, organized and equipped to make the best decisions.

It is in this spirit that the present report was prepared—the result of a dynamic collaboration among federal, provincial and municipal agencies. Its first objective is to protect the life and health of the population as well as the quality of the environment by providing a reference tool allowing the identification of areas posing risks of major industrial accidents, the evaluation of consequences of such industrial accidents on public health and the environment, and the recommendation of actions to minimize risks. More specifically, we hope that this report will encourage at-risk businesses to implement:

1. prevention measures to reduce or eliminate the risks and consequences of accidents likely to occur
2. emergency response plans should such accidents occur
3. means to communicate information to the concerned authorities on the risks and measures put in place to control these risks and ensure the safety of citizens.

This report does not intend to paint a comprehensive picture of all the sites at risk of industrial accidents in Montérégie. However, it does target most of the at-risk businesses of the 20 priority municipalities of the Montérégie territory, located for the most part alongside the St. Lawrence and the Richelieu rivers.

[1] See References page 59
[2] See References page 59

1.1 Responsibilities

At present, municipalities are responsible for events that occur on their territory. The new emergency preparedness legislation approved in December 2001 (Bill 173) makes businesses more accountable by requiring that they notify the concerned municipal authorities of accidents relating to their property or activities. Meanwhile, municipalities will be in charge of updating and implementing emergency plans on their territory.

1.1.1 Responsibilities of the Public Health Planning and Evaluation Branch

By and large, the *Health Services Act* makes the public health manager responsible for:

1. informing the public of the general state of health of the individuals of which it is comprised, the priority health problems, the most vulnerable groups, the main risk factors and the responses he/she deems the most effective;
2. monitoring changes in these areas and, if necessary, carrying out studies or research to this end;
3. identifying and preventing situations likely to put public health in danger and overseeing the implementation of the necessary measures for its protection.

In the scope of risk analysis and minimizing accident risks, there is a need to identify the sites where industrial accidents could take place. The types of accidents that might occur must also be known, not only to minimize their effects but also to allow authorities to be better prepared to handle them when they occur.

1.1.2 Responsibilities of Environment Canada

One of the mandates of Environment Canada is to minimize risks of accident with environmental consequences through prevention activities. Preventing damage to the environment is essential to achieving the goal of the *Canadian Environmental Protection Act, 1999* (CEPA 1999), which is to attain the highest possible level of environmental quality for Canadians. The first step of prevention is knowing which sites are at risk and evaluating the consequences of a possible accident at each site. Another role of Environment Canada is to provide its expertise during prevention, preparedness, response and restoration activities.

Phase III of St. Lawrence Vision 2000 was directed toward reducing the release of 18 priority toxic substances. Among these substances are the metals arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc and the following 10 organic substances or families of organic substances PCBs, dioxins and furans, PAHs, acetaldehyde, formaldehyde, 1,3-butadiene, 1,2-dichloroethane, dichloromethane, hexachlorobenzene and bis (2-ethylhexyl) phthalate. The analysis that was done on the contamination of the St. Lawrence River during the planning of Phase III would suggest that these substances are still present in the environment of the river or still released in quantities of concern.

Since an important cleanup effort had been carried out by large businesses in Quebec, the analysis also recommended starting pollution prevention for small and medium-sized enterprises who for the most part are linked to the municipal sewage systems. A preventive approach was recommended, and a voluntary program oriented toward controlling these substances was developed along these lines, together with the Quebec Ministry of the Environment.

At the same time, Environment Canada has prepared an inventory of toxic substances appearing in Annex 1 of CEPA 1999 that are currently found near the St. Lawrence River. This study will allow responders, by better understanding the establishments at risk and the areas likely to be affected, to better prepare themselves for responses involving these toxic substances.

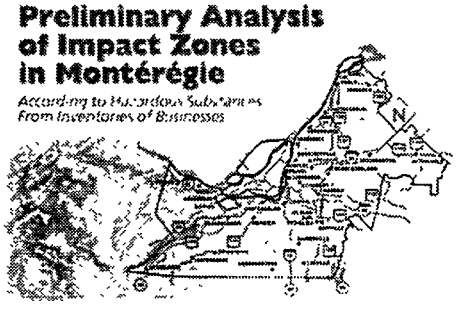
1.2 Report Content

This report identifies target establishments (establishments that contain one or more hazardous substances found on the List of Hazardous Materials, whose inventory at any given moment exceeds the threshold quantities of the list) that are located in the study municipalities. By applying the worst-case scenarios, it determines if an accident involving hazardous substances could have off-site impacts on the health or well-being of the public, on the environment or on property.

As well, the report identifies those establishments having one of the 18 priority toxic substances of Phase III of St. Lawrence Vision 2000 or one of the toxic substances that are found in Annex 1 of CEPA 1999.

The report describes the framework of the study, the objectives and the methodology used (Chapters 1, 2 and 3, respectively). Chapter 4 lists the results of steps 1 and 2 of the methodology, namely the target towns, the potential at-risk sites and the sites having hazardous substances as defined above. Chapter 5 shows the establishments for which the worst-case scenarios have off-site consequences, the model limitations and the explanations of the calculations for some special hazardous substances. Finally, Chapter 6 presents the conclusions and the recommendation.

Objectives



Chapter

The two main objectives of this study are the prevention of industrial accidents and the preparedness of concerned responders to these accidents. These objectives are intended to minimize the risks and consequences of industrial accidents involving hazardous substances.

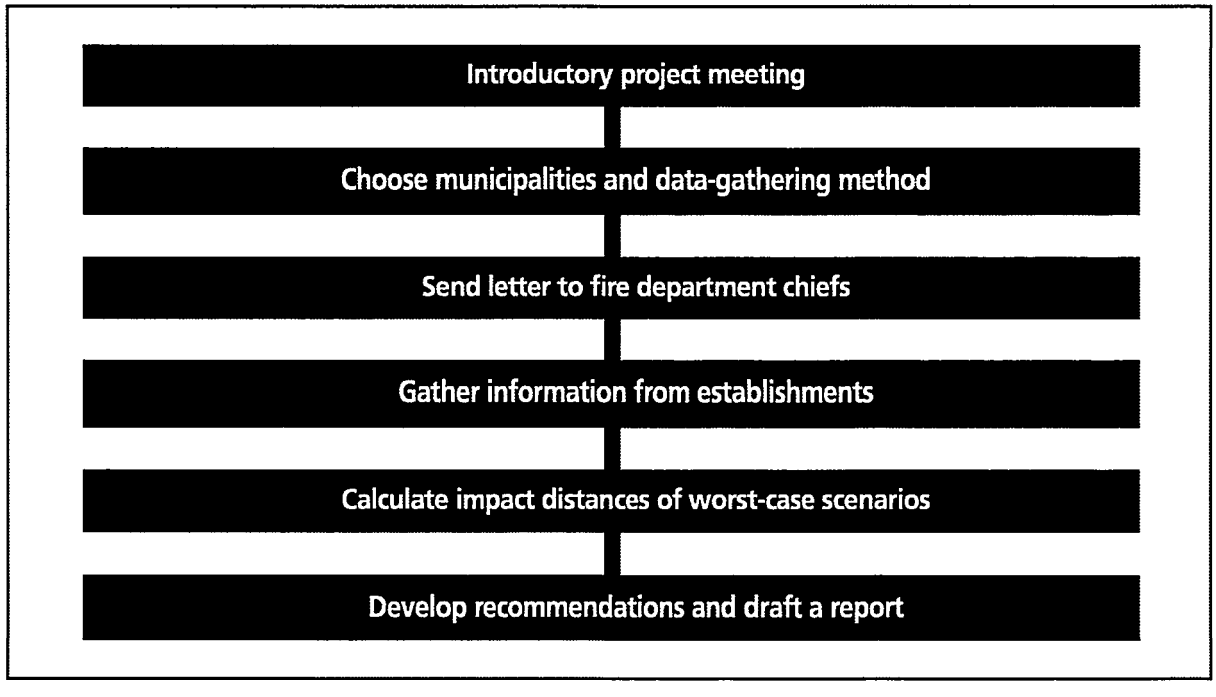
Prevention is the set of actions taken to anticipate, prevent or reduce the likelihood of an uncontrolled release or accidental spill of a pollutant or hazardous substance (definition taken from the CRAIM Risk Management Guide).

To achieve the prevention objective, the risks and their consequences must be identified. This is the first step of the prevention process, which allows at-risk businesses to take a decision when faced with this risk: reject it, modify the process, change the hazardous substance or even accept this risk and take all the operational safety measures to reduce and/or minimize its impacts.

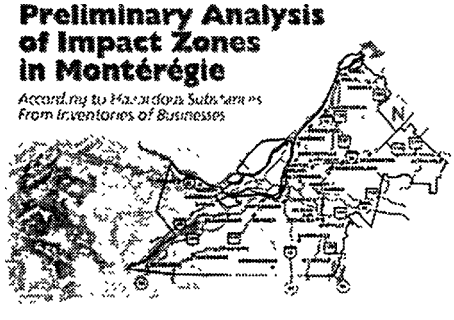
The study identifies the primary at-risk sites of the target towns and as such allows the authorities in charge to better prepare themselves in case of an industrial accident and to better respond to protect the health of citizens and their environment. Preparedness here is the set of actions taken to establish the capacity to respond to and mitigate of the effects of an uncontrolled or accidental release (CRAIM).

Figure 1 shows the different steps that led to the development of this report.

Figure 1:
Work Plan



Methodology



Chapter

The methodology used is the one recommended by CRAIM (Conseil pour la réduction des accidents industriels majeurs) in its "Risk Management Guide for Major Industrial Accidents—intended for municipalities and industry," Montreal, 2002. This methodology draws on the Risk Management Program (RMP) method of the Environmental Protection Agency (EPA) of the United States.

3.1 Step 1: Establishments at Potential Risk

First, the Public Health Planning Evaluation Branch of Montérégie did some research (regional look at emergency preparedness, list of establishments targeted by the PRRI [programme de réduction des rejets industriels/industrial waste reduction program] and evaluation of the waste reduction of the 50 industries of the St. Lawrence Action Plan) in order to target the municipalities likely to shelter industrial establishments holding hazardous substances. For technical reasons, the inventory is limited to municipalities bordering the St. Lawrence River and the Richelieu River. This first step has allowed the identification of 20 study towns with establishments at potential risk of a major industrial accident.

Next, the Public Health Planning Evaluation Branch sent a letter (see Annex 1) to the fire department authorities—who know their territory very well—asking for their help in identifying establishments that given the nature of their operations, could pose a risk of a major industrial accident. To facilitate the identification of these at-risk sites, a list of examples of industries potentially at risk (Annex 2) as well as a list of the hazardous substances targeted (Annex 3) were enclosed with the letter.

After receiving the letter, the fire departments were called by Ms. Nathalie Brault of the Public Health Planning Evaluation Branch to determine if they were interested in participating in the project, evaluate their needs, plan a timetable and inform them that Environment Canada representatives would contact them.

This is how Environment Canada representatives helped fire department chiefs or those in charge of emergency measures for each municipality determine a list of establishments at potential risk. This list included not only those establishments with a hazardous substance appearing on the List of Hazardous Materials but also those holding substances likely to release hazardous substances following a fire or chemical reaction and those establishments possessing one of the priority toxic substances of Phase III of St. Lawrence Vision 2000.

3.2 Step 2: List of Target Establishments

After Environment Canada received the lists, certain establishments were visited by an Environment Canada representative, with or without a representative from the fire prevention department. For the others, information was obtained by telephone. The goal of the visits was to check if the establishments possessed any hazardous substances from the list and gather the inventories of these substances. The target establishments are those whose inventories of hazardous substances from the list (Annex 3) exceed the threshold quantities. It should be noted that priority toxic substances from Phase III of St. Lawrence Vision 2000 were added to the original list, and these do not have threshold quantities. These substances could, following an accident, be found in the St. Lawrence River or the Richelieu River and disrupt fish habitat and thereby contravene Article 36(3) of the *Fisheries Act*.

If an establishment holds a hazardous substance appearing on the list, and for which the maximum inventory at any given moment exceeds the threshold quantity, this establishment must proceed to Step 3 (i.e., an analysis of the worst-case scenario consequences).

3.3 Step 3: Analysis of Worst-Case Scenario Consequences

This step determines if a major industrial accident involving these hazardous substances could have consequences outside the site of the target business. It is carried out according to the method defined by the EPA for "worst-case release scenarios" and by CRAIM for "worst-case accident scenarios."

The worst-case scenario is the release of the greatest quantity of a hazardous substance, held in the largest container, whose impact distance is the greatest (CRAIM, "Risk Management Guide for Major Industrial Accidents—intended for municipalities and industry", Montreal, 2002).

Whether dealing with toxic, flammable or explosive substances, conditions are preestablished to devise the worst-case scenarios. These conditions are the following:

- meteorological conditions
- choice of container
- duration of loss of confinement
- product quantities to consider
- physical conditions of event premises
- passive mitigation systems

The analysis takes into account passive attenuation measures (e.g., physical shelters, diked areas for gases liquefied by refrigeration) only. Administrative measures, such as stock limitations, are also taken into account at this stage of the analysis.

3.3.1 Danger Levels

The danger levels used for calculating the worst-case accident scenarios are those recommended in the "Risk Management Program Guidance" of the EPA (1999) and used again in the "Risk Management Guide for Major Industrial Accidents—intended for municipalities and industry" of CRAIM (2002) and are presented briefly in the sections that follow.

3.3.1.1 Toxic Substances

The danger levels are established according to a criteria hierarchy:

- *Emergency Response Planning Guidelines* 2 (ERPG 2), developed by the American Industrial Hygiene Association, if available; or
- One-tenth of the levels that are immediately dangerous for life and health (IDLH), developed by the National Institute of Occupational Safety and Health (NIOSH); or
- One-tenth of an IDLH derived from toxicological data.

3.3.1.2 Flammable Substances

The danger level used for radiation following a fire of hazardous substances is 5 kW/m², namely that which corresponds to a thermal radiation level that could cause a second-degree burn after 40 seconds of exposure.

3.3.1.3 Explosives and Flammable and Explosive Substances

The danger level used is that for which injuries can be caused by glass debris coming from windows or debris coming from buildings damaged by the effect of pressure. This level is fixed at 68 mbar or 1 psi.

3.3.2 Evaluation of Consequences

The evaluation of consequences for the worst-case scenarios is done according to preestablished parameters depending on the type of hazardous substance. These parameters or criteria are described in the following sections.

3.3.2.1 Toxic Substances

Toxic substances can be divided into two categories: substances in gaseous state and those in liquid state. The specific conditions related to the development of worst-case scenarios are summarized in Table 1.

The impact scenarios were modelled using PHAST software (version 6.0) , RMP.com software (version 1.06) or ALOHA software (version 5.2.3) which all deal with contaminant dispersal in air.

The modelling parameters for the dispersal calculations are shown below:

Wind speed	1.5 m/s
Atmospheric stability	F
Air temperature	25°C
Ground temperature	25°C
Relative humidity	70%

3.3.2.2 Flammable and/or Explosive Substances

Flammable substances include substances stored in gaseous or liquid state under pressure, flammable gases liquefied by refrigeration at atmospheric pressure and flammable liquids. The specific conditions related to the development of worst-case scenarios for flammable substances explosives are summarized in Table 2.

Table 1

Specific Conditions Related to the Development of Worst-Case Scenarios Required by the RMP

Toxic Gases and Liquids

Toxic gases

Toxic substances from the list appearing in gaseous form at 25°C.

1. Total quantity of the vessel or from a pipe failure of the most important process emitted in 10 minutes;
2. Take into account the passive mitigation measures.

Modelling of the emission consequences to determine the impact radii, according to the emission rate and toxicity threshold, using the EPA tables or the appropriate software for this activity.

Toxic gases liquefied by refrigeration

Instantaneous emission of a gas liquefied by refrigeration.

Take into account the passive mitigation measures:

- **If the pool thickness is greater than 1 cm:**
  1. Emission of gas from the pool at the boiling temperature of the toxic liquid at atmospheric pressure.
  2. Use of EPA tables or specific protocols to calculate the evaporation of gas from a liquid pool.
  3. Calculation of quantity emitted in 10 minutes.
- **If the pool thickness is less than 1 cm:**
  Evaporation of all liquid spilled over a 10-minute period.

Modelling of the emission consequences to determine the impact radii, according to the emission rate and toxicity threshold, using the EPA tables or the appropriate software for this activity.

Toxic liquids

Instantaneous emission of a toxic liquid.

For toxic liquids transported by pipeline, the greatest quantity that can be transported and spilled in a pool should be taken into consideration.

Take into account the passive mitigation measures:

- If there is no diked area, assume that the thickness is 1 cm and determine its surface:
  1. Emission of gas from the pool, according to the vapour pressure of the toxic liquid at 25°C.
  2. Use of the EPA tables or the specific calculation protocols to calculate the evaporation of the gas from a liquid pool.

Modelling of the release consequences to determine the levels of danger (toxicity) specific to the substance with the help of the EPA tables or the appropriate software for this activity.

---

1 Includes changes made January 6, 1999, by the United States Senate *(U.S. Senate, S. 880, Clean Air Act Amendment to remove flammable fuels from the list of substances with respect to which reporting and other activities are required under the Risk Management Plan Program, and for other purposes, Washington, D.C., July 1999).*

Table 2

Specific Conditions Related to the Development of Worst-case Scenarios Required by the RMP

FLAMMABLE AND EXPLOSIVE GASES AND LIQUIDS[2]

Flammable substances from the list including flammable gases and volatile liquids

Substances stored in gaseous or liquid state under pressure

Total quantity of the vessel or from a pipe failure of the most important process emitted in 10 minutes.

1. Total mass of the substance for calculating the explosion consequences.
2. Efficiency factor of the explosion is 10%.
3. Distance calculated for a superpressure of 1 psi.
4. Use of EPA tables or protocols and appropriate equations for the calculation.

Modelling of the emission consequences to determine the impact radii, according to the emission rate and the overpressures caused by the explosion, using the EPA tables or the appropriate software for this activity.

Flammable gases liquefied by refrigeration (cryogenics) at atmospheric pressure

Instantaneous emission of the total mass of liquefied gas.

Take into account the passive mitigation measures:

If the liquid does not cover the entire surface of the dike or if there is no dike (pool thickness less than 1 cm):

- The hypothesis is: the total mass of liquid evaporates in 10 minutes.

If the liquid covers the entire surface of the dike and forms a pool greater than 1 cm:

1. Calculate the evaporated quantity according to the EPA tables or the appropriate calculation protocols.
2. Calculate the quantity emitted in 10 minutes.
3. Total mass of the evaporated substance in 10 minutes to calculate the explosion consequences.
4. Efficiency factor of the explosion is 10%.
5. Distance calculated for a superpressure of 1 psi.
6. Use of EPA tables or protocols and appropriate equations for the calculation.

Flammable liquids

Instantaneous emission of the total mass of flammable liquid.

Take into account the passive mitigation measures:

If the liquid does not cover the entire surface of the dike or if there is no dike (pool thickness less than 1 cm):

- Evaporation in 10 minutes of the total liquid mass.

If the liquid covers the entire surface of the dike and forms a pool greater than 1 cm:

1. Calculate the evaporated quantity according to the EPA tables or the appropriate calculation protocols.
2. Calculate the quantity emitted in 10 minutes.
3. Total mass of the evaporated substance in 10 minutes to calculate the explosion consequences.
4. Efficiency factor of the explosion is 10%.
5. Distance calculated for a superpressure of 1 psi.
6. Use of EPA tables or protocols and appropriate equations for the calculation.

Note: This rule applies to volatile substances from the EPA list. For all other substances listed by CRAIM, the vapour pressure must be taken into account and the quantity that will be evaporated must be determined.

---

2 The section dealing with flammable substances was modified by law 880 of the United States Senate.

Table 2 (Continued)

Specific Conditions Related to the Development of Worst-case Scenarios Required by the RMP

Explosives
Total mass of the substance used to calculate the explosion consequences with the efficiency characteristic of the particular explosive substance.

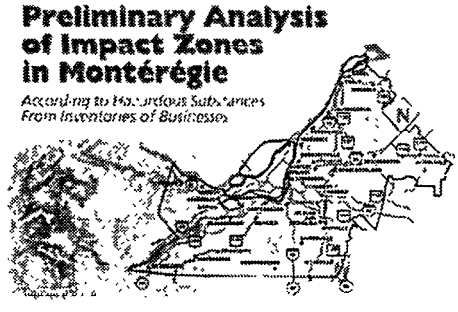
The impact scenarios were modelled using PHAST (version 6.0) software or RMP.com software or even by known mathematical formulas that are used in RMP.com.

3.3.2.3 Other Substances Targeted by CRAIM

Most of the 38 substances added to the RMP list of the EPA have boiling points higher than 25°C. It follows that modelling of a worst-case scenario at 25°C could result in an estimate of minor consequences, which would result in the elimination of establishments that could have off-site consequences as a result of their processes.

> "It is therefore wiser to evaluate the consequences of worst-case release scenarios by taking into account the operating conditions of the equipment that contains the listed substances.
>
> In most of these cases, these operating conditions are found in processes where the temperatures and pressures are higher, although the quantities of the listed substances are lower. By proceeding in this manner, the worst-case scenario will represent the most severe operating conditions, by normally giving greater impact distances than those coming from storage equipment" (CRAIM—"Risk Management Guide for Major Industrial Accidents—intended for municipalities and industry," Montreal, 2002).

Results of Steps 1 and 2



Chapter

Table 3 presents the 20 municipalities chosen by the Public Health and Evaluation Branch for the project. They are primarily located near the St. Lawrence River and the Richelieu River.

Table 3

List of 20 Study Municipalities

Beauharnois	McMasterville
Beloeil	Melocheville
Boucherville	Saint-Hubert
Brossard	Saint-Jean-sur-Richelieu
Candiac	Sainte-Catherine
Contrecoeur	Salaberry-de-Valleyfield
Delson	Sorel
Greenfield Park	Tracy
La Prairie	Varennes
Longueuil	Verchères

All these municipalities received a letter inviting them to participate in the project. To facilitate the identification of at-risk sites, a list of examples of industries potentially at risk (Annex 2) as well as a list of targeted hazardous substances (Annex 3) were enclosed with the letter. The preliminary contact with the fire department authorities of the chosen municipalities allowed the establishment of a partial list of potential sites (see Table 4) that, given the nature of their operations, can pose a risk of a major industrial accident. A fairly complete inventory of the industries at risk was obtained for 14 municipalities. For two municipalities of great concern, it was not possible to get access to the inventories gathered by the fire department. Finally, authorities from four municipalities did not participate in the project due to a lack of time or interest. Meanwhile, some establishments located in non-participating target municipalities were also included in this report.

Annex 4 provides contact information for the authorities of the contacted municipalities.

Table 4

List of Potential Sites

COMPANY	TOWN
CSX TransFlo	Beauharnois
Produits chimiques CXY	Beauharnois
Spexel	Beauharnois
Duochem inc.	Boucherville
H.B. Fuller Canada inc.	Boucherville
Nacan	Boucherville
Produits chimiques Techni-seal inc. (Les)	Boucherville
Canadian Tire	Brossard
Cedarome Canada	Brossard
Costco	Brossard
Isolation Manson	Brossard
Sonic Propane	Brossard
ADM Ogilvie ltée	Candiac
Bristol-Myers Squibb	Candiac
Chanel inc.	Candiac
Dur-Pro ltée	Candiac
Emballage Gab ltée	Candiac
Fruits Passion	Candiac
Produits chimiques Handy (Les)	Candiac
Groupe Wilco	Candiac
Industries M.K.E. (Les)	Candiac
Owens Corning Canada	Candiac
Papiers Perkins (Les)	Candiac
Precimold inc.	Candiac
Produits moulés Synertech inc. (Les)	Candiac
Stork Canada	Candiac
U.B.A.	Candiac
Usine de filtration de Candiac	Candiac
Argonal	Contrecœur
Hydro Agri Canada	Contrecœur
Ispat Sidbec inc.	Contrecœur
Centre sportif	La Prairie
Fers et métaux recyclés ltée	La Prairie
Traitements thermiques	La Prairie
ARC Resins	Longueuil
Héroux	Longueuil

Table 4 *(continued)*

List of Potential Sites

COMPANY	TOWN
Sergaz	Longueuil
Sico	Longueuil
Ultramar garage Normand Roy	McMasterville
Alcan	Melocheville
Corporation gestion de la voie	Melocheville
Hydro-Québec	Melocheville
PPG	Melocheville
Asten inc.	Salaberry-de-Valleyfield
Atelier d'usinage Meloche inc.	Salaberry-de-Valleyfield
Budget Propane	Salaberry-de-Valleyfield
Canbro inc.	Salaberry-de-Valleyfield
Distilleries Schenley inc. (Les)	Salaberry-de-Valleyfield
EKA Chimie Canada	Salaberry-de-Valleyfield
GEON Canada inc.	Salaberry-de-Valleyfield
Goodyear Canada inc.	Salaberry-de-Valleyfield
Grace Davison	Salaberry-de-Valleyfield
Macco Organiques inc.	Salaberry-de-Valleyfield
Noranda-CEZ inc.	Salaberry-de-Valleyfield
Rhodia Canada inc.	Salaberry-de-Valleyfield
Silicates National ltée	Salaberry-de-Valleyfield
Trimac Transport inc.	Salaberry-de-Valleyfield
Van Waters & Rogers ltée	Salaberry-de-Valleyfield
Vêtements de sport Gildan (Les)	Salaberry-de-Valleyfield
Distribution Praxair	Saint-Hubert
Flèche de fer (La)	Saint-Hubert
Groupe Sollab Cobourg	Saint-Hubert
Jonergin	Saint-Hubert
Mulco	Saint-Hubert
Pratiques industriels	Saint-Hubert
Pillsbury	Saint-Hubert
Pratt & Whitney	Saint-Hubert
Toitures Couture et associés (Les)	Saint-Hubert
Formica	Saint-Jean-sur-Richelieu
ICG Propane	Saint-Jean-sur-Richelieu
P. Baillargeon ltée	Saint-Jean-sur-Richelieu
Usine de filtration	Saint-Jean-sur-Richelieu

Table 4 *(continued)*

List of Potential Sites

COMPANY	TOWN
ICG Propane	Sainte-Catherine
Aliments Carrière inc.	Sainte-Martine
Forges de Sorel (Les)	Sorel
James Richardson	Sorel
ABB Alstom Power	Tracy
Aciers inoxydables Atlas	Tracy
ICG Propane	Tracy
IPB International inc.	Tracy
Kildair Service ltée	Tracy
Air Liquide	Varennes
Air Liquide Canada	Varennes
Environnement Eaglebrook ltée	Varennes
Garage Olco	Varennes
Garage Olco	Varennes
Praxair	Varennes
Propane 2000	Varennes
Régie intermunicipale de l'eau potable	Varennes

Using this list of potential sites, put together by compiling the lists received from the fire departments and other sources such as the National Pollutant Release Inventory (NPRI), a representative from Environment Canada visited certain establishments with or without a representative from the fire department. For the others, information was obtained by telephone. It should be pointed out that for the municipalities that did not provide a list of establishments for the reasons mentioned above, the Environment Canada representatives still visited some industries and conducted a partial inventory of their holdings of hazardous substances. The goal of the visits was to check if these establishments actually possessed hazardous substances from the list and to gather the inventories of these substances with the generators themselves. As a result, of the 89 establishments at potential risk (Table 4), 53 were found to possess a hazardous substance from the list. Table 5 lists these 53 establishments with their hazardous substances and the corresponding maximum quantities held.

The 32 target establishments for which the inventories of hazardous substances from the List of Hazardous Materials (Annex 3) exceed the threshold quantities are shown in Table 6. It is important to remember that the maximum quantity held that exceeds the threshold quantity only needs to represent the situation at the target establishment for a single day during the year.

Table 5

Establishments with Hazardous Substances

COMPANY	TOWN	CHEMICAL NAME	MAXIMUM QUANTITY (TONNES)
Produits chimiques CXY	Beauharnois	Ammonia, anhydrous	6.00
Produits chimiques CXY	Beauharnois	Hydrogen chloride (hydrochloric acid >37%)	70.00
Produits chimiques CXY	Beauharnois	Sodium chlorate (solution)	852.00
Produits chimiques CXY	Beauharnois	Sodium chlorate	800.00
Nacan	Boucherville	Vinyl acetate	220.00
Produits chimiques Techni-seal inc. (Les)	Boucherville	Nitric acid (conc. 80% or more)	4.00
Canadian Tire	Brossard	Propane	1.00
Isolation Manson	Brossard	Ammonium hydroxide (conc. 20% or more)	33.00
Sonic Propane	Brossard	Propane	5.00
ADM Ogilvie ltée	Candiac	Acetylene	0.10
ADM Ogilvie ltée	Candiac	Anhydrous hydrogen chloride	0.27
ADM Ogilvie ltée	Candiac	Hydrogen	0.01
ADM Ogilvie ltée	Candiac	Propane	0.27
Bristol-Myers Squibb	Candiac	Ammonium hydroxide (conc. 20% or more)	0.01
Bristol-Myers Squibb	Candiac	Cyclohexane	0.05
Bristol-Myers Squibb	Candiac	Lead	0.01
Bristol-Myers Squibb	Candiac	Nickel and compounds	0.01
Bristol-Myers Squibb	Candiac	Zinc	0.01
Industries M.K.E. (Les)	Candiac	Xylenes	0.50
Owens Corning Canada	Candiac	Silane	0.60
Papiers Perkins (Les)	Candiac	Acetylene	0.14
Precimold inc.	Candiac	Acetylene	0.03
Precimold inc.	Candiac	Propane	0.10
Produits chimiques Handy (Les)	Candiac	Formaldehyde (solution)	158.00
Produits moulés Synertech inc. (Les)	Candiac	Acetylene	0.10
Stork Canada	Candiac	Acetylene	1.00
Stork Canada	Candiac	Propane	0.10
Usine de filtration de Candiac	Candiac	Chlorine	9.00
Argonal	Contrecœur	Hydrogen	1.50
Hydro Agri Canada, Chemport	Contrecœur	Ammonium nitrate	14 000.00

Table 5 *(continued)*

Establishments with Hazardous Substances

COMPANY	TOWN	CHEMICAL NAME	MAXIMUM QUANTITY (TONNES)
Ispat Sidbec inc.	Contrecœur	Hydrogen	5.50
ARC Resins	Longueuil	Formaldehyde (solution)	100.00
ARC Resins	Longueuil	Phenol	300.00
Sergaz	Longueuil	Propane	3.00
Sico	Longueuil	Ethylbenzene	20.00
Sico	Longueuil	Toluene	20.00
Sico	Longueuil	Xylenes	33.00
Ultramar garage Normand Roy	McMasterville	Propane	3.00
Alcan	Melocheville	Chlorine	2.00
PPG	Melocheville	Chlorine	530.00
PPG	Melocheville	Propane	0.59
Distribution Praxair	Saint-Hubert	Acetylene	2.00
Distribution Praxair	Saint-Hubert	Ethylene	2.00
Distribution Praxair	Saint-Hubert	Propylene	10.00
Mulco	Saint-Hubert	Naphtha	14.55
Mulco	Saint-Hubert	Xylenes	46.91
Pillsbury	Saint-Hubert	Ammonia, anhydrous	6.00
Toitures Couture et associés (Les)	Saint-Hubert	Propane	8.00
Formica	Saint-Jean-sur-Richelieu	Formaldehyde (solution)	38.00
Formica	Saint-Jean-sur-Richelieu	Motor fuel (gasoline)	16.00
Formica	Saint-Jean-sur-Richelieu	Nitric acid (conc. 80% or more)	1.00
Formica	Saint-Jean-sur-Richelieu	Propane	0.10
ICG Propane	Saint-Jean-sur-Richelieu	Propane	98.00
P. Baillargeon ltée	Saint-Jean-sur-Richelieu	Motor fuel (gasoline)	14.00
Usine de filtration	Saint-Jean-sur-Richelieu	Chlorine	9.00
ICG Propane	Sainte-Catherine	Propane	247.00
Aliments Carrière inc.	Sainte-Martine	Ammonia, anhydrous	2.96
James Richardson International	Sorel	Phosphine	0.21
Aciers inoxydables Atlas	Tracy	Anhydrous hydrogen fluoride hydrofluoric acid (conc. >50%)	34.60
Aciers inoxydables Atlas	Tracy	Hydrogen	5.30
Aciers inoxydables Atlas	Tracy	Nitric acid (conc. 60% or more)	63.00
Aciers inoxydables Atlas	Tracy	Propane	3.80

Table 5 *(continued)*

Establishments with Hazardous Substances

COMPANY	TOWN	CHEMICAL NAME	MAXIMUM QUANTITY (TONNES)
ICG Propane	Tracy	Propane	40.00
Budget Propane	Salaberry-de-Valleyfield	Propane	88.00
Canbro inc.	Salaberry-de-Valleyfield	Zinc	10.00
Distilleries Schenley inc. (Les)	Salaberry-de-Valleyfield	Copper and compounds	0.47
Distilleries Schenley inc. (Les)	Salaberry-de-Valleyfield	Propane	13.00
EKA Chimie Canada	Salaberry-de-Valleyfield	Chromium and compounds	0.57
EKA Chimie Canada	Salaberry-de-Valleyfield	Chlorine	0.01
EKA Chimie Canada	Salaberry-de-Valleyfield	Hydrogen chloride (hydrochloric acid >37%)	83.30
EKA Chimie Canada	Salaberry-de-Valleyfield	Hydrogen peroxide (>52%)	633.00
EKA Chimie Canada	Salaberry-de-Valleyfield	Propane	29.00
EKA Chimie Canada	Salaberry-de-Valleyfield	Sodium chlorate	3 360.00
Grace Davison	Salaberry-de-Valleyfield	Ammonium hydroxide (conc. 20% or more)	160.00
Grace Davison	Salaberry-de-Valleyfield	Hydrogen chloride (hydrochloric acid >37%)	13.00
Macco Organiques inc.	Salaberry-de-Valleyfield	Hydrogen chloride (hydrochloric acid >37%)	24.00
Noranda-CEZ inc.	Salaberry-de-Valleyfield	Chlorine	1.00
Noranda-CEZ inc.	Salaberry-de-Valleyfield	Hydrogen peroxide (>52%)	2.50
Noranda-CEZ inc.	Salaberry-de-Valleyfield	Propane	58.00
Noranda-CEZ inc.	Salaberry-de-Valleyfield	Sulphur dioxide	14.16
Rhodia Canada inc.	Salaberry-de-Valleyfield	Ammonium hydroxide (conc. 20% or more)	22.00
Rhodia Canada inc.	Salaberry-de-Valleyfield	Chlorosulphonic acid	131.00
Rhodia Canada inc.	Salaberry-de-Valleyfield	Formaldehyde (solution)	0.50
Rhodia Canada inc.	Salaberry-de-Valleyfield	Hydrogen chloride (hydrochloric acid >37%)	32.00
Van Waters & Rogers ltée	Salaberry-de-Valleyfield	Ammonium hydroxide (conc. 20% or more)	25.00
Van Waters & Rogers ltée	Salaberry-de-Valleyfield	Formaldehyde (solution)	22.00
Van Waters & Rogers ltée	Salaberry-de-Valleyfield	Hydrogen chloride (hydrochloric acid >37%)	32.00
Van Waters & Rogers ltée	Salaberry-de-Valleyfield	Methyl chloride	42.00
Van Waters & Rogers ltée	Salaberry-de-Valleyfield	Toluene	99.00
Van Waters & Rogers ltée	Salaberry-de-Valleyfield	Xylenes	99.00

Table 5 *(continued)*

Establishments with Hazardous Substances

COMPANY	TOWN	CHEMICAL NAME	MAXIMUM QUANTITY (TONNES)
Vêtements de sport Gildan (Les)	Salaberry-de-Valleyfield	Propane	0.90
Air Liquide	Varennes	Acetylene	11.00
Air Liquide	Varennes	Hydrogen	3.50
Environnement Eaglebrook ltée	Varennes	Chlorine	82.00
Garage Olco	Varennes	Propane	4.00
Propane 2000	Varennes	Propane	52.00
Régie intermunicipale de l'eau potable	Varennes	Chlorine	4.00

Table 6

Establishments with Hazardous Substances Exceeding Threshold Quantities

COMPANY	TOWN	ENGLISH NAME	FRENCH NAME	THRESHOLD QUANTITY (TONNES)	MAXIMUM QUANTITY (TONNES)
Produits chimiques CXY	Beauharnois	ammonia, anhydrous	ammoniac	4.5	6
Produits chimiques CXY	Beauharnois	hydrochloric acid (conc. 37% or greater)	chlorure d'hydrogène (acide chlorhydrique 37% et plus)	6.8	70
Produits chimiques CXY	Beauharnois	sodium chlorate (solution)	chlorate de sodium (solution)	10	852
Produits chimiques CXY	Beauharnois	sodium chlorate	chlorate de sodium	10	800
Nacan	Boucherville	vinyl acetate	acétate de vinyle	6.8	220
Isolation Manson	Brossard	ammonia solution (conc. 20% or greater)	ammoniaque, solution acq. (conc. 20% ou plus)	9.1	33
Sonic Propane	Brossard	propane	propane	4.5	7.7
Produits chimiques Handy (Les)	Candiac	formaldehyde (solution)	formaldéhyde (solution)	6.8	158
Usine de filtration de Candiac	Candiac	chlorine	chlore	1.14	9
Hydro Agri Canada, Chemport	Contrecœur	ammonium nitrate	nitrate d'ammonium	10	14 000
Ispat Sidbec Inc.	Contrecœur	hydrogen	hydrogène	4.5	5.5
ARC Resins	Longueuil	formaldehyde (solution)	formaldéhyde (solution)	6.8	100
ARC Resins	Longueuil	phenol	phénol	10	300
Alcan	Melocheville	chlorine	chlore	1.14	2
PPG	Melocheville	chlorine	chlore	1.14	530
Distribution Praxair	Saint-Hubert	propylene	propylène	4.5	10
Pillsbury	Saint-Hubert	ammonia, anhydrous	ammoniac	4.5	6
Toitures Couture et associés (Les)	Saint-Hubert	propane	propane	4.5	8
Formica	Saint-Jean[1]	formaldehyde (solution)	formaldéhyde (solution)	6.8	38
ICG Propane	Saint-Jean[1]	propane	propane	4.5	98
Usine de filtration (Saint-Jean)	Saint-Jean[1]	chlorine	chlore	1.14	9

Table 6 *(continued)*

Establishments with Hazardous Substances Exceeding Threshold Quantities

COMPANY	TOWN	ENGLISH NAME	FRENCH NAME	THRESHOLD QUANTITY (TONNES)	MAXIMUM QUANTITY (TONNES)
ICG Propane	Sainte-Catherine	propane	propane	4.5	247
Aciers inoxydables Atlas	Tracy	hydrofluoric acid (conc. >50%)	fluorure d'hydrogène anhydre, acide fluorhydrique (conc. >50%)	0.45	34.6
Aciers inoxydables Atlas	Tracy	hydrogen	hydrogène	4.5	5.3
ICG Propane	Tracy	propane	propane	4.5	40
Budget Propane	Valleyfield[2]	propane	propane	4.5	88
Distilleries Schenley inc. (Les)	Valleyfield[2]	propane	propane	4.5	13
EKA Chimie Canada	Valleyfield[2]	hydrochloric acid (conc. 37% or greater)	chlorure d'hydrogène (acide chlorhydrique 37% et plus)	6.8	83.30
EKA Chimie Canada	Valleyfield[2]	hydrogen peroxide (>52%)	peroxyde d'hydrogène (>52%)	3.4	633
EKA Chimie Canada	Valleyfield[2]	propane	propane	4.5	29
EKA Chimie Canada	Valleyfield[2]	sodium chlorate	chlorate de sodium	10	3360
Grace Davison	Valleyfield[2]	ammonia (conc. 20% or greater)	ammoniaque, solution acq (conc. 20% ou plus)	9.1	160
Grace Davison	Valleyfield[2]	hydrochloric acid (conc. 37% or greater)	chlorure d'hydrogène (acide chlorhydrique 37% et plus)	6.8	13
Macco Organiques inc.	Valleyfield[2]	hydrochloric acid (conc. 37% or greater)	chlorure d'hydrogène (acide chlorhydrique 37% et plus)	6.8	24
Noranda-CEZ inc.	Valleyfield[2]	propane	propane	4.5	58
Noranda-CEZ inc.	Valleyfield[2]	sulphur dioxide	dioxyde de soufre	2.25	14.163*
Rhodia Canada inc.	Valleyfield[2]	chlorosulphonic acid	acide chlorosulfonique	1	131
Rhodia Canada inc.	Valleyfield[2]	ammonia (conc. 20% or greater)	ammoniaque,solution acq. (conc. 20% ou plus)	9.1	22
Rhodia Canada inc.	Valleyfield[2]	hydrochloric acid (conc. 37% or greater)	chlorure d'hydrogène (acide chlorhydrique 37% et plus)	6.8	32

* Outflow of 14 163 kg/hour

Table 6 *(continued)*

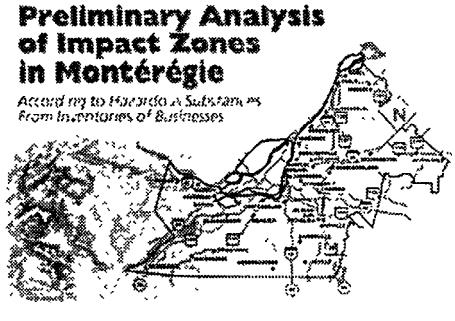
Establishments with Hazardous Substances Exceeding Threshold Quantities

COMPANY	TOWN	ENGLISH NAME	FRENCH NAME	THRESHOLD QUANTITY (TONNES)	MAXIMUM. QUANTITY (TONNES)
Van Waters & Rogers ltée	Valleyfield[2]	ammonia (conc. 20% or greater)	ammoniaque, solution acq (conc. 20% ou plus)	9.1	25
Van Waters & Rogers ltée	Valleyfield[2]	formaldehyde (solution)	formaldéhyde (solution)	6.8	22
Van Waters & Rogers ltée	Valleyfield[2]	hydrochloric acid (conc. 37% or greater)	chlorure d'hydrogène (acide chlorhydrique 37% et plus)	6.8	32
Van Waters & Rogers ltée	Valleyfield[2]	methyl chloride	chlorure de méthyle	4.5	42
Van Waters & Rogers ltée	Valleyfield[2]	toluene	toluène	50	99
Van Waters & Rogers ltée	Valleyfield[2]	xylenes	xylènes	50	99
Air Liquide	Varennes	acetylene	acétylène	4.5	11
Environnement Eaglebrook ltée	Varennes	chlorine	chlore	1.14	82
Propane 2000	Varennes	propane	propane	4.5	52
Régie intermunicipale de l'eau potable	Varennes	chlorine	chlore	1.14	4

[1] Saint-Jean refers to Saint-Jean-sur-Richelieu

[2] Valleyfield refers to Salaberry-de-Valleyfield

Results of Worst-Case Scenarios



Chapter

Of the 53 establishments with substances from the List of Hazardous Materials, 32 hold amounts exceeding the threshold quantities (see Table 6). These 32 target establishments, must conduct a consequence analysis based on the worst-case scenario. The consequence analysis aims to establish if off-site consequences could occur during an industrial accident. Table 7 lists the 31 establishments for which the calculation of worst-case scenarios indicates off-site consequences.

The worst-case scenario consequences were calculated according to the method described in Chapter 3. It should be pointed out that these calculations were carried out using one of the following: formulas like those of RMP, RMP.com software (version 1.06), PHAST software (version 6.0) or ALOHA software (version 5.2.3).

5.1 Model Limitations

Predictions of the dispersal of chemical products in the atmosphere by the different models do not take into account wind speed or wind direction changes. Instead, they use an instant and constant wind speed and wind direction. The models used for this study do not factor in the topography. Local topographical accidents can affect the displacement of toxic snow. This is why the distance calculation is limited to 10 km.

5.2 Details

5.2.1 Internal Reservoirs

For modelling of leakage from reservoirs located inside structures, information on the evacuation openings was needed. This information includes the dimensions of the room, the dimensions of the openings (window, window with expulsion fan) and the air expulsion capacity of the fans when present—i.c., the number of cubic metres or cubic feet of air expelled per minute. This type of modelling was done using PHAST software. We found this type of setup specifically in municipal filtration plants where several chlorine reservoirs were found inside airtight rooms. Other industrial facilities such as food-processing plants, also possess such reservoirs.

5.2.2 Products Stored at Temperatures Above 25°C

For those products stored at raised temperatures, the worst-case scenario method at 25°C does not work. Take, for example, formaldehyde in solution—a viscous liquid with a very low vapour pressure. Accordingly, it is stored at 65°C at the ARC Resins plant of Longueuil; the temperature is used to estimate the impact distance. Another product with similar characteristics, phenol, is stored at 55°C at the same plant. The dispersion modelling in these cases was carried out with PHAST software (version 6.0).

5.2.3 Sodium chlorate in solution

In the case of sodium chlorate in solution, the scenario consists of a rupture of the reservoir with a total loss of product followed by contact with hydrochloric acid. The reaction causes the formation of very toxic products, chlorine dioxide and chlorine, according to the following chemical equations:

$$NaClO_3 + 2HCl = ClO_2 + \frac{1}{2} Cl_2 + H_2O + NaCl$$

$$NaClO_3 + 6HCl = 3Cl_2 + 3H_2O + NaCl$$

The impact distance calculated represents the distance where a TEEL-2 (Temporary Emergency Exposure Limit) level of 0.5 ppm of chlorine and chlorine dioxide is reached.

5.2.4 Solid sodium chlorate

The scenario considered consists of a spill of a product that comes into contact with hydrochloric acid. This could occur during a collision followed by a spill coming from sodium chlorate and hydrochloric acid tanks. The same equations as for sodium chlorate in solution (section 5.2.3) were used.

5.2.5 Hydrogen peroxide

Some establishments possess hydrogen peroxide at a 50% concentration. They were not retained, as the product does not meet the concentration of 52% stipulated in the list and the explosion risk at this concentration is practically nonexistent.

5.2.6 Others

In some cases, establishments not in possession of hazardous substances in amounts above the threshold quantities could still have off-site consequences should an accident occur. For example, look at Les Aliments Carrière de Sainte-Martine, whose ammonia inventory is below the threshold quantity of 4.5 tonnes. Some establishments with propane find themselves in the same situation. These other cases are also found in Table 7 for a total of 36 establishments.

Table 7

Establishments for which the Worst-Case Scenarios Have Off-Site Consequences

COMPANY	ENGLISH NAME	FRENCH NAME	THRESHOLD QUANTITY (TONNES)	MAXIMUM. QUANTITY (TONNES)
Aciers inoxydables Atlas	hydrofluoric acid (conc. >50%)	fluorure d'hydrogène acide fluorydrique (conc. ≥50%)	0.45	34.6
Aciers inoxydables Atlas	hydrogen	hydrogène	4.5	5.3
Air Liquide	acetylene	acétylène	4.5	11
Alcan	chlorine	chlore	1.14	2
Aliments Carrière (Les)	ammonia, anhydrous	ammoniac	4.5	2.9
ARC Resins	phenol	phénol	10	300
Budget Propane	propane	propane	4.5	88
Distilleries Schenley inc. (Les)	propane	propane	4.5	13
Distribution Praxair	propylene	propylène	4.5	10
EKA Chimie Canada	hydrochloric acid (conc. 37% or greater)	chlorure d'hydrogène (acide chlorhydrique 37% et plus)	6.8	83.30
EKA Chimie Canada	hydrogen peroxide (>52%)	peroxyde d'hydrogène (>52%)	3.4	633
EKA Chimie Canada	propane	propane	4.5	29
EKA Chimie Canada	sodium chlorate	chlorate de sodium	10	3360
Environnement Eaglebrook ltée	chlore	chlorine	1.14	82
Grace Davison	ammonia solution (conc. 20% or greater)	ammoniaque, solution acq. (conc. 20% ou plus)	9.1	160
Grace Davison	hydrochloric acid (>37%)	chlorure d'hydrogène (acide chlorhydrique >37%)	6.8	13
Hydro Agri Canada, Chemport	ammonium nitrate	nitrate d'ammonium	10	14 000
ICG Propane (Tracy)	propane	propane	4.5	40
ICG Propane (Saint-Jean-sur-Richelieu)	propane	propane	4.5	98

Table 7 *(continued)*

Establishments for which the Worst-Case Scenarios Have Off-Site Consequences

COMPANY	ENGLISH NAME	FRENCH NAME	THRESHOLD QUANTITY (TONNES)	MAXIMUM. QUANTITY (TONNES)
ICG Propane (Sainte-Catherine)	propane	propane	4.5	247
Isolation Manson	ammonia solution (conc. 20% or greater)	ammoniaque, solution acq. (conc. 20% ou plus)	9.1	33
Ispat Sidbec Inc.	hydrogen	hydrogène	4.5	5.5
Macco Organiques inc.	hydrochloric acid (>37%)	chlorure d'hydrogène (acide chlorhydrique >37%)	6.8	24
Nacan	vinyl acetate	acétate de vinyle	6.8	220
Noranda-CEZ inc.	chlore	chlorine	1.14	1
Noranda-CEZ inc.	propane	propane	4.5	58
Noranda-CEZ inc.	sulphur dioxide	dioxyde de soufre	2.25	14.163*
Pillsbury	ammonia, anhydrous	ammoniac	4.5	6
PPG	chlorine	chlore	1.14	530
Produits chimiques CXY	ammonia, anhydrous	ammoniac	4.5	6
Produits chimiques CXY	sodium chlorate (solution)	chlorate de sodium (solution)	10	852
Produits chimiques CXY	sodium chlorate	chlorate de sodium	10	800
Produits chimiques CXY	hydrochloric acid (>37%)	chlorure d'hydrogène (acide chlohydrique >37%)	6.8	70
Propane 2000	propane	propane	4.5	52
Régie intermunicipale de l'eau potable	chlorine	chlore	1.14	4

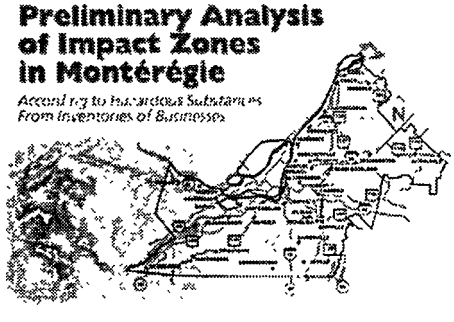
* Outflow of 14 163 kg/hour

Table 7 *(continued)*

Establishments for which the Worst-Case Scenarios Have Off-Site Consequences

COMPANY	ENGLISH NAME	FRENCH NAME	THRESHOLD QUANTITY (TONNES)	MAXIMUM. QUANTITY (TONNES)
Rhodia Canada inc.	chlorosulphonic acid	acide chlorosulfonique	1	131
Rhodia Canada inc.	ammonia solution (conc. 20% or greater)	ammoniaque, solution acq. (conc. 20% ou plus)	9.1	22
Rhodia Canada inc.	hydrochloric acid (>37%)	chlorure d'hydrogène) (acide chlorhydrique >37%)	6.8	32
Sonic Propane	propane	propane	4.5	7.7
Toitures Couture et associés (Les)	propane	propane	4.5	8
Usine de filtration de Candiac	chlorine	chlore	1.14	9
Usine de filtration de Saint-Jean-sur-Richelieu	chlorine	chlore	1.14	9
Van Waters & Rogers ltée	ammonia solution (conc. 20% or greater)	ammoniaque, solution acq. (conc. 20% ou plus)	9.1	25
Van Waters & Rogers ltée	chlorure de méthyle	methyl chloride	4.5	42
Van Waters & Rogers ltée	hydrochloric acid (>37%)	chlorure d'hydrogène (acide chlorhydrique >37%)	6.8	32

Recommendations and Conclusion



Chapter

The formation of the Joint Coordinating Committee (JCC), recommended previously by the Major Industrial Accidents Council of Canada (MIACC) in 1990 and widely promoted and encouraged by Quebec Emergency Preparedness, is ideal for taking inventories of hazardous sites and preparing the community for possible accidents. Meanwhile, other municipal-industrial groups can be created, like the one existing in Montérégie, to do a similar and effective job.

For the calculation of the worst-case scenarios in this study, we took inventories of 36 establishments for which accidents could have impacts beyond their premises in the 20 study municipalities. These establishments, both private and municipal, must now complete the risk management program by going to Step 4, "Review of Accidents Over a 5-Year Period," and Step 5, "Analysis of Consequences—Alternative Accident Scenarios." These alternative scenarios take into account the control measures in place to attenuate the consequences and reduce the accident risks. The establishments are responsible for these last two steps. Next, they must present the results to the JCCs or to the municipality and harmonize of the emergency plans to deal with a possible accident. Finally, the citizens will have to be informed of these results.

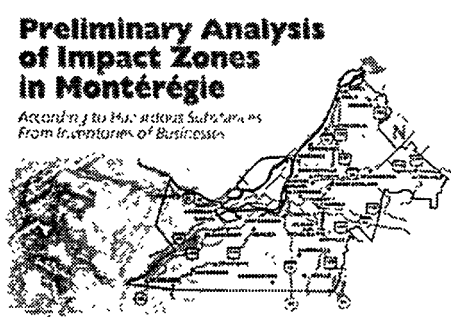
Several establishments possess reservoirs of hazardous substances without diked areas. All the reservoirs or groups of reservoirs of hazardous substances must be surrounded by diked areas of a greater capacity than the reservoir or group of reservoirs. As well, these diked areas must not have a large surface, but instead must be built vertically. By minimizing the air contact surface, the quantity of the evaporated substance is diminished, thus reducing the impact distance.

Just like the municipalities, the industries must evaluate their level of understanding of risk as well as their state of preparedness by using the self-evaluation tools developed by MIACC, which are based on the approach developed by the Center for Chemical Process Safety of the American Institute of Chemical Engineers. Other similar approaches can also be adopted, such as the CARE program.

As a good corporate citizen, each business that uses, stores or produces hazardous substances must evaluate its major industrial accident risk and implement risk reduction measures to bring the risk to an acceptable level for its employees, the surrounding population and the environment. The fire departments must know the businesses located on their territory, the risks related to their activities, and the means to prevent and contain accidents linked to hazardous substances. The businesses will have to produce a sound emergency plan based on the residual risks (those of the alternative scenarios) and align it with the plans of the municipal or regional authorities. This must be a systematic process for the establishments holding hazardous substances.

This study has allowed us to determine to what extent the preparedness and awareness levels of the different municipal and business responders can vary. Certain responders are ready to respond to an emergency (we asked them if they had prepared an emergency plan), while others still have a lot of work to do.

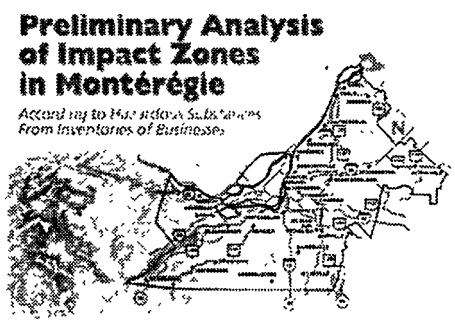
In order to obtain a more complete picture of the industrial risks for the entire Montérégie region, the other municipalities that were not targeted in this report could be the subject of a subsequent study.



References

- Canadian Standard Association (CSA), Gestion des risques : Guide à l'intention des décideurs, CAN/CSA-Q850-97, 1997.
- Canadian Standard Association (CSA), Planification des mesures d'urgence pour l'industrie, CAN/CSA-Z731-95, 1995.
- Conseil pour la réduction des accidents industriels majeurs, Risk Management Guide for Majors Industrial Accidents—intended for municipalities and industry, Montreal, 2002.
- Emergency Response Planning Guidelines 2, American Industrial Hygiene Association.
- Évaluation des risques aux ports de Montréal, Chicoutimi, Québec, Sept-Îles et Trois-Rivières, Environnement Canada, Direction de la protection de l'environnement, Division des urgences environnementales, 1996.
- Lefebvre, Luc, Lignes directrices pour la réalisation des évaluations de conséquences sur la santé, des accidents industriels majeurs et leurs communications au public, 2001.
- Preliminary Hazard Analysis of the Joint Inland Border Region Between Canada and the United States, Québec Region, Environment Canada, EPA, 1997.
- Principes directeurs pour un processus conjoint municipal et industriel de préparation aux mesures d'urgence, Major Industrial Accidents Council of Canada, 1993.
- Risk Management Program Guidance for Offsite Consequence Analysis, Chemical Emergency Preparedness and Prevention Office, U.S. Environmental Protection Agency, 1999 (http://www.epa.gov/swercepp/ap-ocgu.htm#112r)

Letter Sent to Fire Departments of Target Towns of Montérégie



Annex

January 31, 2000

Subject: Inventory of Hazardous Substances

Dear Sir or Madam,

The Public Health Branch of Montérégie wishes to obtain a realistic picture of the major industrial accident risks related to the presence of hazardous substances on business sites in Montérégie. This work is being done together with Environment Canada. The goal is to implement accident prevention measures in cases where such accidents could occur, to inform concerned authorities of the risks and the measures put in place to control the consequences, and to ensure the safety of citizens. This documentation is extremely relevant, as it will allow public health authorities and all responders to better plan their responses in case of a catastrophe.

You will find enclosed a list of hazardous substances targeted in the present exercise (Annex 1) and a list of businesses likely to use or store these substances (Annex 2). The first step of our process, which we are inviting you to participate in today, consists of identifying those businesses in your region that could be considered for this inventory.

Soon after receiving this letter, you will be contacted by Ms. Nathalie Brault of the Public Health Branch who will see if you are interested in participating in this project, evaluate your needs and work out a realistic timetable. After this first step, you will be questioned by an Environment Canada representative who will help you proceed with the inventory, business by business.

We trust you understand that this process is of great significance and will lead to the generation of accurate documentation that can be computerized for management and updating purposes. We hope that you share our conviction in the importance of this process.

Respectfully yours,

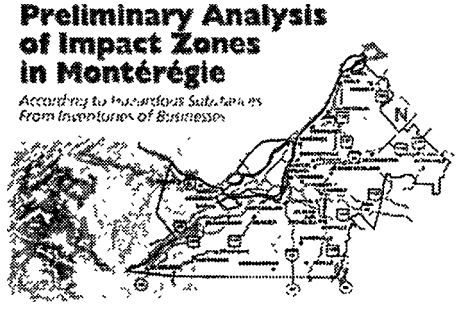
Claude Tremblay, Ph.D.

Coordinator of module the Environmental Program
Public Health Planning and Evaluation Branch
1255 Beauregard Street
Longueuil, Québec
J4K 2M3
Tel.: (450) 928-6777, ext. 4031
Fax: (450) 928-3760

Robert Reiss

Emergency Responder
Environmental Protection Branch
Environment Canada, Quebec Region
105 McGill Street, 4th Floor
Montréal, Québec
H2Y 2E7
Tel.: (514) 283-0822
Fax: (514) 496-1157

Examples of Establishments Likely to Have Hazardous Substances



Annex

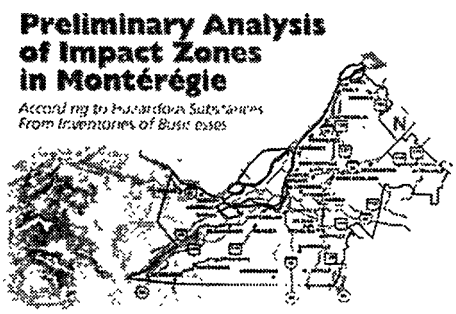
	LOCATIONS	HAZARDOUS MATERIALS AND OTHER SUBSTANCES
1	LARGE STORAGE OR COMBUSTIBLE-PROCESSING FACILITIES	
	Refinery and storage	Gasoline, naphtha, hydrofluoric acid, propane, butane, ethylene, propylene, mercaptan, liquefied natural gas and other combustibles
	Intermediary storage	Gasoline, diesel, propane, butane and other combustibles
	Service station	Gasoline, diesel, propane
2	TRANSPORT OF PETROLEUM OR GASOLINE	
	Gas distribution centre	Natural gas, propane
	Pipelines	Natural gas, propane, butane, ethylene, ethane, methane, kerosene, crude petroleum, chlorine, hydrogen, etc.
3	LARGE COOLING FACILITIES	
	Food industry (slaughterhouses, dairy products, fat, fish and meat, breweries, refrigerated warehouses, etc.)	Ammonia
4	FOOD	
	Spices	Ethyl oxide
	Sugar industry	Sulphur dioxide
	Flour processing	Methyl bromide
	Extraction of vegetable or animal oils and fats	Hexane
	Cocoa, chocolate and coffee industry	Hexane, ammonia
	Yeast	Various solvents, ammonia
	Distilleries, alcohol bottling	Ethanol
5	SPECIFIC BASIC PRODUCTS	
	Leather industry (tannery)	Acrolein, formic acid
	Wood distribution industry	Formaldehyde, impregnation agents
	Paper industry	Chlorine, chlorine dioxide, sulphur dioxide, ammonia
	Rubber industry	Styrene, butadiene
	Glass industry	Hydrofluoric acid

	LOCATIONS	HAZARDOUS MATERIALS AND OTHER SUBSTANCES
6	METALLURGIC AND ELECTRONIC INDUSTRY	
	Aluminum smelters	Hydrofluoric acid, oleum, chlorine
	Magnesium	Hydrochloric acid, chlorine, hydrogen, sulphur dioxide
	Gold	Carbon monoxide, nitric oxide
	Smelting furnaces	Cyanides, sulphur dioxide
	Lead processing	Lead compounds
	Surface preparation (plating)	Acids, plating solutions, arsine, cyanides
	Copper refining	Sulphuric acid, arsine, sulfur dioxide
	Pigments of titanium dioxide	Sulphuric acid, chlorine, titanium tetrachloride
	Electronic	Arsine, trimethylchlorosilane
7	SPECIFIC CHEMICAL PRODUCTS	
	Fertilizer	Ammonia, nitric acid, nitric oxide, ammonium nitrate
	Synthetic resins	Ethylene oxide, propylene oxide, chlorine, acrylonitrile, phosgene, isocyanates, formaldehyde, styrene
	Rubber	Butadiene, styrene
	Plastics and other synthetic products	Ethylene, propylene, vinyl chloride, acrylonitrile, chlorine, toxic combustion products
	Paints and pigments	Phosphine, various solvents
	Perfumes and essences	Acids, solvents, toxic combustion products
	Synthetic products	Carbon sulphide, hydrogen sulphide
	Medications and other pharmaceutical products	Chlorine, sulphur compounds, solvents, formic acid
	Detergents	Acids, bases, ethylene oxide
	Cleaning agents	Acids, bases
	Linoleum products	Solvents, toxic combustion products
	Textiles	Lye, dyes, solvents, formic acid
	Printing products	Solvents
	Photographic and cinematographic products	Nitrocellulose
	Fluorocarbons	Hydrofluoric acid

	LOCATIONS	HAZARDOUS MATERIALS AND OTHER SUBSTANCES
8	PESTICIDES	
	Production of raw materials	Phosgene, isocyanates, chlorine
	Bulk sale and storage	Toxic powders and liquids, toxic combustion products, ammonia
	Retail sale and storage	Various substances, methyl bromide
	Smelting furnaces	Cyanides, sulfur dioxide
9	CHEMICAL PRODUCTS: NON-SPECIFIC RAW MATERIALS	
	Inorganic products	Chlorine, ammonia, hydrochloric acid, sulphuric acid, oleum, sulphur dioxide, chlorine dioxide
	Organic products	Acrylic nitrile, phosgene, solvents
	Industrial gases	Hydrogen, solvents, phosgene
10	EXPLOSIVES	
	Production and storage of explosives	Explosives, nitric acid, TNT, ANFO
	Storage of munitions	Munitions, TNT
	Manufacturing and sale of fireworks	Fireworks, pyrotechnic parts
	Others	Hydrogen peroxide, organic peroxides, ammonium nitrate, sodium chlorate, etc.
11	PUBLIC AREAS AND SERVICES	
	Drinking water filtration plant	Chlorine
	Sewage treatment plant	Chlorine, hydrogen peroxide
	Pool	Chlorine
	Arena, rink	Ammonia
	Hospital	Oxygen, various gases and solvents
12	PIPELINES EXCEPT THOSE USED FOR FIXED INSTALLATIONS	
	Chlorine	

	LOCATIONS	HAZARDOUS MATERIALS AND OTHER SUBSTANCES
13	LAUNDRIES	Chlorinated solvents
14	CENTRES FOR TRANSFERRING, PROCESSING AND ELIMINATING HAZARDOUS MATERIALS	Solvents, chlorinated solvents, cyanides
15	PVC INDUSTRIES	Hydrogen chloride, chlorine, phosgene, dioxins
16	STORAGE SITES FOR HAZARDOUS WASTE	Various chemical products
17	STORAGE OF PCBS, TIRES, VARIOUS SCRAPS (PLASTIC)	Toxic combustion products

List of Hazardous Materials



Annex

Hazardous materials are a group of products (substances) which due to their chemical and physical properties require particular safety measures for their management (manufacturing, use, storage, transport, elimination). A substance is a material that is characterized by its properties. Toxic, infectious, flammable, explosive, oxidizing, corrosive and radioactive substances are all hazardous materials. It only follows that the greater the quantity and diversity of these products in the same area, the more the risks related to their management increase.

Elements that make up this document:

- List 1 of priority hazardous substances, according to the Major Industrial Accidents Council of Canada (MIACC – *Lists of Hazardous Substances*, 1994).
- *List of Regulated Toxic and Flammable Substances and Thresholds for Accidental Release Prevention, Environmental Protection Agency* (EPA), in: *Federal Register,* vol. 59, no. 20, 19 January 1993, pp. 4493-4499).
- Hazardous materials included in Lists 2 and 3 of MIACC (*Lists of Hazardous Substances,* 1994), when these are also included in the EPA list, or in the list of substances regulated by the *Occupational Safety and Health Administration* (Federal Register, vol. 57, no. 36, 24 February 1992), or in the list of substances listed by the National Fire Protection Agency in the NFPA 325 guide (*Fire Hazards Properties of Flammable Liquids, Gases, Volatile Solids*, 5 August 1994) as representing an extreme danger (level 4) from the point of view of health, flammability or reactivity.
- Threshold quantities are those regulated by the EPA, or by default by OSHA, or by default by those recommended by List 2 of MIACC. The identification numbers are those of the United Nations (UN) and those of the Chemical Abstracts Service (CAS).

If an industry has a substance that is not mentioned in List 1, but for which the properties, conditions and storage risk creating a major industrial accident, this substance should be reported to the JCC.

The list of hazardous materials is presented here under two formats: the first reproduces the format used at the JCC of Montréal-Est which lists the materials according to the way to calculate the scenarios. For example, a list includes all the materials considered as toxic, which thus necessitates that the scenarios be calculated according to the method described for toxic materials in Chapter 3. The second format is the list of hazardous materials appearing in alphabetical order. The columns labeled T, I.E. and A also refer to the calculation method for each of the materials.

LIST OF HAZARDOUS MATERIALS OF CRAIM

(by class and by alphabetical order of English name)

No.	Name of substances (English name)	(French name)	Threshold qty (metric ton)	CAS No.	UN No.	CRAIM Class	Origin	Remarks
		EPA - LISTED FLAMMABLE SUBSTANCE						
1	1-butene	Butylène (1-Butène)	4.5	106- 98- 9	1012	A	EPA	
2	1-buten-3-yne	Butényne (Vinyle acétylène)	4.5	689- 97- 4		A	EPA	
3	1,3-butadiene	Butadiène	4.5	106- 99- 0	1010	A	EPA	
4	1-chloro-1-propene	Chlorure de propenyl	4.5	590- 21- 6	1278	A	EPA	
5	1,1-dichloroethylene	Chlorure de vinylidène	4.5	75- 35- 4	1303	A	EPA	
6	1,1-difluoroethane	Difluoréthane	4.5	75- 37- 6	1030	A	EPA	
7	1,1-difluoroethene	Difluoro-1,1 éthylène	4.5	75- 38- 7	1959	A	EPA	
8	1- propyne	Méthylacéthylène	4.5	74- 99- 7	1060	A	EPA	
9	2- butene	Butylène (1-Butène)	4.5	107- 01- 7	1012	A	EPA	
10	2 chloropropane	Chloro-2 propane	4.5	75- 29- 6	2356	A	EPA	
11	2-chloro-1-propene	Chloro-2 propène	4.5	557- 98- 2	2456	A	EPA	
12	2-methyl-1-butene	Méthyl-2 butène-1	4.5	563- 46- 2	2459	A	EPA	
13	3-methyl-1-butene	Méthyl-3 butène-1	4.5	563- 45- 1	2561	A	EPA	
14	Acetaldehyde	Acétaldéhyde	4.5	75- 07- 0	1089	A	EPA	
15	Acetylene	Acétylène	4.5	74- 86- 2	1001	A	EPA	
16	Bromotrifluoroethylene	Bromotrifluoréthylène	4.5	598- 73- 2	2419	A	EPA	
17	Butane	Butane	4.5	106- 97- 8	1011	A	EPA	
18	Butylene	Butylène (1-Butène)	4.5	25167- 67- 3	1012	A	EPA	
19	Carbonyl sulfide	Sulfure de carbonyle	4.5	463- 58- 1	2204	A	EPA	
20	Chlorotrifluoroethylene	Trifluorochloroéthylène	4.5	79- 38- 9	1082	A	EPA	
21	cis-2-butene	Butylène (1-Butène)	4.5	590- 18- 1	1012	A	EPA	
22	cis-2-pentene	Pentène-cis (2-)	4.5	627- 20- 3	1027	A	EPA	
23	Cyanogen	Cyanogène	4.5	460- 19- 5	1026	A	EPA	
24	Cyclopropane	Cyclopropane	4.5	75- 19- 4	1027	A	EPA	
25	Dichlorosilane	Dichlorosilane	4.5	4109- 96- 0	2189	A	EPA	
26	Dichlorine oxide	Oxyde de dichlore	4.5	7791- 21- 1		A	EPA	
27	Diethyl ether	Éther éthylique	4.5	60- 29- 7	1155	A	EPA	
28	Dimethyl ether	Oxyde de diméthyle	4.5	115- 10- 6	1033	A	EPA	
29	Dimethylamine	Diméthylamine anhydre	4.5	124- 40- 3	1032 et 1160	A	EPA	
30	Ethane	Éthane	4.5	74- 84- 0	1035 et 1961	A	EPA	
31	Ethyl acetylene	Éthylacétylène	4.5	107- 00- 6	2452	A	EPA	
32	Ethyl chloride	Chlorure d'éthyle	4.5	75- 00- 3	1037	A	EPA	

A = Listed flammable substance (EPA) **B** = Listed toxic substance (EPA) **C** = Listed flammable substance (CRAIM)
D = Listed toxic substance (CRAIM) **E** = Listed explosive substance (CRAIM) **F** = Listed various substance (CRAIM)

LIST OF HAZARDOUS MATERIALS OF CRAIM

(by class and by alphabetical order of English name)

No.	Name of substances (English name)	(French name)	Threshold qty (metric ton)	CAS No.	UN No.	CRAIM Class	Origin	Remarks
			EPA - LISTED FLAMMABLE SUBSTANCE					
33	Ethylene	Éthylène	4.5	74- 85- 1	1038 et 1962	A	EPA	
34	Ethyl mercaptan	Mercaptan éthylique	4.5	75- 08- 1	2363	A	EPA	
35	Ethyl nitrite	Nitrite d'éthyle	4.5	109- 95- 5	1194	A	EPA	
36	Ethyl vinyl ether	Éther éthylvinylique	4.5	109- 92- 2	1302	A	EPA	
37	Ethylamine	Éthylamine	4.5	75- 04- 7	1036 et 2270	A	EPA	
38	Hydrogen	Hydrogène	4.5	1333- 74- 0	1049	A	EPA	
39	i- pentane	Pentane (Iso)	4.5	78- 78- 4	1265	A	EPA	
40	Isobutane	Isobutane	4.5	75- 28- 5	1969	A	EPA	
41	Isobutylene	Isobutylène	4.5	115- 11- 7	1055	A	EPA	
42	Isoprene	Isoprène	4.5	78- 79- 5	1218	A	EPA	
43	Isopropylamine	Isopropylamine	4.5	75- 31- 0	1221	A	EPA	
44	Methane	Méthane	4.5	74- 82- 8	1971 et 1972	A	EPA	
45	Methyl formate	Formiate de méthyle	4.5	107- 31- 3	1243	A	EPA	
46	Methylamine	Méthylamine	4.5	74- 89- 5	1061	A	EPA	
47	n- pentane	Pentane (normal)	4.5	109- 66- 0	1265	A	EPA	
48	Neopantane	Diméthyl- 2,2 propane	4.5	463- 82- 1	2044	A	EPA	
49	Pentene (1,3-pentadiene)	Pentène (1,3-pentadiène)	4.5	504- 60- 9	1108	A	EPA	
50	Pentene (1-pentene)	Pentène (1-pentène)	4.5	109- 67- 1	1108	A	EPA	
51	Pentene (trans-2-pentene)	Pentène (trans-2-pentène)	4.5	646- 04- 8	1108	A	EPA	
52	Propadiene	Allène, propadiène	4.5	463- 49- 0	2200	A	EPA	
53	Propane	Propane	4.5	74- 98- 6	1978	A	EPA	
54	Propylene	Propylène	4.5	115- 07- 1	1077	A	EPA	
55	Silane	Silane	4.5	7803- 62- 5	2203	A	EPA	
56	Vinyl chloride	Chlorure de vinyle	4.5	75- 01- 4	1086	A	EPA	
57	Vinyl fluoride	Fluorure de vinyle	4.5	75- 02- 5	1860	A	EPA	
58	Vinyl methyl ether	Éther méthylvinylique	4.5	107- 25- 5	1087	A	EPA	
59	Tetrafluoroethylene	Tétrafluoréthylène	4.5	116- 14- 3	1081	A	EPA	
60	Tetramethyl silane	Tétraméthylsilane	4.5	75- 76- 3	2749	A	EPA	
61	Trans-2-butene	Butylène (1-Butène)	4.5	624- 64- 6	1012	A	EPA	
62	Trichlorosilane	Trichlorosilane	4.5	10025- 78- 2	1295	A	EPA	
63	Trimethylamine	Triméthylamine	4.5	75- 50- 3	1083 et 1297	A	EPA	

A = Listed flammable substance (EPA) **B** = Listed toxic substance (EPA) **C** = Listed flammable substance (CRAIM)
D = Listed toxic substance (CRAIM) **E** = Listed explosive substance (CRAIM) **F** = Listed various substance (CRAIM)

LIST OF HAZARDOUS MATERIALS OF CRAIM

(by class and by alphabetical order of English name)

No.	Name of substances (English name)	(French name)	Threshold qty (metric ton)	CAS No.	UN No.	CRAIM Class	Origin	Remarks
			EPA - LISTED TOXIC SUBSTANCE					
1	1,1- dimethylhydrazine	Diméthylhydrazine	5.8	57- 14- 7	2382	B	EPA	
2	1,2- propylene oxide	Oxyde de propylène	4.5	75- 56- 9	1280	B	EPA	
3	2- methylpropanenitrile	Isobutyronitrite	9.1	78- 82- 0	2284	B	EPA	
4	2,4- toluene diisocyanate	Diisocya. (2,4- toluène diisocyanate)	4.5	584- 84- 9	2078	B	EPA	
5	2,6- toluene diisocyanate	Diisocya. (2,6- toluène diisocyanate)	4.5	91- 08- 7	2078	B	EPA	
6	Acrolein	Acroléine	2.25	107- 02- 8	1092	B	EPA	
7	Acrylyl chloride	Chlorure d'acryloyle	2.25	814- 68- 6	NA 9188	B	EPA	
8	Acrylonitrile	Acrylonitrile	9	107- 13- 1	1093	B	EPA	
9	Allyl alcohol	Alcool allylique	6.8	107- 18- 6	1098	B	EPA	
10	Allylamine	Allylamine	4. 5	107- 11- 9	2334	B	EPA	
11	Ammonia, anhydrous,	Ammoniac, anhydre	4.5	7664- 41- 7	1005	B	EPA	
12	Ammonia, solution (conc. ≥ 20 %)	Ammoniaque solution acq (conc. 20 % ou plus)	9.1	7664- 41- 7	2073	B	EPA	
13	Arsenic trichloride	Chlorure (ou tri-) d'arsenic	6.8	7784- 34- 1	1560	B	EPA	
14	Arsine	Arsine	0.45	7784- 42- 1	2188	B	EPA	
15	bis (chloromethyl) ether	Éther dichlorodiméthylique	0.45	542- 88- 1	2249	B	EPA	
16	Boron trichloride	Trichlorure de bore	2.25 1	0294- 34- 5	1741	B	EPA	
17	Boron trichloride	Trichlorure de bore	2.25	7637- 07- 2	1008	B	EPA	
18	Boron trifluoride dimethyletherate	Éthérate diméthylique de trifluorure de bore	6.8	353- 42- 4	2965	B	EPA	
19	Bromine	Brome	4.5	7726- 95- 6	1744	B	EPA	
20	Carbon disulfide	Sulfure de carbone	9.1	75- 15- 0	1131	B	EPA	
21	Chlorine	Chlore	1.14	7782- 50- 5	1017	B	EPA	
22	Chlorine dioxide	Dioxyde de chlore hydraté, gelé	0.45	10049- 04- 4	9191	B	EPA	
23	Chloroform	Chloroforme	9.1	67- 66- 3	1888	B	EPA	
24	Chloromethyl methyl ether	Éther méthylique monochloré	2.25	107- 30- 2 1	239	B	EPA	
25	Crotonaldehyde	Crotonaldéhyde	9.1	4170- 30- 3	1143	B	EPA	
26	Crotonaldehyde (E)	Crotonaldéhyde (E)	9.1	123- 73- 9		B	EPA	
27	Cyclohexylamine	Cyclohexylamine	6.8	108- 91- 8	2357	B	EPA	

A = Listed flammable substance (EPA) **B** = Listed toxic substance (EPA) **C** = Listed flammable substance (CRAIM)
D = Listed toxic substance (CRAIM) **E** = Listed explosive substance (CRAIM) **F** = Listed various substance (CRAIM)

LIST OF HAZARDOUS MATERIALS OF CRAIM

(by class and by alphabetical order of English name)

No.	Name of substances (English name)	(French name)	Threshold qty (metric ton)	CAS No.	UN No.	CRAIM Class	Origin	Remarks
			EPA - LISTED TOXIC SUBSTANCE					
28	Cyanogen chloride	Chlorure de cyanogène	4.5	506- 77- 4	1589	B	EPA	
29	Diborane	Diborane	1.4	19287- 45- 7	1911	B	EPA	
30	Dimethyldichlorosilane	Diméthyldichlorosilane	2.25	75- 78- 5	1162	B	EPA	
31	Ethylenediamine	Éthylènediamine	9.1	107- 15- 3	1604	B	EPA	
32	Ethyleneimine	Aminoéthylène	4.5	151- 56- 4	1185	B	EPA	
33	Ethylene oxide	Oxyde d'éthylène	4.5	75- 21- 8	1040	B	EPA	
34	Fluorine	Fluor	0.45	7782- 41- 4	1045	B	EPA	
35	Formaldehyde (solution)	Formaldéhyde (solution)	6.8	50- 00- 0	2209	B	EPA	
36	Furan	Furanes	2.25	110- 00- 9	2389	B	EPA	
37	Hydrazine	Hydrazine	6.8	302- 01- 2	2029	B	EPA	
38	Hydrochloric acid	Chlorure d'hydrogène (acide chlorhydrique > 37%)	6.8	7647- 01- 0	2186 and 1789	B	EPA	
39	Hydrofluoric acid (conc. >50%)	Fluorure d'hydrogène anhydre, acide fluorhydrique (conc. >50%)	0.45	7664- 39- 3	1052 and 1790	B	EPA	
40	Hydrogen Chloride, anhydrous	Chlorure d'hydrogène	2.25	7647- 01- 0	1050	B	EPA	
41	Hydrogen cyanide	Cyanure d'hydrogène	1.14	74- 90- 8	1051	B	EPA	
42	Hydrogen selenide	Séléniure d'hydrogène	0.22	7783- 07- 5	2202	B	EPA	
43	Hydrogen sulfide	Sulfure d'hydrogène	4.5	7783- 06- 4	1053	B	EPA	
44	Iron pentacarbonyl	Fer pentacarbonyle	1.14	13463- 40- 6 1	994	B	EPA	
45	Isopropyl chloroformate	Chloroformate d'isopropyle	6.8	108- 23- 6	2407	B	EPA	
46	Methyl chloride	Chlorure de méthyle	4.5	74- 87- 3	1063	B	EPA	
47	Methyl chloroformate	Chloroformate de méthyle	2.25	79- 22- 1	1238	B	EPA	
48	Methyl isocyanate	Isocyanate de méthyle	4. 5	624- 83- 9	2480	B	EPA	
49	Methyl mercaptan	Mercaptan méthylique	4.5	74- 93- 1	1064	B	EPA	
50	Methyl thiocyanate	Thiocyanate de méthyle	9.1	556- 64- 9		B	EPA	
51	Methylacrylonitrile	Méthacrylonitrite	4.5	126- 98- 7	3079	B	EPA	
52	Methylhydrazine	Méthylhydrazine	6. 8	60- 34- 4	1244	B	EPA	
53	Methyltrichlorosilane	Méthyltrichlorosilane	2.25	75- 79- 6	1250	B	EPA	
54	n- propyl chloroformate	Chloroformate de n- propyle	6.8	109- 61- 5	2740	B	EPA	
55	Nickel carbonyl	Nickel- tétracarbonyle	0 45	13463- 39- 3	1259	B	EPA	
56	Nitric acid	Acide nitrique (conc. 80% ou plus)	6.8	7697- 37- 2	2031 and 2032	B	EPA	
57	Nitric oxide	Oxyde nitrique	4.5	10102- 43- 9	1660	B	EPA	

A = Listed flammable substance (EPA) **B** = Listed toxic substance (EPA) **C** = Listed flammable substance (CRAIM)
D = Listed toxic substance (CRAIM) **E** = Listed explosive substance (CRAIM) **F** = Listed various substance (CRAIM)

LIST OF HAZARDOUS MATERIALS OF CRAIM

(by class and by alphabetical order of English name)

No.	Name of substances (English name)	(French name)	Threshold qty (metric ton)	CAS No.	UN No.	CRAIM Class	Origin	Remarks
			EPA - LISTED TOXIC SUBSTANCE					
58	Oleum	Oléum (Acide sulfurique fumant, acide sulfurique avec du trioxyde de soufre en solution)	4.5	8014- 95- 7	1831	B	EPA	
59	Peracetic acid	Acide peroxyacétique	4.5	79- 21- 0	2131	B	EPA	
60	Pichlorhydrin	Épichlorhydrine	9.1	106- 89- 8 2	023	B	EPA	
61	Piperidine	Pipéridine	6.8	110- 89- 4	2401	B	EPA	
62	Phosgene	Phosgène	0.22	75- 44- 5	1076	B	EPA	
63	Phosphine	Phosphine	2.25	7803- 51- 2	2199	B	EPA	
64	Phosphorus oxychloride	Oxychlorure de phosphore	2.25	10025- 87- 3	1818	B	EPA	
65	Phosphorus trichloride	Trichlorure de phosphore	6.8 7	719- 12- 2 1	809	B	EPA	
66	Propionitrile	Propionitrile	4.5	107- 12- 0	2404	B	EPA	
67	Propyleneimine	Propylèneimine	4.5	75- 55- 8	1921	B	EPA	
68	Sulfur dioxide	Dioxyde de soufre	2.25	7446- 09- 5	1079	B	EPA	
69	Sulfur tetrafluoride	Tétrafluorure de soufre	1.14	7783- 60- 0	2418	B	EPA	
70	Sulfur trioxide	Trioxyde de soufre	4.5	7446- 11- 9	1829	B	EPA	
71	Tetramethyl lead	Plomb tétraméthyle	4.5	75- 74- 1	1649	B	EPA	
72	Tetranitromethane	Tétranitrométhane	4.5	509- 14- 8	1510	B	EPA	
73	Titanium tetrachloride	Tétrachlorure de titane	1.14	7550- 45- 0	1838	B	EPA	
74	Toluene diisocyanate	Diisocyanate de toluène	4.5	26471- 62- 5	2078	B	EPA	
75	Trichloromethanesulfenyl chloride	Mercaptan méthylique perchloré	4.5	594- 42- 3	1670	B	EPA	
76	Trimethylchlorosilane	Triméthylchlorosilane	4.5	75- 77- 4	1298	B	EPA	
77	Vinyl acetate	Acétate de vinyle	6.8	108- 05- 4	1301	B	EPA	

A = Listed flammable substance (EPA) **B** = Listed toxic substance (EPA) **C** = Listed flammable substance (CRAIM)
D = Listed toxic substance (CRAIM) **E** = Listed explosive substance (CRAIM) **F** = Listed various substance (CRAIM)

LIST OF HAZARDOUS MATERIALS OF CRAIM

(by class and by alphabetical order of English name)

No.	Name of substances (English name)	(French name)	Threshold qty (metric ton)	CAS No.	UN No.	CRAIM Class	Origin	Remarks
	CRAIM - LISTED FLAMMABLE SUBSTANCE							
1	1,2- Dichloroethane	Dichlorure d'éthylène	50	107- 06- 2	1184	C	CCAIM List #1	inflammable
2	2- Methyl - 2- Propanamine	t- Butylamine	10	75- 64- 9	1125	C	CCAIM List #2 and NFPA (F= 4)	inflammable
3	Benzene	Benzène	10	71- 43- 2	1114	C	CCAIM List #1	inflammable
4	Cyclohexane	Cyclohexane	50	110- 82- 7	1145	C	CCAIM List #1	inflammable
5	Dimethyl sulfide	Sulfure de méthyle	10	75- 18- 3	1164	C	CCAIM List #2 and NFPA (F= 4)	inflammable
6	Ethylbenzene	Éthylbenzène	50	100- 41- 4	1175	C	CCAIM List #1	inflammable
7	Gasoline	Carburant d'automobile (essence)	50	86290- 81- 5	1203	C	CCAIM List #1	inflammable
8	Naphte petroleum ether	Naphta	50	8030- 30- 6	2553 and 1256	C	CCAIM List #1	inflammable
8	Natural gas	Gaz naturel liquéfié (voir méthane)	4.5	8006- 14- 2	1074	C	CCAIM List #1	inflammable
10	Toluene	Toluène	50	108- 88- 3	1294	C	CCAIM List #1	inflammable
11	Xylenes	Xylènes	50	1330- 20- 7	1307	C	CCAIM List #1	inflammable

A = Listed flammable substance (EPA) **B** = Listed toxic substance (EPA) **C** = Listed flammable substance (CRAIM)
D = Listed toxic substance (CRAIM) **E** = Listed explosive substance (CRAIM) **F** = Listed various substance (CRAIM)

LIST OF HAZARDOUS MATERIALS OF CRAIM

(by class and by alphabetical order of English name)

No.	Name of substances (English name)	(French name)	Threshold qty (metric ton)	CAS No.	UN No.	CRAIM Class	Origin	Remarks
			CRAIM - LISTED TOXIC SUBSTANCE					
1	2- Chloroethanol	Chloroét. (2- Chloroéthanol)	1	107- 07- 3	1135	D	CCAIM List #2 and NFPA (H= 3)	toxic
2	Allyl chloride	Chlorure d'allyle	0.45	107- 05- 1	1100	D	CCAIM List #2 and OSHA	toxic and inflammable
3	Anhydre hydrobromic acid	Bromure d'hydrogène	2.25	10035- 10- 6	1048	D	CCAIM List #2 and OSHA	toxic
4	Carbon monoxide	Monoxyde de carbone	10	630- 08- 0	1016	D	CCAIM List #2 and NFPA (F= 4)	toxic
5	Chloropicrin (Trichoronitromethane)	Chloropicrine (Trichoronitrométhane)	0.22	76- 06- 2	1580	D	CCAIM List #2 and OSHA	toxic
6	Chlorosulfonic acid	Acide chlorosulfonique	1	7790- 94- 5	1754	D	CCAIM List #2 and NFPA (H= 4)	toxic and decomposed
7	Cyanogen bromide	Bromure de cyanogène	1	506- 68- 3	1889	D	CCAIM List #2 and NFPA (H= 4)	toxic
8	Ketene	Cétène	0.05	463- 51- 4		D	CCAIM List #2 and OSHA	toxic
9	Mercury	Mercure	1	7439- 97- 6	2809	D	CCAIM List #1	toxic
10	Methacrolein	Méthylacroléine	0.45	78- 85- 3	2396	D	CCAIM List #2 and OSHA	toxic and inflammable
11	Methacryloyloxyethyl isocyanate	Méthacrylate de 2-isocyanatoéthyle	0.05	30674- 80- 7	2478	D	CCAIM List #2 and OSHA	toxic
12	Methyl bromide	Bromure de méthyle	1.15	74- 83- 9	1062	D	CCAIM List #2 and OSHA	toxic
13	Methyl iodide	Iodure de méthyle	3.4	74- 88- 4	2644	D	CCAIM List #1	toxic
14	Methyl vinyl ketone	Méthyl vinyl cétone	0.05	78- 94- 4	1251	D	CCAIM List #2 and OSHA	toxic
15	Nitrogen dioxide	Dioxyde d'azote	0.11	10102- 44- 0	1067	D	CCAIM List #2 and OSHA	toxic
16	Osmium tetroxide	Tétroxyde d'osmium	0.05	20816- 12- 0	2471	D	CCAIM List #2 and OSHA	toxic and explosive
17	Phenol	Phénol	10	108- 95- 2	1671, 2821 et 2312	D	CCAIM List #2 and NFPA (H= 4)	toxic and poison
18	Stibine	Stibine	0.22	7803- 52- 3	2676	D	CCAIM List #2 and OSHA	toxic and inflammable
19	Tetraethyl lead	Plomb tétraéthyle	1	78- 00- 2	1649	D	CCAIM List #1	toxic and inflammable

A = Listed flammable substance (EPA) **B** = Listed toxic substance (EPA) **C** = Listed flammable substance (CRAIM)
D = Listed toxic substance (CRAIM) **E** = Listed explosive substance (CRAIM) **F** = Listed various substance (CRAIM)

Annex 3

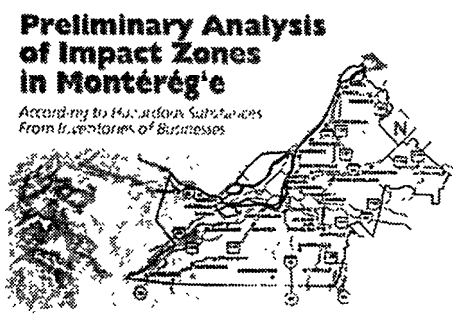
LIST OF HAZARDOUS MATERIALS OF CRAIM

(by class and by alphabetical order of English name)

No.	Name of substances (English name)	(French name)	Threshold qty (metric ton)	CAS No.	UN No.	CRAIM Class	Origin	Remarks
			CRAIM - LISTED TOXIC SUBSTANCE					
20	Thionyl chloride	Chlorure de thionyle	0.11	7719- 09- 7	1836	D	CCAIM List #2 and OSHA	toxic and decomposed
21	Trioxychlorofluoride	Fluorure de perchloryle	2.25	7616- 94- 6	3083	D	CCAIM List #2 and OSHA	toxic
22	Trichloronitromethane (chloropicrin)	Trichloronitrométhane (chloropicrin)	0.22	76- 06- 2	1580	D	CCAIM List #2 and OSHA	toxic
			CRAIM - LISTED EXPLOSIVE SUBSTANCE					
1	Ammonium perchlorate	Perchlorate d'ammonium	3.4	7790- 98- 9	1442	E and OSHA	CCAIM List #2	oxidant and explosive
2	Explosives	Explosifs (classe 1.1)	2.25			E		explosive
3	Hydrogen peroxide (> 52%)	Peroxyde d'hydrogène (> 52%)	3.4	7722- 84- 1	2015	E and OSHA	CCAIM List #2 (explose)	oxidant and reactive
4	Sodium chlorate	Chlorate de sodium	10	7775- 09- 9	1495	E	CCAIM Liste #1 si confiné en baril	oxidant and explosive
			CRAIM - LISTED VARIOUS SUBSTANCE					
1	Phosphorus (white)	Phosphore blanc	1 77	23- 14- 0	1381 et 2447	F	CCAIM List #2 and NFPA (F= 4)	inflammable and product of toxic combustion

A = Listed flammable substance (EPA) **B** = Listed toxic substance (EPA) **C** = Listed flammable substance (CRAIM)
D = Listed toxic substance (CRAIM) **E** = Listed explosive substance (CRAIM) **F** = Listed various substance (CRAIM)

Contact Information for Study Municipalities



Annex

1. Beauharnois

Contact person:

Mr. Jean-Claude Nareau
Ville de Beauharnois
Beauharnois, Québec
Tel.: (450) 429-7831

2. Beloeil

Contact person:

Mr. Donald Lebrun
Service des incendies
Beloeil, Québec
Tel.: (450) 536-2835

3. Boucherville

Contact person:

Mr. Sylvain Sawyer and Mr. Michel Huguerot
Ville de Boucherville
Boucherville, Québec
Tel.: (450) 449-8263

4. Brossard

Contact person:

Mr. Gérard Chouinard, Chef de la prévention
Service de la prévention des incendies
Ville de Brossard
3300 boul. Lapinière
Brossard, Québec J4Z 3L8
Tel.: (450) 926-7910
Fax: (450) 926-7928

5. Candiac

Contact person:

Mr. Steve Lamontagne and
Mr. André Marcoux, responsable de l'inventaire
Ville de Candiac
Candiac, Québec
Tel.: (450) 444-6063

6. Contrecœur

Contact person:

Mr. Michel Robert
Ville de Contrecoeur
888 St-Antoine
Contrecoeur, Québec
Tel.: (450) 587-2042

7. Delson

Contact person:

Mr. Gaétan Leclerc
Ville de Delson
Delson, Québec
Tel.: (514) 820-7909

8. Greenfield Park

Contact person: **Mr. Lepage**
Ville de Greenfield Park
Greenfield Park, Québec
Tel.: (450) 466-8167

9. La Prairie

Contact person: **Mr. Yvon Daunais**, Directeur-adjoint
Sécurité publique
Prévention des incendies
Ville de La Prairie
600 boul. Taschereau
La Prairie, Québec J5R 1V1
Tel.: (450) 444-6652
Fax: (450) 444-6681

10. Longueuil

Contact person: **Mr. Gilles LaMadeleine,**
Ville de Longueuil
Longueuil, (Québec
Tel.: (450) 468-7600
Fax: (450) 468-7604

11. McMasterville

Contact person: **Mr. Mario Léonard**
Ville de McMasterville
McMasterville, Québec
Tel.: (514) 280-4850

12. Melocheville

Contact person: **Mr. Daniel Bolduc**
Ville de Melocheville
Melocheville, Québec
Tel.: (450) 429-6481

13. Saint-Hubert

Contact person: **Mr. Yvon Peat,**
Ville de Saint-Hubert
Saint-Hubert, Québec
Tel.: (450) 445-6742

14. Saint-Jean-sur-Richelieu

Contact person: **Mr. Gilbert Dupuis,**
Ville de Saint-Jean-sur-Richelieu
Saint-Jean-sur-Richelieu, Québec
Tel.: (450) 357-2072

15. Sainte-Catherine

Contact person: **Mr. Daniel Perron**
Ville Sainte-Catherine
Sainte-Catherine, Québec
Tel.: (450) 632-4602

16. Salaberry-de-Valleyfield

Contact person: **Mr. Jean Gariépy, Capitaine**, Prévention des incendies
Direction de la prévention des incendies
Ville de Salaberry-de-Valleyfield
75 rue St-Jean-Baptiste
Salaberry-de-Valleyfield, Québec J6T 1Z6
Tel.: (450) 370-4752
Fax: (450) 370-4755
E-mail: jean.gariepy@ville.valleyfield.qc.ca

17. Sorel

Contact person: **Mr. Alain Rouleau**
Ville de Sorel
Sorel, Québec
Tel.: (450) 742-5656

18. Tracy

Contact person: **Mr. Bertrand Tellier**
Ville de Tracy
Tracy, Québec
Tel.: (450) 742-5611

19. Varennes

Contact person: **Mr. Gérard Provost**
Ville de Varennes
Varennes, Québec
Tel.: (450) 652-9811 ext. 104

20. Verchères

Contact person: **Mr. André Larouche**
Ville de Verchères
Verchères, Québec
Tel.: (514) 592-1225