THE MAJOR INDUSTRIAL ACCIDENTS REGIONAL COUNCIL-MONTREAL METROPOLITAN area:

A global risk management multi-stakeholder process supported by consensus building and technology

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ABSTRACT:

MIARC-MM is a regional organization not for profit which aims to reduce the frequency and the severity of technological accidents principally hazardous substances. MIARC-MM strongly recommends the creation of a joint municipal-industrial process when referring to a risk management approach with well defined terms of reference and responsabilities for a municipality and its industries. Along with the advocated process, MIARC-MM insists on the utilization of aid-to-decision-making tools like modelization softwares underlining the characteristics and limitations of those softwares.

1. MIARC-MM

MIARC-MM is a regional independent chapter of the Major Industrial Accidents Council of Canada with its own operations at the regional and local level but submitted to by-laws, policies and rules of MIACC.

Therefore, its **VISION** is to virtually eliminate the risk from major industrial accidents involving hazardous substances.

The **MISSION** of MIACC and thus of MIARC is to reduce the frequency and severity of major industrial accidents involving hazardous substances and its main **OBJECTIVE** is to promote uniformity in the implementation of prevention, preparedness and response (PPR) program in every jursidiction and community of the Montreal Metropolitan area. Such a uniformity will help to ensure that PPR efforts are more co-ordinated and that the administrative burden of industry is reduced. This approach is viewed as an alternative to a strictly government-driven regulatory approach. It works through a voluntary, consultative and consensus-building process. This is a unique experience recognized in international fora such as the United Nations Environment Program, the Organization for Economic Cooperation and Development and the International Labour Office.

The network of MIARC reaches out near 300 industries, 100 municipalities, regional institutions in the field of public health and public safety, federal and provincial government organizations of the Montreal Metropolitan area. It promotes the adoption and use of MIACC products (guidelines, standards and policies especially) with some regional adaptation and develops its own products and services when necessary.

MIARC is about to complete risk management guidelines as an integrative and global process to better achieve its goals of prevention and preparedness. MIARC has run five seminars on risk assessment as an awareness of first steps towards joint municipal-industry risk management efforts and training of those that need to develop basic skills in risk assessment. In the same fashion, a risk communication workshop was held to allow further training and continuous risk communication programs to be set up throughout the area.

In line with the Guiding principles for effective joint municipal and industry emergency preparedness which focusses on the interface between local public authorities and industrial risk generators, MIARC promotes the joint municipal-industry planning process:a committee including the two line-stakeholders, involved citizens and representatives of other public services in the eastern part of the Montreal area (Montreal-East, Montreal and Anjou). This intitiative reflects the APELL (awareness,prevention,emergency at the local level) program of UNEP. Other communities are progressing towards such a process: Varennes, Valleyfield, Basses Laurentides, St-Laurent, West Island, Laval, the South shore with Longueil as a leader, St-Jean and several areas within the City of Montreal.

MIACC has developed a standard on emergency planning for industry (CAN CSA Z 731-95) published through CSA which provides operators of industrial sites with the necessary guidelines to implement a comprehensive emergency response plan. This standard is now being promoted as an international standard through the International Standardization Organization (ISO). MIARC does promote the implementation of the standard.

Among the MIACC products in the category of risk management, let us mention the following: lists of priority hazardous substances; risk assessment guidelines; risk-based land use planning guidelines; transportation of dangerous goods corridors and pipeline corridors guidelines.

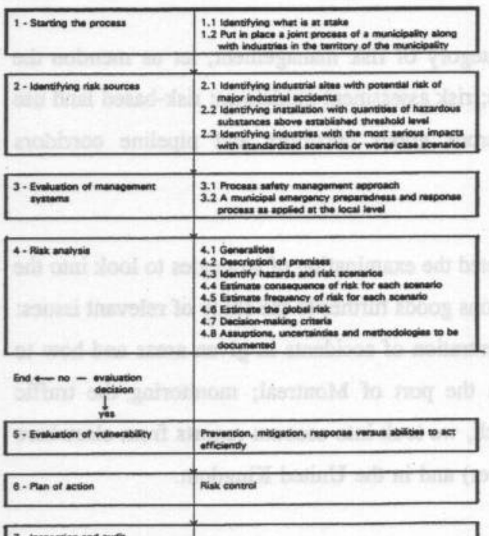
Montreal Urban Community has completed the examination of strategies to look into the multi-modal aspects of transportation of dangerous goods further to the study of relevant issues: choices of routes and their management; concentration of accidents in given areas and how to prevent this to happen; multi-modal yards in the port of Montreal; monitoring the traffic controls; inspections and audits. In this approach, we took into account reports from elsewhere in Canada (Toronto, Alberta, Greater Vancouver) and in the United Kingdom.

In developing the process, MIARC attempts to integrate in an overall system risk management, process safety management, environment management systems, the EHS total process as linked with the above.

When we do all of this, we are confronted with more than concepts: data bases, softwares,technological guidance. It has been especially our experience in risk management where we have several support tools at our disposal.

We will now focuss on support tools to risk management decision-making process. As mentioned above, MIARC will soon be completing risk management guidelines with reference to Canadian Standards Association (CSA) Q 850 guiding principles on **risk management for decision-makers**. MIARC has developed an adapted concept of this standard to better reflect its needs as seen in figure 1. In different steps, each stakeholder has a role to play: joint municipal-industry committees, municipalities and industries involved in the effective risk management process.

FIGURE 1 - Risk management process



In the course of the risk management process, a certain number of supportive tools may be useful while making decisions. One must understand that software tools may not answer all questions. These decision-making tools are not the exclusive source of reference while making decisions.

2. THE RISK ASSESSMENT PROCESS

In a risk assessment process, the first step is to identify the hazard. We could help ourselves with three different types of lists to prioritize facilities that represent a major risk with a serious impact on the population: the first list will identify industrial sites with potential risk of a major industrial accident; the second list will identify installations with quantities of hazardous substances above established threshold level or with substances that are deemed hazardous further to a fire or as a chemical reaction. The third list is the one where we have industries with the most serious impacts. It is here that we will rely on softwares that could provide a basis for better results and reliable criteria for safe results to be used afterwards. One must underline that regardless of recent progress same uncertainties may remain and require to be cautious with the results. In our risk management guidelines, certain tools will be useful to assess impact zones. For instance, in such cases we may take into account the domino effect. If we simulate the explosion of a tank, we must include when it applies the presence of other tanks in the vicinity, thus expanding the impact zone.

As shown in figure 2, when we know the nature of hazardous substances involved in an accident, we could identify the consequence of a loss of confinement. The figure does modelize different types of accidents.

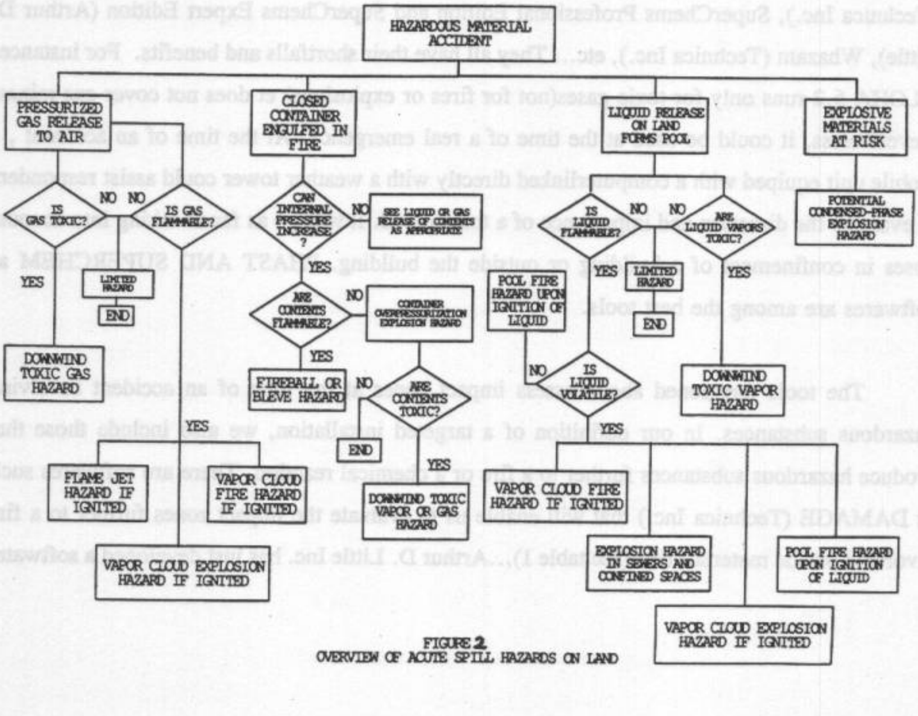


FIGURE 2
OVERVIEW OF ACUTE SPILL HAZARDS ON LAND

2.1 AID TO DECISION-MAKING TOOLS

In this risk management process, certain tools will allow to establish impact zones and buffer zones in a land-use planning strategy. ARCHIE (Automated Resource for Chemical Hazard Incident Evaluation) is a trigger software made available free of charge through the american environment protection agency (EPA). ARCHIE enables us to assess different types of accidents involving hazardous substances.It will take into account release quantities, estimate impact zones or plume when in presence of a toxic cloud, fire characteristics (fire ball resoluting from a bleve, liquid pool fire, vapour or dust cloud, jet flames), explosion characteristics (explosion from a vapour cloud, BLEVE, radiation and overpressure). When calculating the impact zone, one has to take into account retention bassins, that may influence the rate of evaporation. We must notice that results obtained with ARCHIE are conservative, but must be used a a trigger for other steps.

Many other sofwares are also available: ALOHA 5.2 (EPA), PHAST Professional (Technica Inc.), SuperChems Professional Edition and SuperChems Expert Edition (Arthur D. Little), Whazam (Technica Inc.), etc... They all have their shortfalls and benefits. For instance, ALOHA 5,2 runs only for toxic gases(not for fires or explosions) et does not cover gas mixes. Nevertheless, it could be used at the time of a real emergency. At the time of an accident , a mobile unit equiped with a computerlinked directly with a weather tower could assist responders to evaluate the direction and importance of a toxic cloud. It will go as far as taking into account doses in confinement of a building or outside the building. PHAST AND SUPERCHEM as softwares are among the best tools.

The tools mentioned above assess impact zones at the time of an accident involving hazardous substances. In our definition of a targeted installation, we also include those that produce hazardous substances further to a fire or a chemical reaction. There are softwares such as DAMAGE (Technica Inc.) that will enable us to evaluate the impact zones further to a fire involving plastic material, tires(see table 1)...Arthur D. Little Inc. has just developed a softwatre which applies the risk assessment methodology to transportation of dangerous goods issues: ADL-TRS.

TABLE 1

ARCHIE	- Fire, explosion, toxic gas - The results are very high	FEMA/DOT/EPA
ALOHA	- Toxic cloud modelization - Data base of 800 hazardous substances - Possible to run with a meteo tower - Superposition of results on a map	NOAA
Superchem Expert	- Fire, explosion, toxic gas - Precision applicable for risk analysis	Arthur D. Little
PHAST	- Fire, explosion, toxic gaz - Precision applicable for risk analysis	Technica
SAFETI-MICRO	- Risk analysis - Run with PHAST	Technica
HGSYSTEM	- Heavy gas modelization - Developed for Fluorydric acid (HF)	Shell research
EFFECT-2	- Dispersion model	TNO
DAMAGE	- Consequence for hazardous substances formed as result of a chemical reaction	TNO
ADL-TRS	- Risk analysis applied to transportation of dangerous goods issues	ADL

Several of these software may interface with geocoding mapping systems for more accuracy.

Once a targeted installation has been identified, it is up to the industrial authorities to conduct a risk analysis. During such a phase, one must take into consideration not only the consequences but also the probabilities that an accident will occur, RISK = PROBABILITY X CONSEQUENCE. This is the quantitative risk assessment (QRA approach) which is more appropriate.

Qualitative risk assessment allows to identify hazards, to prioritize and suggest corrective measures when necessary. Several qualitative methods could be mentioned namely: What if? HAZOP, DOW index, MOND index, Fault tree, Event tree ...

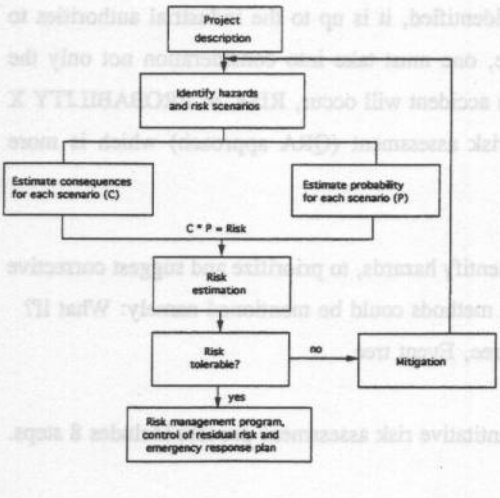
As you will notice in figure 3, the quantitative risk assessment process includes 8 steps.

Such an approach will provide an estimation of the risk with quantities end therefore will establish the individual risk. For instance, we could estimate that the risk to be exposed to an accident for a person living at 500 meters from the hazardous site is 1 out of 1 000 000 or 10^6. We should have a better understanding of the risk when we compare it with something less abstract such as dying in a house further to an explosion caused by natural gas. This should facilitate the decision-making process.

Afterwards, if the risk is tolerable, the industry will put into place a risk management program with firm control of residual risks and emergency planning. If the risk is intolerable, the industry will put in place mitigation measures in order to make it tolerable. For instance, the industry could think of reducing the volume of tanks, reinforce with double sides, install retention bassin, have walls to stop the fire...

For new projects, evaluation of the risk will be useful for the purpose of land-use planning. We shall be able to establish buffer zones beside determining the category of land use permitted according to the risk level.

Figure 3: Methodology of risk analysis



2.2 GUIDING PRINCIPLES

A number of rules must be followed in order to make the results of those softwares acceptable. The accident scenario modelized will be a standardized scenario or worse case scenario, which will consist of a lost of confinement of the greater quantity of hazardous material in a container or a group of interconnected containers. It implies a total loss of confinement within ten minutes under the worse weather conditions (stability F with a wind at the velocity of 1.5 meter per second) and that we have retention bassins. In the case of explosions, it implies the total volume of explosives.

Toxicity levels are of great importance to measure a plume.One must use ERPG 3 (emergency response planning guidelines) as being a maximum concentration in the air under which we believe most people could be exposed within an hour without being affected by consequences that would put their lives in jeopardy. When ERPG are not well defined for a given hazardous susbstances, we must use 1/10 of IDLH(immediate dangerous for life and health) in order to take into account the general population.

For flammables, thermal flux will be 5.0 kw/m2 where with explosives, the overpressure will be 68 mbar(a) ou 1.0 psia. Those two indexes reflect deaths.

This well illustrates that beyond figures there is a scientific base that we must take into account to support what we state.

CONCLUSION

A process like MIARC must assist the operators and managers in the field of risk technology to rely on scientifc and technical grounds for their decisions. In doing so, one must use a risk management process which does include risk evaluation. A grid of criteria may help in choosing the most convenient tools when managing the process and determine the course of action.

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