

PART III
RESPONSE

Report of Working Group 3

**A Review of Measures Taken by Industries and
Governments to Prepare for and Respond to
Major Industrial Incidents in Canada**

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SUMMARY

This report examines the measures taken by industries and governments to prepare for, and respond to major chemical accidents in Canada. The magnitude of Bhopal-type incidents is so great, and the events can develop so quickly that the primary effort must be in their prevention. There are some technical, economic and logistical limits to the abilities of both industries and governments to confine, or to limit damage from a major release once it has occurred. Fortunately, accidents of major magnitude have been extremely rare in Canada. The main efforts for improving chemical accident preparedness and response by industries and governments have been for the minor and medium-sized accidents, although contingency plans do provide for escalation to major disasters. Prompt, effective response to the smaller and medium-sized releases can help to ensure that these incidents do not grow to disaster proportions. In general, industries are responding to such releases quite well.

Our review group also found that considerable work towards preparedness has been done by industries and governments for major accidents as well. While recognizing these efforts, we have also identified a number of gaps in technical knowledge, in assessment and acquisition of existing technology, and in the development of new and innovative countermeasures technology for both smaller and larger chemical releases.

Several conclusions and recommendations in this report address these gaps or needs. Such actions can help to improve our collective readiness for major incidents in Canada, but the biggest step that must be taken, is a wider understanding and acknowledgement that a major chemical accident can occur in Canada, virtually in any urban or rural location where hazardous chemicals or dangerous goods are manufactured, transported or used. With a change in outlook, people having concerns or responsibilities for preventing and preparing for such events can review their efforts and gain the needed support and resources to improve their contingency plans and their responses to hazardous chemical accidents.

1 INTRODUCTION

This report outlines the measures taken in Canada by industries and governments to prepare for and respond to Bhopal-type incidents. Canadians are aware of recent major industrial accidents that have taken place around the world, such as in Seveso (Italy), Mexico City, and most recently Bhopal. Closer-to-home incidents such as the Mississauga train derailment and the sour natural gas blow-out at Lodgepole, Alberta, have alerted the public that Canada may not be immune to such potential major disasters.

The Bhopal Aftermath Steering Committee established Working Group 3 to determine what steps are being taken to prepare for such calamities in Canada.

This group was given the following terms of reference:

- a) Review the recommendations of previous evaluations for federal-provincial councils of ministers (e.g., Canadian Council of Resources and Environment Ministers, Council of Ministers of Transport and Highway Safety) and of other appropriate technical documents in regard to the whole area of response to environmental emergencies.
- b) Identify the information gaps that need to be filled.
- c) Review the extent of consultation between industry and governments in developing plans and preparing for accidents.
- d) Make recommendations as appropriate.

Although all industrial accidents large or small are undesirable, the principal focus of this report will be on major chemical accidents as defined by the Steering Committee. These are major industrial or transportation incidents resulting in acute exposure to chemicals and which have the potential to cause death or adverse health effects in the community.

The preparations for and response to smaller but significant chemical accidents are also addressed because of the importance of preventing these incidents from escalating into major ones.

The types of major chemical accidents that this report addresses are as follows:

- 1) explosions or fires at a chemical manufacturing plant, oil refinery or storage facility;
- 2) an inadvertent release of an acutely toxic gas from a manufacturing or storage facility;

- 3) transportation accidents releasing large volumes of hazardous chemicals; and
- 4) misuse of chemicals causing a major toxic release, e.g., accidental mixtures.

Provincial and territorial input to this report was sought through the circulation of a questionnaire to a composite group of provincial agencies in each province and territory, usually coordinated by an emergency measures agency. Background information was also received from a number of provinces.

2 EMERGENCY INCIDENT READINESS AND RESPONSE

2.1 Industries

As is stressed repeatedly in this report, the magnitude of Bhopal-type incidents can be so great, and the events can happen so quickly that the primary effort must be focussed on prevention. Industrial and government capabilities to mitigate damage once a major accident has occurred are severely limited. Industrial efforts have been largely focussed on preparing for and responding to small and medium-sized chemical accidents (while still planning for major disaster scenarios), and on countermeasures to ensure that the event does not grow into a more serious accident.

In Canada, in every jurisdiction of government concerned with emergencies, the principle that is applied is "the polluter pays", i.e., the polluter is responsible for initiating the response and for all the costs of clean-ups and damage/liability. The chemical and petroleum industries and several others that are major chemical consumers have a number of levels of spill response plans in place, either as individual companies, or as mutual-aid associations. Furthermore, many individual companies are members of more than one trade association. This provides the opportunity for an exchange of ideas, information and equipment to some extent between, for example, the petroleum industry, the industrial chemical industry, chlorine producers and ammonia producers. Most of the chemical industry contingency plans also cover their products during transportation and delivery to major chemical consumers. A few commercial spill clean-up contractors are also established in Canada, but with the possible exception of some sour gas blowout control companies, they are not experienced in dealing with major incidents involving toxic chemicals.

2.1.1 The Petroleum Industry. The "upstream" (exploration and production) and "downstream" (refining and marketing) segments of the petroleum industry have, since the mid-1970s, cooperated with each other and with federal and provincial agencies in programs for oil spill prevention, contingency planning, response training and countermeasures evaluation and research. An industry-wide committee forms the Spill Response Division of PACE (The Petroleum Association for Conservation of the Canadian Environment) and meets three times a year with associated federal government representatives to coordinate this effort. The investments by the oil industry in spill programs over the years have amounted to thousands of hours of effort and many millions of dollars, including considerable funding of joint research projects with government agencies. The

net result of this substantial effort by the oil industry (represented by the Canadian Petroleum Association and its regional affiliates, and by PACE) has been the development of a comprehensive state of preparedness for small to medium-sized oil and petroleum fuel spills, and a substantial advancement in oil spill countermeasures equipment and techniques, particularly for cold climates. A further long-term effort with the federal government has resulted in a joint government-industry contingency plan for major marine oil spills

Potential releases of petrochemicals from petroleum industry refineries and product storage facilities are covered both by company contingency plans, and by plans involving response mutual aid for facilities located in areas of refinery and chemical industry concentration (e.g., in Sarnia, Ontario, the Chemical Valley Emergency Control Organization). These local plans and another national mutual aid plan called "TEAP" which covers incidents during transportation of petrochemical industry products, are discussed further in Section 2.1.2.

The propane and butane producers of the petroleum industry are represented by the Propane Gas Association of Canada (PGAC). In response to the passage of legislation under the Transportation of Dangerous Goods Act, the PGAC and its member companies (mainly the local and regional propane or butane dealers) developed a comprehensive response plan for propane and butane incidents. The PGAC plan involves a network of "Remedial Measures Advisors" or RMAs who can be called through an emergency telephone number to go to the scene of a propane or butane incident and deal with the situation. The role of RMAs may be the provision of special tools, technical advice or assistance to an on-scene commander, or on occasion, the hands-on fixing of the problem.

Another series of company response plans have been developed in the exploration, production and marketing sectors of the petroleum industry. Comprehensive oil spill response plans and specialized equipment inventories are wide-spread in the western provinces and in frontier areas of Canada (approximately 90 co-operative equipment pools currently exist). Some of this equipment is also applicable and available for certain toxic chemical spills, although not for most of the chemicals considered in this review. In the Bhopal context, however, sour gas (natural gas contaminated by hydrogen sulphide) emergency contingency plans have been required by provincial regulatory agencies for a number of years for all companies active in petroleum exploration and production. Even more comprehensive response plans have been developed in Alberta to cover potential releases of sour gas from "critical sour gas wells" having a high

concentration of hydrogen sulphide. The development of such plans and response mechanisms has been closely guided and monitored by provincial government agencies such as the Alberta Energy Resources Conservation Board and the Alberta Public Safety Services agency. In recognition of the industry's responsibilities, and the valid concerns of the public, nearby communities and provincial regulatory agencies, the Canadian Petroleum Association is developing guidelines for the preparation of company contingency/response plans for critical sour gas wells.

These guidelines outline methods of hazard assessment, company personnel responsibilities, interfacing with government agencies and the public evacuation criteria and arrangements, gas dispersion monitoring, and post-emergency procedures. In the planning process, close contact is maintained with the public, including personal interviews with all residents who could have exposure to excessive levels of hydrogen sulphide to identify those who may be handicapped or need special assistance in evacuation. The emergency plans are freely available to the public, and are generally discussed annually in open public meetings. Although implemented by industry, these plans require close involvement with affected government personnel and with the public in plan preparation.

2.1.2 The Industrial Chemical Industry. The Canadian Chemical Producers' Association (CCPA) represents companies that produce approximately 75 percent of the industrial chemicals and synthetic resins manufactured in Canada. All of these companies have signed the CCPA's responsible care statement that includes a guiding principle calling for the company to "ensure that its operations do not present an unacceptable level of risk to its employees, customers, the public or the environment". They have all considered the need for contingency plans addressing emergencies should they occur. A few companies have determined that an elaborate plan is not necessary since the companies either do not handle dangerous chemicals or the dangerous chemicals they do handle have little or no propensity to escape from the plant site. These companies have contingency plans that are similar in scope to those of the typical manufacturing facility. At the other extreme are large chemical companies that have developed comprehensive contingency plans designed to address every possible emergency scenario that could reasonably be expected to occur.

For example, CIL Inc. has Chemical Emergency Response Teams at its five major plants in Canada, managed by trained response personnel and equipped with special vehicles, basic specialized equipment and protective gear. Smaller Product

Emergency Response Teams (PERTs) are located at 12 other centres to deal with specific product releases. All of these teams are linked to a 24-hour emergency telephone call system and there is back-up support from more than 200 trained personnel within the CIL emergency response system. Such a system is representative of the larger company's standard for contingency planning and response to its own incidents.

In between these two extremes are companies that are often medium-sized and handle dangerous goods but not in the same volume or variety as the larger chemical companies. These companies have the difficult task of designing emergency plans that are suitable for the dangerous goods they handle and yet workable, recognizing that they may not have the resources of the larger chemical company.

A CCPA survey carried out early in 1985 provided some evidence that companies in this category have prepared contingency plans that are reviewed and updated either routinely, in response to serious fires or other incidents in the local municipality, or following major international incidents. However, this survey was not sufficient to conclusively demonstrate that all of these companies have adequate plans. CCPA's proposed safety assessment program described in the report by Working Group Number 2 has sections addressing in-plant emergency control, identification of the potential impact of emergencies and the development of an emergency plan framework. The overall level of preparedness of CCPA members will be more precisely determined when this assessment is completed by CCPA's membership. The CCPA will also be preparing a responsible care practice for its members that will provide them with guidelines for emergency planning.

In two areas of Canada where there is some concentration of chemical and petroleum facilities, mutual aid systems that are well integrated with the local community have been established. In Sarnia, Ontario, an industrial mutual aid plan involving the Sarnia fire department, was first developed in 1951. Now this organization functions as a committee of the Chemical Valley Emergency Control Organization (CVECO). The purpose of CVECO is to bring together key industry, fire, law enforcement and public utility personnel to formulate and put into action an emergency plan, to provide a closer relationship between members and to cooperate with authorities in the event of an emergency. Membership is open to industry and community personnel actively engaged or interested in the protection of lives, property and equipment in the industrial area of Sarnia. Over the years, the original emergency plan has been tested through regular simulations and revised and updated as needed. The end result is a thoroughly tested emergency plan that can be put into effect on a moment's notice.

The mutual aid system in Fort Saskatchewan, Alberta, is called FORT MAP. FORT MAP has a constitution and maintains separate funds and equipment not possessed by individual members. The membership incorporates a large segment of the local chemical industry, the Canadian National Railway and representation from public sector organizations including the fire department, RCMP, ambulance service and local hospital. FORT MAP undertakes general contingency planning, actual mitigation of disasters and their effects on the population, establishment of emergency communications and public information systems, and preparation for security and traffic-related problems arising during emergencies. FORT MAP holds one large-scale disaster drill annually followed by a performance evaluation of participants. A review of the system by Alberta Public Safety Services early in 1985 concluded that "local industry should be applauded for developing and subsidizing FORT MAP". The review went on to suggest that in the future FORT MAP may want to place greater emphasis on mutual education and training of members as well as education of Fort Saskatchewan citizens.

In the field of emergency response to chemical transportation incidents, CCPA has had a Transportation Emergency Assistance Plan (TEAP) since 1971. TEAP was the first national system established in North America to offer technical advice at the scene of transportation emergencies and companies provided emergency response teams when they were requested. Early in 1983 TEAP was modified to fully transform the system into an emergency response organization.

TEAP is now a national voluntary mutual assistance service administered by the CCPA to minimize the effects of chemical transportation emergencies on human health, the environment and property. Under contract, if a chemical shipped by a TEAP member company is involved in a transportation emergency, a trained and equipped TEAP team is dispatched to the incident scene upon request by the TEAP member. TEAP functions through 10 (soon to be 11) Regional Response Centres (RRCs) located across Canada (see Appendix III-1) to offer complete coverage 24 hours a day, 7 days a week. Each RRC maintains a team of experienced personnel ready to provide technical advice and assistance. The minimum list of equipment suggested for each RRC appears in Appendix III-2. Each RRC maintains a vehicle for transporting this and other equipment to the emergency scene. Emergency vehicles range from trailers towed by utility vehicles up to large emergency response vans.

To activate TEAP, on-scene officials can telephone the shipper directly or through the Canadian Transportation Emergency Centre (CANUTEC), a public service operated by Transport Canada. The shipper may respond with his own emergency response

team or activate the TEAP system. In the latter event the TEAP RRC closest to the scene will dispatch an emergency team that will make every effort to reach the emergency scene within six hours. At the same time the shipper will send out his own technical advisor. Once these personnel reach the scene their role is to assist and advise the authorities on measures to control the situation. The TEAP team will be relieved by the shipper's own emergency response team within 24 hours if ongoing assistance is required. The CCPA's Board of Directors recently approved an extension of TEAP to non-CCPA companies associated with the chemical industry, providing that these companies are prepared to enter into a formal mutual-aid contract with CCPA.

TEAP is no longer largely an information service since this role has been assumed by CANUTEC, which provides immediate advice by telephone to anyone requesting information in any emergency situation involving dangerous goods in a spill, leak, fire, or incident involving human exposure. This assistance is available 24 hours a day, 7 days a week. CANUTEC and TEAP are complimentary - CANUTEC offers technical information and TEAP offers on-the-scene assistance. Together, they provide those at the scene of a chemical transportation emergency with rapid access to information and professional assistance in dealing with the chemicals involved. In 1983 and 1984 the number of calls upon TEAP totalled only 17, ranging from telephone referrals to the call-out of a TEAP team. This may reflect the rather small number of serious transportation incidents involving CCPA companies.

Another important TEAP activity has been the development of an Emergency Response Assessment with assistance from Esso Chemical Canada. This assessment provides a comprehensive check list of questions and points to be considered in a company's self-assessment of its contingency plan and emergency response arrangements. The assessment is in the final stages of development and so far has been completed by most of the companies operating TEAP Regional Response Centres.

Approximately 25 percent of the industrial chemicals and synthetic resins manufactured in Canada are produced by companies that are not members of CCPA and that may not have agreed to participate in any mutual-aid response plan for chemical accidents involving their products. Transportation in this segment of the industry has been reviewed by the Transport of Dangerous Goods Directorate (TDGD) of Transport Canada. The TDGD requires that a summary of contingency plans be filed if the company does not participate in TEAP or another approved mutual-aid plan. However, as indicated by the question marks in Appendix III-6, we feel that this part of the industry should be

examined in more depth, and that the recommendations described in this report should be applied to non-CCPA companies both for plant-site and transportation situations.

2.1.3 Other Segments of the Chemical Industry.

The Chlorine Industry. As part of a joint response plan by chlorine producers in Canada and the U.S., releases of chlorine in Canada are covered by a special industry plan called the Chlorine Emergency Plan (CHLOREP). This plan is administered by the Chlorine Institute in New York, but is normally activated in Canada through a call to the TEAP network or to Transport Canada's CANUTEC emergency centre. Response teams are located in Canada as part of the CHLOREP network. The plan, dealing solely with chlorine releases, is somewhat like that of a TEAP response plan, in that the responding CHLOREP Team is sent to the incident scene for a limited period of technical advice, assistance to an on-scene commander, or hands-on remedy of the problem. The shipper is expected to relieve the CHLOREP Team as soon as feasible. Standardized repair kits are used to deal with most leak problems arising from various standard sizes of chlorine cylinder, container, tank car and barge.

Hydrogen Fluoride Producers. Several North American manufacturers of hydrogen fluoride, including the single Canadian producer, have established a mutual aid "HF Emergency Response Program" for incidents involving this product. The plan is comparable to the CHLOREP plan described above, and can be triggered by a call to CANUTEC, or the CHEMTREC emergency centre in the United States.

The Specialty Chemicals Industry. A number of smaller specialty chemical suppliers and manufacturers operate plants and warehouses in Canada. These companies deal with smaller quantities of packaged products and would not likely have the potential for a Bhopal-type incident, although many of their products are acutely toxic. A study of their products, exact hazards and potential risks would be appropriate, however, in view of other industries also being examined.

The Pesticide Chemical Industry. One part of the Agricultural Chemicals Industry, represented by the Canadian Agricultural Chemicals Association, deals with pesticides. The primary concern for a Bhopal-type incident in this industry sector is a major fire of pesticides and other associated chemicals that may be present in an agricultural warehouse or transport vehicle. Such an incident could cause health effects in nearby communities, through a combination of toxic smoke plumes and contaminated water runoff. The smoke plume is the primary concern since it may contain a

combination of pesticide vapours, unburnt particles of active ingredient and many poorly characterized but possibly toxic products of chemical combustion. All of these products are carried skyward by the smoke plume's thermal rise, and then dispersed downwind over a wide area.

Contingency plans and response strategies for dealing with pesticide storage fires are somewhat different than for normal fires. General guidance is available through a brochure available from Pesticide Safety Data Distributors of Scarborough, Ontario, although specific advice should also be sought from the supplier, warehouse, operator, provincial agencies and the pesticide information data bank held by Transport Canada's CANUTEC emergency centre.

The Fertilizer Chemical Industry. The other facet of the "agrochemicals industry" is the fertilizer industry. This industry sector deals in large volumes of two chemicals of possible concern for Bhopal-type incidents - anhydrous ammonia and ammonium nitrate, although the primary concern would be for explosive-grade ammonium nitrate, not the fertilizer grade.

There are two response plans in place for anhydrous ammonia incidents in Canada, through the TEAP plan, and through an additional mutual-aid plan of western producers of anhydrous ammonia, under the Western Canada Fertilizer Association. We are not aware of any contingency plan for response to and mitigation of ammonium nitrate explosions. However, an inquiry or a site investigation after any explosion would involve the ammonium nitrate manufacturer, together with provincial authorities, the Explosives Branch inspectors of the Federal Department of Energy, Mines and Resources, or Bureau of Explosives inspectors from the American Association of Railroads, as well as the Canadian Transport Commission if the accident were to occur on a railway.

2.1.4 Other Process Industries. A number of other industries, including the pulp and paper, mining, and manufacturing industries involve companies which use toxic chemicals in their processes or operations, including some of those identified by Working Group I as chemicals of specific concern for major incidents. These industries should be examined in greater detail than was possible in this review, for their risk levels and their specific prevention and response capabilities.

The Pulp and Paper Industry. The pulp and paper industry uses large quantities of Bhopal-type chemicals such as chlorine, hydrogen sulphide and sulphur dioxide. Most pulp and paper plants have company contingency plans and trained teams to deal with minor incidents involving these and other chemicals. As customers of major chemical

suppliers, they also have access to mutual aid plans such as the CHLOREP and the TEAP plans for larger incidents.

The Mining Industry. The mining industry's mine rescue teams have an excellent reputation. Based on the nature of some mining industry responses to incidents involving toxic chemicals having potential major consequences (e.g., sodium cyanide), the level of company and industry contingency planning, training and response for incidents may not match the standard set for its rescue teams, particularly for off-site accidents where the plant response team may be many hours away from the spill site. We are aware of a few contingency plans and specially-equipped, trained teams for spill response at the site of mines, mills or smelters. More work by the industry appears necessary to address the questions of off-site releases and the adequacy of plans and response mechanisms for all mining industry companies that handle and use hazardous chemicals.

The Manufacturing Industry. The manufacturing industry is mainly comprised of small companies, most of which do not use toxic chemicals in quantities sufficient to create a Bhopal-type incident. A small proportion of these companies, however, could become involved in a major incident involving release of a significant volume of a toxic chemical of concern. The Canadian Manufacturers Association should survey its member companies to determine the level of risks and the guidance needed and stimulation of contingency planning and response by member companies or mutual-aid systems available from the chemical suppliers. Thereafter, in consultation with appropriate provincial and federal agencies and the chemical industry, it could undertake or guide specific technical projects to improve the level of contingency planning, training and response for member companies in this position.

2.1.5 The Transportation Industries.

The Railway Industry. In Canada, approximately 70 percent of the volume of dangerous goods regulated by the Transportation of Dangerous Goods Act is moved by rail. The frequency of spills due to railroad incidents is reportedly 10 percent of all transportation incidents. However, the volumes released in spills due to railway incidents are a far higher proportion than 10 percent because of the bulk quantities carried in rail cars.

Many railway companies in Canada have developed comprehensive preventative maintenance and emergency programs instituted by the railway industry. These programs have been supplemented through the implementation of the Grange Inquiry recommendations resulting from the Mississauga derailment. Major recommendations

from the Grange Inquiry include the development of speed restrictions for a list of special commodities being moved through populated areas, replacement of conventional bearings with roller bearings on freight cars, and coupler and thermal insulation protection on tank cars. The two major railway companies, and Ontario Northland, have each undertaken substantial training programs involving the handling of dangerous goods and emergency responses to incidents involving all types of dangerous goods, community awareness information seminars have been given throughout Canada involving well over 6 000 emergency-force personnel at 260 locations. Specialized response equipment has been strategically located in each railway region with smaller response equipment units operating from smaller centres within the regions.

For example, CN has three "Mobile 1" trailers, three medium-sized trailers, and six smaller "Mobile 3" vans each equipped with sophisticated response equipment (gas detecting instruments, self-contained breathing apparatus, specialized tools to secure emissions), all with fully-trained personnel. CP Rail also has designated emergency personnel from both the transportation and equipment departments of each region trained to respond to emergencies. The emergency mobile vans can serve as a command post, first-aid centre, communication centre, as well as a storage facility for initial response equipment. The vans may be transported either by rail or road.

In event of an accident, the computer systems within the major railway companies have the capability to identify precisely the dangerous goods involved, the car numbers, their location on the train, and what other goods are involved. Legislation covers the management of each trailerload, carload and containerload of dangerous goods. An emergency response form indicating the potential hazards, course of initial response action to be taken, and first-aid measures must accompany the shipment throughout its journey.

There are limitations, however, on the types and size of incidents that can be managed by the existing response plans and the current equipment inventories. Government agencies could assist the railways in a review of countermeasures capability.

The Trucking Industry. The trucking industry has a greater accident:tonnage ratio than the railway industry, however, this industry has recently accelerated its efforts for contingency planning and spill response training in order to comply with regulations under the Transportation of Dangerous Goods Act. Considerable progress has been made, although the training for some carriers has been rushed and may not be retained by participants unless followed by annual hands-on exercises and periodic refresher training. A number of major trucking companies, especially bulk chemical carriers, have their own