ON-LINE COMPUTER SYSTEMS FOR ENVIRONMENTAL EMERGENCY MANAGEMENT

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Our civilization is fueled on oil. The petroleum industry is vital to the Canadian economy. As our civilization increases in complexity, its requirements for petroleum continue to grow. Demand is outpacing supply. To meet the ever-increasing demand, more oil must be moved from ever-more remote producing areas to ever-increasing markets. Probability and experience tell us that spills of oil in the Canadian environment are inevitable. As land and resources grow more valuable, the consequences of spills of oil become of even greater concern.

The Environmental Emergency Branch of Environment Canada is concerned with the growing problem of accidental oil spills in Canada. This branch is designated the federal center to provide leadership, guidance, and technical advice in environmental emergency matters to other departments and agencies, provinces, and industries, both for contingency plans and on-scene operations. A national system for reporting and alerting the appropriate authorities of environmental accidents has been implemented. Dr. S.L. Ross, our chief of research and development, will be discussing the programs of the branch to improve preventive measures and to evaluate, test, and develop new equipment and countermeasure techniques in another paper at this conference.

In Canada, oil spills are a truly national problem. No area of our country is immune. We are quickly able to sketch the rough dimensions of this problem.[1] Regionally there is a fairly even distribution of oil spills. The Pacific Region (British Columbia and the Yukon) accounts for approximately 20%, the Northwest Region (Prairies and the Northwest Territories) approximately 24%, Ontario 11%, Quebec 24%, and the Atlantic provinces 21%. Approximately 39% of the significant spills recorded were from marine sources, 15% from road, 3% from rail, and 17% from pipelines. Stationary sources account for the rest. Light oil, such as diesel or stove oil, was involved in the largest number of spills (44%) Bunker accounted for 18%, crude 13% and gasoline 7%. The remainder includes other oils or undetermined kinds of oil. Forty-one percent of the significant oil spills were judged to occur in sensitive environments. Forty-four percent were not cleaned up at all, with only 23% cleaned up entirely. Human error was involved in at least 41% of the significant spills, and over half occurred with no contingency plans in force by the polluter. In only 38% of the oil spills recorded was any cleanup affected at all by the polluter.

Surely we can do a great deal better. There is much to do and little time to do it in.

One of the few things that has not grown in this ever-expanding society of ours is time–time to do something about the growing problems. Accurate and timely information is vital for the conduct of both countermeasures and analysis of accidental oil pollution. In the summer of 1973, the Environmental Emergency Branch decided to develop or acquire on-line computer systems for the support of countermeasures, operations, and analysis. To better manage that vital time resource, we would have computer systems that interactively converse with the emergency manager. We would make it easy for him to get vital information quickly, accurately, and in a usable form. By developing nation-wide systems at minimum cost we would provide federal leadership through a truly cooperative approach with industry and provinces.

Let us now examine what we have, how we and others use it, and how you can use it. If you or your firm are ever involved in a spill of oil in the Canadian environment, these environmental emergency management computer systems could be of real assistance to you.

In every spill there are questions that must be answered immediately.

1. What is the substance spilled?
2. What countermeasures and special precautions need to be taken?
3. Where are the nearest suitable equipment and materials to combat the spill?
4. Whom do we contact to get this vital equipment and material quickly?

Of less immediate importance, but still vital, are questions such as:

5. How did someone else handle a similar spill?
6. Is this spill part of a significant trend?
7. What experts and literature are available to assist?
8. What sections of federal law are applicable?

Our environmental emergency computer systems are configured to respond quickly to each of these questions and others too numerous to list here (see figure 1).

Technical Assistance Data System

In the event of an oil spill, the normal problems are not what is spilled and how to handle it. We do, however, have access through dial-up terminals to EPA's Oil and Hazardous Materials-Technical Assistance Data System (OHM-TADS) in Washington which could be used to identify an unknown material from its physical properties and to inform us of handling and countermeasures precautions, as well as toxicities of the substance spilled.

National Emergency Equipment Locator System

In dealing with spills of oil, the most pressing need is often for suitable equipment and material. To meet this need, Environment Canada directed the development by I.P. Sharp Associates, Ltd., of the National Emergency Equipment Locator System (NEELS) in

[1] This information is derived from the National Analysis of Trends in Emergencies (NATES) data base of approximately 450 spills of oil recorded by the National Environmental Emergency Centre between May 1972 and September 1974 (not including reports of just slicks). It is, of course, recognized that the data base is by no means all inclusive. It is hoped that the data in its present form will provide useful indications of some of the dimensions of the problems that we face. As more and more agencies become partners in NATES and add to the national-spill data base, the indications of trends and problem areas will sharpen and become better defined.

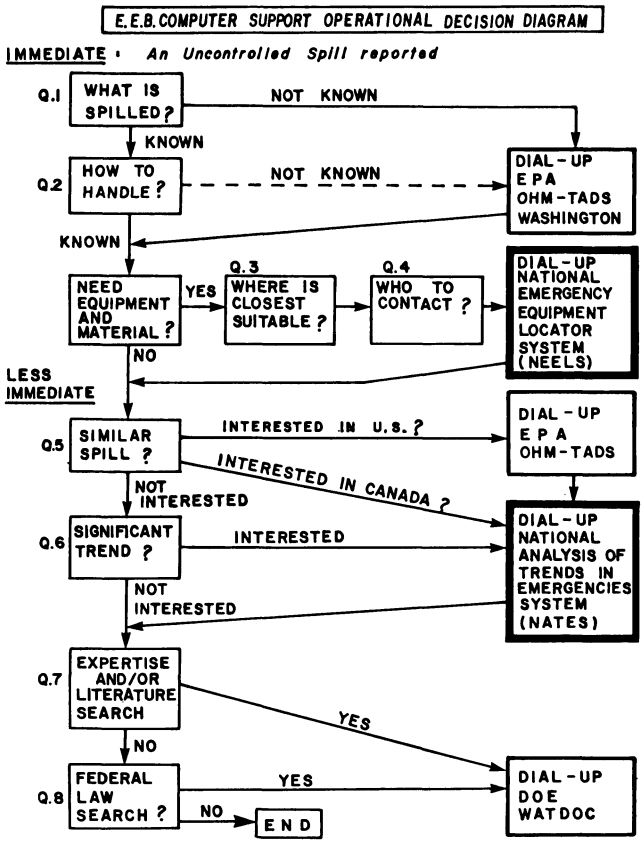

Figure 1. E.E.B. Computer Support Operational Decision Diagram

close cooperation with the Ministry of Transport and the Petroleum Association for Conservation of the Canadian Environment (PACE).

Our aim to cooperate with industry in the development of NEELS was made easy by PACE, consisting of the 11 major oil companies in Canada, in that PACE immediately located its entire national inventory of emergency equipment and materials in NEELS. NEELS possesses the description, location, and point of contact of the nearest suitable emergency equipment to combat a spill at any location in Canada. Fixed or portable computer terminals quickly access the system through telephone dial-up connections. After the location of the spill has been specified and the kind of equipment identified, the computer provides the name of the organization, facility, and location of the nearest suitable equipment and its description, complete with telephone numbers and names of contacts. If sufficient equipment is not available at this location, the next nearest location, then the next, etc., is printed until the requirement is satisfied. The advantages of NEELS are many: the master inventory is instantly available coast to coast; searches for the nearest specialized equipment have never been faster or easier; and keeping the inventory up to date is cheaper and easier in that NEELS UPDATE is on-line and the inventory change can be entered the same day it is made. With better inventory control, both emergency response and contingency planning are facilitated. Equipment lists for locations where no computer access is available can be printed cheaper and easier than ever before.

One of the most outstanding features of this system is its low cost. I.P. Sharp maintains the National Emergency Base on-line as a public service. It also maintains free telephone lines to the Toronto computer from major North American centers. We pay only the standard rates for connect and CPU time. We pay only for the time we use. Another outstanding feature is its ease of use by people not familiar with computers. NEELS guides you through your search in the language of your choice, French or English. It is so easy to use that we suggest that half a day of training is sufficient for anyone to be able to use the National Emergency Equipment Locator System.

Computers at the spill site provide immediate information on the nearest countermeasures equipment, how a similar spill was handled, special precautions, and much more.

National Analysis of Trends in Emergencies Systems

To answer the question of how someone else handled a similar spill or whether there is a significant trend involved, we directed I.P. Sharp to develop a national spill history data base and analysis package, the National Analysis of Trends in Emergencies System (NATES). It is not only an on-line aid for the emergency manager, but a powerful research tool.

NATES allows the user to search through historical files for environmental emergencies which have similar characteristics. The system has been created in conversational mode so that the user has only to answer questions in English or French to execute a search. No prior knowledge of computer languages or of computer systems is required. Upon request, this system prints out a description of how it is to be used. While more complex than the NEELS, it is also very easy to use for both searching and updating on-line coast to coast.

As soon as the details of a spill are available, the regional office inputs the coded spill report in as much detail as possible to NATES. Information is held on location, data, material spilled, cause, environment (including site conditions and contingency plans), cleanup (including method used), weather, agencies involved, and costs and legal action. Other data are also available. There are 41 fields of information in all.

In keeping with the management by exception principle, one only selects what data is of interest. It can then be printed selectively or in total, displayed in tabular form or in histograms, or be statistically analyzed.

This rather comprehensive system is used by the Department of the Environment, the Ministry of Transport, and the Department of Indian and Northern Affairs to highlight significant trends and to guide and measure our efforts to prevent or better handle future spills. It is available to other federal, provincial, and municipal government agencies. We wholeheartedly encourage its use as a national data base of spill reports.

WATDOC

If literature or a federal law search is required by the environmental emergency manager, a search of Environment Canada's WATDOC system will select the applicable chemical, biological, engineering, or water resources references from over 200,000 environmental citations on the system. The Revised Statutes of Canada

(Canadian Federal Law) are also located on the WATDOC system and searchable in the same powerful free-text mode. We are in the process of loading WATDOC with the names, areas of expertise, and phone numbers of key environmental emergency experts. This will enable the emergency manager, by a key-word search of WATDOC, to locate any person or persons able to advise him on a particular problem. The WATDOC system is available on a dial-up basis from QL Systems, Ltd., Ottawa through WATDOC, Environment Canada, Ottawa.

Other systems

In addition to the above major systems, two small programs on the I.P. Sharp system are worthy of note. The first is MAILBOX. This standard support package allows us to send free-text messages across the country for only the cost of CPU and connect time. I.P. Sharp provides free links with our major centers and free storage of the messages until it is convenient for the receiver to "read his mail." The multiaddress feature allows the man on the site to keep both his regional office and headquarters informed of developments. The free-storage feature has been most useful in mitigating scheduling problems of differing time zones and busy people.

The other program is a spill-spreading model developed by our Centre of Spill Technology in Burlington, Ontario. This model calculates the diameter of a slick at various times of a specified volume of oil under specified conditions.

Thus, we have the environmental emergency management computer systems. But, how are they used and how does it all come together? Let us examine the computer systems in action.

Spill computers in action

The place: a petroleum storage facility on Lake Ontario.

The time: 6:15 in the morning.

A sleepy foreman checking the tank farm comes suddenly wide awake. He has just seen oil running through the gate in a dyke left open to drain the runoff from the heavy rainfall of the previous day. With the assistance of a nearby worker he closes the dyke gate, but they are too late. In the morning light he can see that a considerable amount of oil has flowed down the shore into the harbor. He spreads the alarm. The trouble is located: a broken pipe. Pumping is stopped. They deploy what boom they have and that of a neighboring facility, but it is not nearly sufficient.

A pre-arranged contingency plan is put into action. As one person contacts the Ontario Ministry of Environment, another phones the control room of a nearby refinery. The Ministry of Environment dispatches a man to the scene and also alerts Environment Canada and Ministry of Transport. The refinery control room crew use their computer terminal to log-on the National Emergency Equipment Locator System. They quickly enter the longitude and latitude of the spill location and do a search by TYPE for booms, since containment is the immediate problem. The computer prints out not only a description of the nearest boom but also the company name and address of the facility, and the name and number of the man to call, including his home phone number. By pushing the carriage return, the four closest booms are printed out and quick telephone calls soon have them on the way to the spill. Skimmers are the next priority; a quick computer search locates suitable skimmers and they are on their way from as far as 50 miles.

In the meantime, the Regional Environmental Emergency Coordinator from Environment Canada has arrived with his portable suitcase terminal. He is on-site to assist the company (who have assumed cleanup responsibility) with information and advice in this environmentally sensitive situation. Over 35,000 gallons of Bunker C oil has escaped into the harbor and threatens many close-by recreational areas, as well as nesting areas in a nearby marsh.

The man from Environment Canada soon has printout from the National Analysis of Trends in Emergencies System with information on who has handled other similar spills. He also searches WATDOC for literature on spills of oil in freshwater marshes. Three citations look interesting. He logs into MAILBOX and sends spill reports to his office and to headquarters, adding a request for the literature found in the WATDOC search.

Next day, when the spill has been controlled and cleanup is well under way, a spill report is coded in as much detail as is possible at the time and added to NATES. As more detail becomes available, this record will be updated to indicate the successful conclusion of countermeasures against a potentially damaging spill that was caught in time.

The foregoing spill scenario has not taken place, yet. But Environment Canada's emergency management computer systems are here, now. The EPA Technical Assistance Data System, the National Emergency Equipment Locator System, the National Analysis of Trends in Emergencies System, and WATDOC comprise what is probably the most comprehensive computer-based environmental emergency management support system in the world. They are in each of the regional offices of the Environmental Protection Service, Environment Canada in case of need.