Interim Federal Contingency Plan for OIL AND TOXIC MATERIAL SPILLS

FIELD MANUAL

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CONTINGENCY PLAN FIELD MANUAL

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0. PREFACE

The Interim Federal Contingency Plan for Oil and Toxic Material Spills predesignates the On-Scene Co-ordinators (OSC) who are responsible for preparedness and counteraction response. This manual is provided as a technical aid to the On-Scene Co-ordinator. It is not a rule book; rather, it is a guide to the preparedness and counteraction needed to protect our water resources from the effects of spilled oil and other toxic materials.

The countermeasure technology described in the manual represents the "state of the art" in a rapidly developing field. New information will be provided as fast as possible so as to keep the information up-to-date.

1.0 INTRODUCTION

1.1 Objectives

This manual is provided as a major reference for On-Scene Co-ordinators and others who are charged with the responsibility of protecting our water resources against the ravages of spills of oil and other toxic materials. This goal can be achieved by prevention, countermeasures and cleanup.

By far the most effective way of protecting the water resources is to prevent spills of oil and other hazardous materials. Prevention includes regulation and the provision of adequate navigational and engineering features to reduce to the lowest possible level the likelihood of an accident which would result in the spill of oil or toxic material into the water. Clearly, this approach is beyond the scope of the Interim Federal Contingency Plan and will not be dealt with in detail in this manual. However, it should be borne in mind that those who are active in the field in preparing a contingency plan may well uncover unsafe practices and procedures which can be eliminated in advance of a catastrophe and thus contribute to the prevention of spills. On-Scene Co-ordinators are particularly charged with this responsibility.

Countermeasures to be employed in the event of a spill form the major portion of this manual. These techniques are the prime responsibility of the On-Scene Co-ordinator in each sub-region of the country.

The most important aspect of a countermeasure technology is preparedness. This can be provided at several levels of responsibility. Preparedness at the national level requires a clearly defined and pre-designated authority for major response along with the strike force which would be capable of providing the expertise in technique and potential environmental impact. Preparedness at the local sub-regional level is the responsibility of the On-Scene Co-ordinator. This is best provided by people familiar with the local scene and can be formalized and systematized by the preparation of inventories. The chapter in the manual on Preparedness outlines the kinds of inventories that should be provided.

In some cases preparedness will require the stockpiling of strategic supplies and equipment for rapid deployment in the event of a spill in a given locality. Equipment such as slick-lickers and booms may be stockpiled in co-operation with Provincial and/or industrial authorities.

The activation of a countermeasure depends initially on communication so that the authorities will be aware of the spill. Rapid and accurate communication is essential to the operation and is discussed in detail in Chapter 2. The occurrence of a spill may be reported by the party responsible or by any citizen who happens to observe it. This information must be relayed rapidly to the responsibility centre and then must be transmitted by clearly defined alerting procedures to all those who need to respond to that particular level of threat.

The technology for combatting oil and other toxic material spills is developing very rapidly in the wake of such disastrous spills as the "Torrey Canyon", "Ocean Eagle" and "Arrow". Thus the information that can be contained in the manual will be out-dated almost immediately and will be up-dated by new information as soon as it becomes available. In any event it must be recognized that each pollution incident is unique and will require a unique response. The techniques described in the manual should serve as a guide and a compendium of past experience so that the On-Scene Co-ordinator can choose those techniques which best fit the incident and utilize the resources at his disposal.

In many cases it will be necessary to follow the countermeasure activities with a cleanup phase to restore the environment to its original condition insofar as this is possible. Many techniques have been suggested, but in almost every case they are less than completely satisfactory and must be evaluated in light of the impact that the pollutant and the countermeasure will have on the ecology of the area. In many cases it will be necessary to leave the final cleanup to natural forces. For example, the bulldozing of coarse material from a beach in order to remove oil covered material may well destroy the stability of that beach with resulting disastrous erosion of shore property. A major element in the cleanup operation is that of manpower. This may be provided commercially or in many instances could involve the Department of National Defence. The On-Scene Co-ordinator should be familiar with the sources of manpower available to him.

1.2 Scope

Water pollution resulting from a spill of oil or other toxic material does not recognize political boundaries. In almost every instance a number of levels of government will be involved and concerned about the impact of the spill. Thus it is essential to prepare in advance those agreements between governments which will permit rapid and unimpeded response by those who are charged with this responsibility. The reporting procedures in Chapter 2 spell out the means of co-ordinating this multi-level response. The material in this manual should be helpful to the On-Scene Co-ordinator of a response team regardless of whether he is an official of the municipal, provincial or federal governments. Specific areas of responsibility are spelled out so that in most cases the official with prime responsibility would be clearly identified.

1.3 Alerting

The effectiveness of a Contingency Plan depends on the alertness of local citizens. The polluter or any local citizen observing a spill is responsible for notifying local officials. These local officials, be they police, fire department, or other government agency, must be provided with the details of efficient communication channels to transfer this information to the On-Scene Co-ordinator for the sub-region. Details of this procedure are spelled out in Chapter 2 of the manual. The On-Scene Co-ordinator will, in all probability, be the first observer on the scene who can make, with the assistance of local observers, an accurate assessment

of the significance of the spill. This information should be relayed to other responsibility centres so as to assemble an adequate response at the earliest possible time. Chapter 2 details the alerting procedures that should be followed so as to inform the various levels of government of the threat and the initial responses that are indicated.

2.0 PROCEDURES IN THE EVENT OF A SPILL

An effective response to the spill of oil or other toxic substances requires rapid communication of the news of the spill followed by quick deployment of expertise and equipment for counterattack. Communication involves two phases - reporting and alerting. Deployment must follow these phases.

2.1 Reporting Procedures

The On-Scene Co-ordinator in each sub-region must develop an effective reporting network. Potential polluters and the general public must know how and to whom a spill should be reported.

The polluter is primarily responsible for reporting a spill and for initiating countermeasures. In some cases the polluter will be unaware of the spill. In this event the news may come from aircraft or ships in the area or from an alert private citizen.

A telephone number which will be answered on a 24-hour-a-day basis must be widely publicized by the OSC. This facility should be known especially by agencies likely to receive citizens' calls such as local and provincial police stations, fire stations, newspapers and local radio stations. Ships captains, refinery operators and other officials likely to be involved in a spill should be aware of the reporting telephone number to avoid the intermediate transfer of information through the police, etc. The person on duty at the 24-hour telephone must be able to contact the OSC or his alternate at all times.

This will require a roster of predesignated alternates, both below and above the OSC level.

Co-ordination with other levels of government and an automatic alert at this juncture may be incorporated into the procedures for a given sub-region. This will depend on prior arrangements with the province and municipalities involved.

2.2 Alerting Procedures

A countermeasure response will require the alerting of appropriate agencies. The OSC is responsible for assessing the significance of the spill and of countermeasures underway, and alerting the agencies which are needed to respond. In most cases, even for small spills, it will be necessary to alert the appropriate provincial and local officials. If the initial reporting is to a provincial OSC, then the circumstances requiring the alerting of federal officials should be clearly established beforehand.

With certain pollutants such as industrial and agricultural chemicals it may be necesssary to activate contingency organizations established by industrial associations. For example, an association within the oil industry called PACE (Petroleum Association for the Conservation of the Canadian Environment) anticipates that it will serve a need in this regard and the Canadian Chemical Producer's Association is operating a contingency plan for spills of chemicals. Information centres with details on special countermeasure techniques and precautions are manned on a 24-hour basis as listed below.

a) Western Ontario - Dow Chemical of Canada Ltd.
Sarnia, Ontario
519 337-8282

b) Central Ontario - Cyanamid of Canada Ltd.
Niagara Falls, Ontario
416 356-8310

c) Eastern Ontario - Du Pont of Canada Limited
Maitland, Ontario
613 348-3616

d) Northern Ontario - Canadian Industries Limited
Copper Cliff, Ontario
705 682-2881

e) Southwest Quebec - Allied Chemicals Limited
Valleyfield, P.Q.
514 373-7570

f) North Central Ontario - Shawinigan Chemicals Div.
Shawinigan, P.Q.
(Gulf Oil Canada Limited)
819 537-1123

2.3 The Federal Network

Spills of catastrophic proportions will elicit the response of the Headquarters Federal team (Table 1) and adjoining regional teams under On-Scene and Regional Co-ordinators (Table 2). The following charts (Figs. 1 to 5) indicate the regional and sub-regional boundaries. On-Scene Co-ordinators must be familiar with the geographic extent of their responsibility and of their counterparts' responsibility in adjoining regions. Activation of the Federal response team is to occur through the Canadian Forces Operations Centre (Table 3) and, as outlined in the Contingency Plan (see Chapter 7.0 of this Manual), the OSC

> "...will report the incident via CFCS, Canadian Forces Operations Centre, CFHQ, Ottawa, which will in turn alert designated officials in Ottawa."

TABLE 1
MEMBERS OF THE INTERIM INTERDEPARTMENTAL COMMITTEE
ON CONTINGENCY PLANNING AND ALTERNATES

Name	Dept.	Office Address	Office Phone	Home Address	Home Phone
W. J. H. Stuart	MOT	433 Hunter Bldg. OTTAWA, Ont.	613 992-9743	Suite 911 2220 Halifax Dr. OTTAWA, Ont.	613 737-4168
Col. R. Christie	DOPS DND	3419 "A" Bldg. Cartier Square OTTAWA, Ont.	613 992-4248	535 Picadilly Ave. OTTAWA 3, Ont.	613 728-7209
Maj. C. J. Mialkowski Alt. DND Member	DOPS DND	3425 "A" Bldg. Cartier Square OTTAWA, Ont.	613 992-6160	1352 Leaside Ave. OTTAWA, Ont.	613 728-9516
Dr. A. T. Prince	DOE	#8 Temporary Bldg. OTTAWA, Ont.	613 994-9225	20 Riverside Dr. Manotick, Ont.	613 692-3743
A. LeFeuvre	DOE CCIW	Canada Centre for Inland Waters Box 5050 BURLINGTON, Ont.	416 637-4303	274 Starview Rd. Burlington, Ont.	416 634-2437
D.H.W. Woodward	IAND	A/Director Northern Economic Development Room 1352 Centennial Tower 400 Laurier Ave. W OTTAWA, Ont.	613 992-5179	2220 Louisiana Ave. OTTAWA 8, Ont.	613 731-8716
P.M. Higgins	DOE	Sir Charles Tupper Bldg. OTTAWA, Ont.	613 997-8550	37 Riopelle Cres. P.O. Box 204 Kanata, Ont.	613 836-4171
J.P. Parkinson Alt.	DOE	Sir Charles Tupper Bldg. OTTAWA, Ont.	613 997-4785	782 Eastvale Dr. OTTAWA, Ont. K1J 7A1	613 745-6679
R. E. Tait	DOE	Environmental Health Services Tunney's Pasture OTTAWA, Ont.	613 992-2011	2535 Regina OTTAWA, Ont.	613 828-5200
W. S. Tait Alt.	DOE	Environmental Health Services Tunney's Pasture OTTAWA, Ont.	613 992-2011	75 Tiffany Place Box 325 Kanata, Ont.	613 836-1431
A. L. Brown	Canada EMO	"A" Bldg. Cartier Square OTTAWA, Ont.	613 992-6713	895 Chenier Ave. OTTAWA, Ont.	613 728-1553

FEDERAL PLAN FOR COMBATTING OIL
AND TOXIC MATERIAL SPILLS

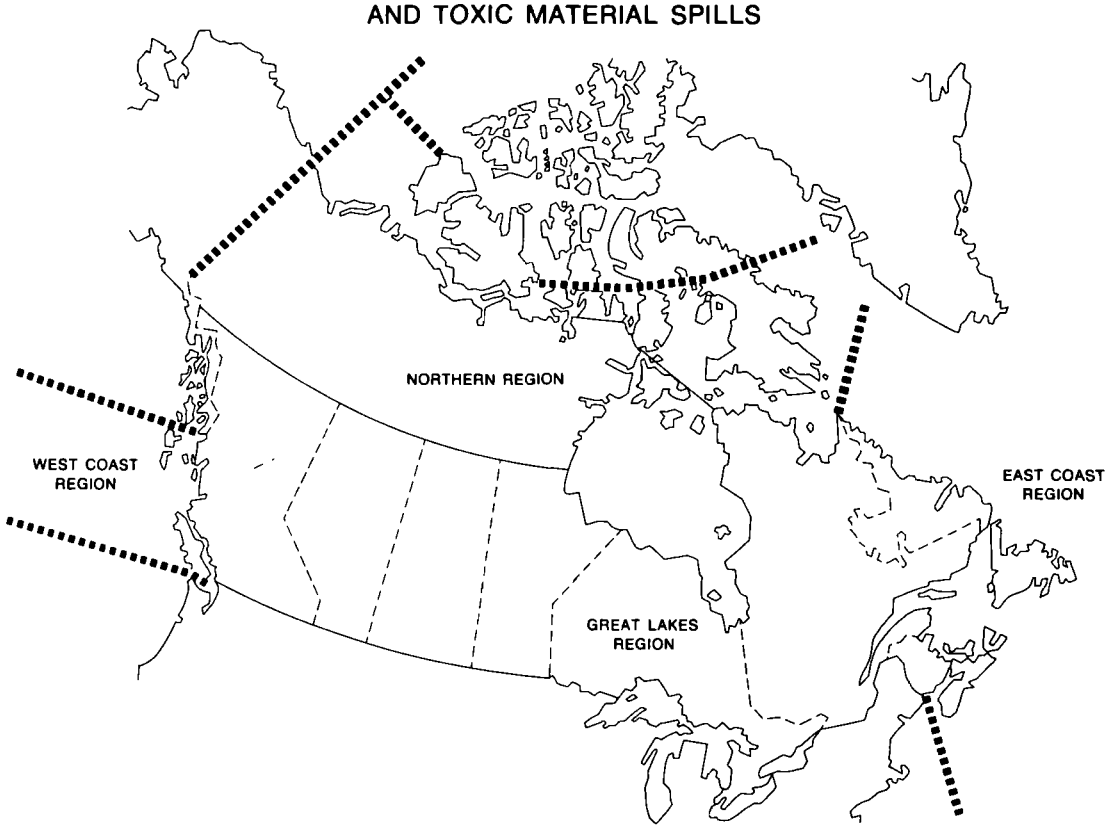


FIGURE 1

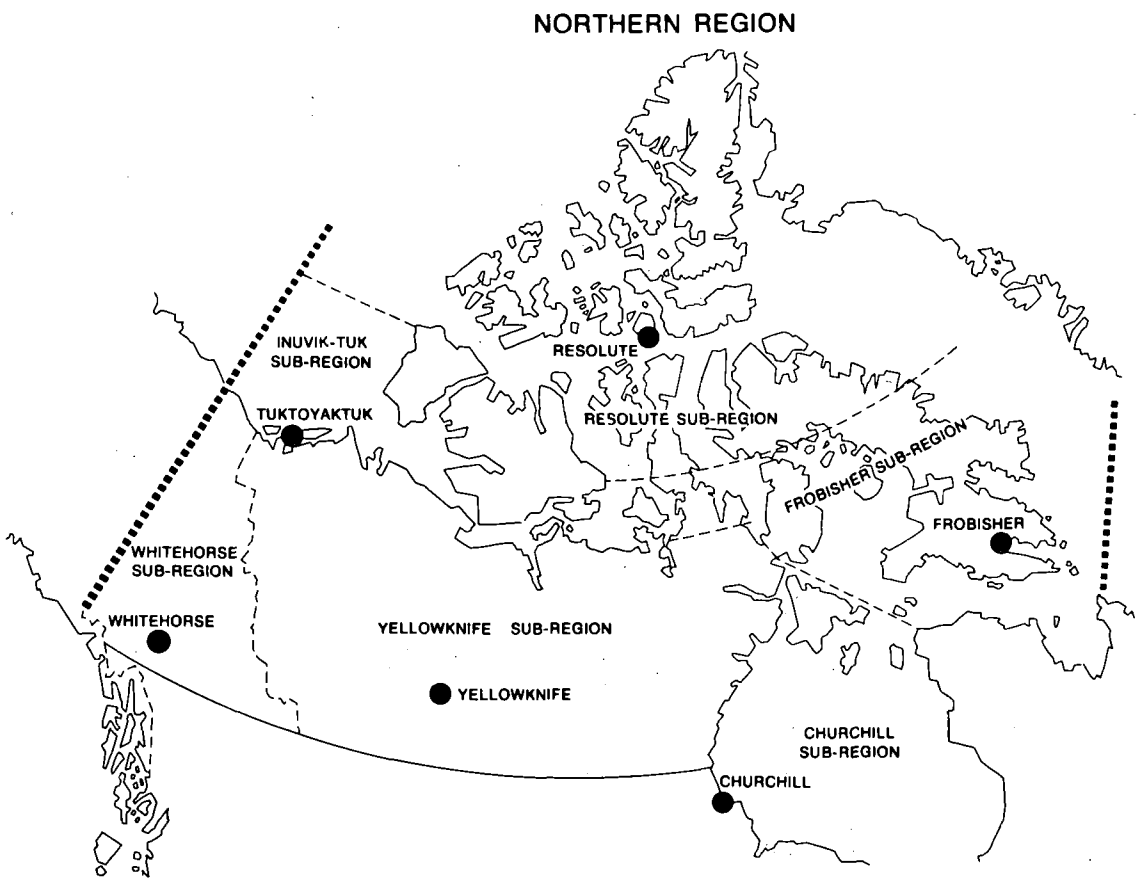

NORTHERN REGION
INUVIK-TUK
SUB-REGION
TUKTOYAKTUK
RESOLUTE
RESOLUTE SUB-REGION
FROBISHER SUB-REGION
FROBISHER
WHITEHORSE
SUB-REGION
WHITEHORSE
YELLOWKNIFE SUB-REGION
YELLOWKNIFE
CHURCHILL
SUB-REGION
CHURCHILL

FIGURE 2

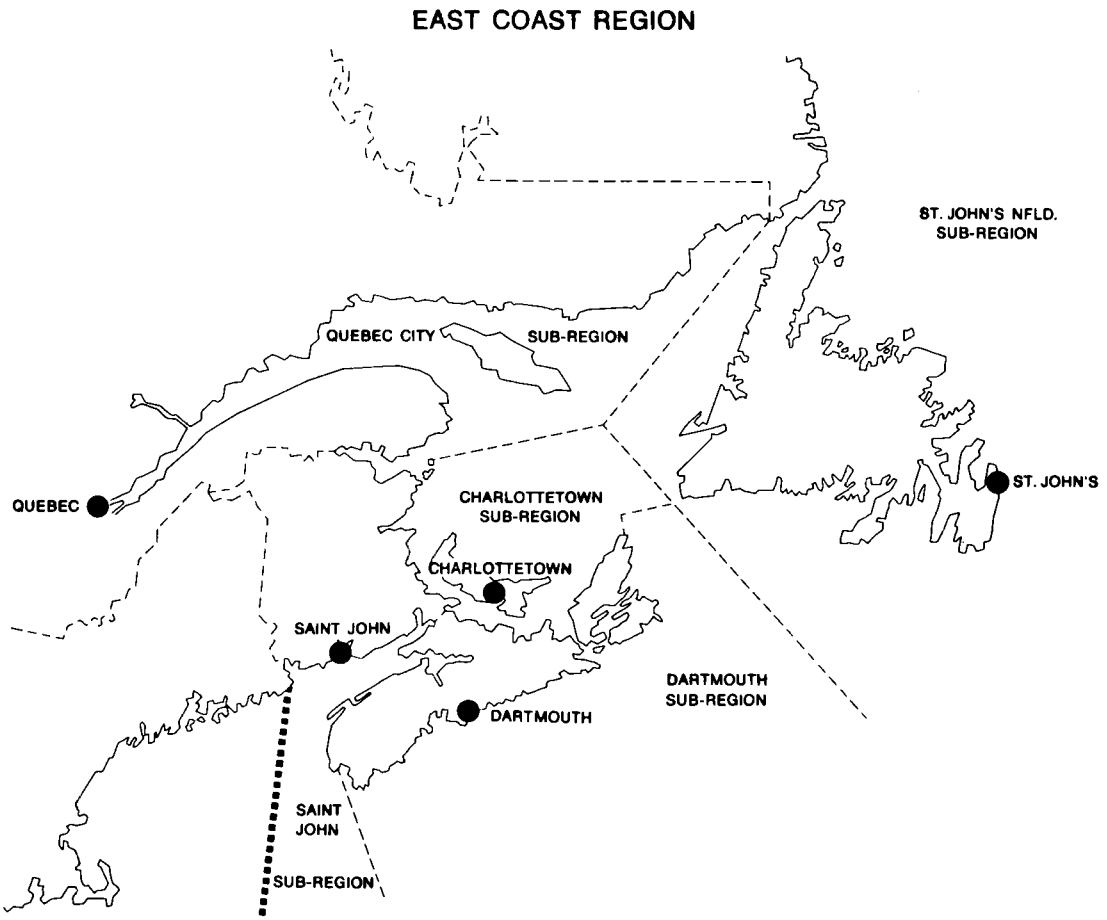

EAST COAST REGION
ST. JOHN'S NFLD.
SUB-REGION
QUEBEC CITY
SUB-REGION
QUEBEC
CHARLOTTETOWN
SUB-REGION
ST. JOHN'S
CHARLOTTETOWN
SAINT JOHN
DARTMOUTH
SUB-REGION
DARTMOUTH
SAINT
JOHN
SUB-REGION

FIGURE 3

WEST COAST REGION

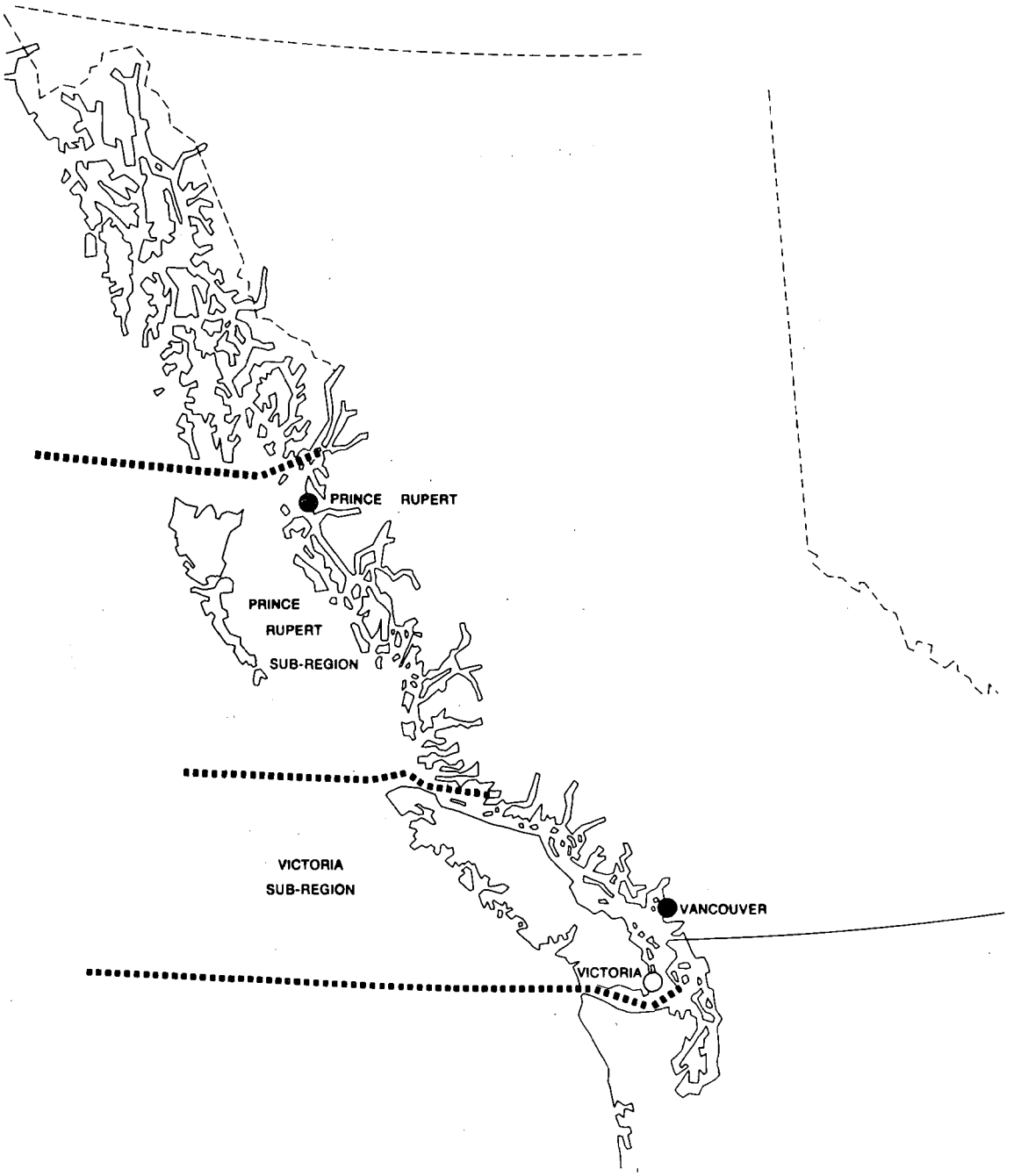


FIGURE 4

GREAT LAKES REGION

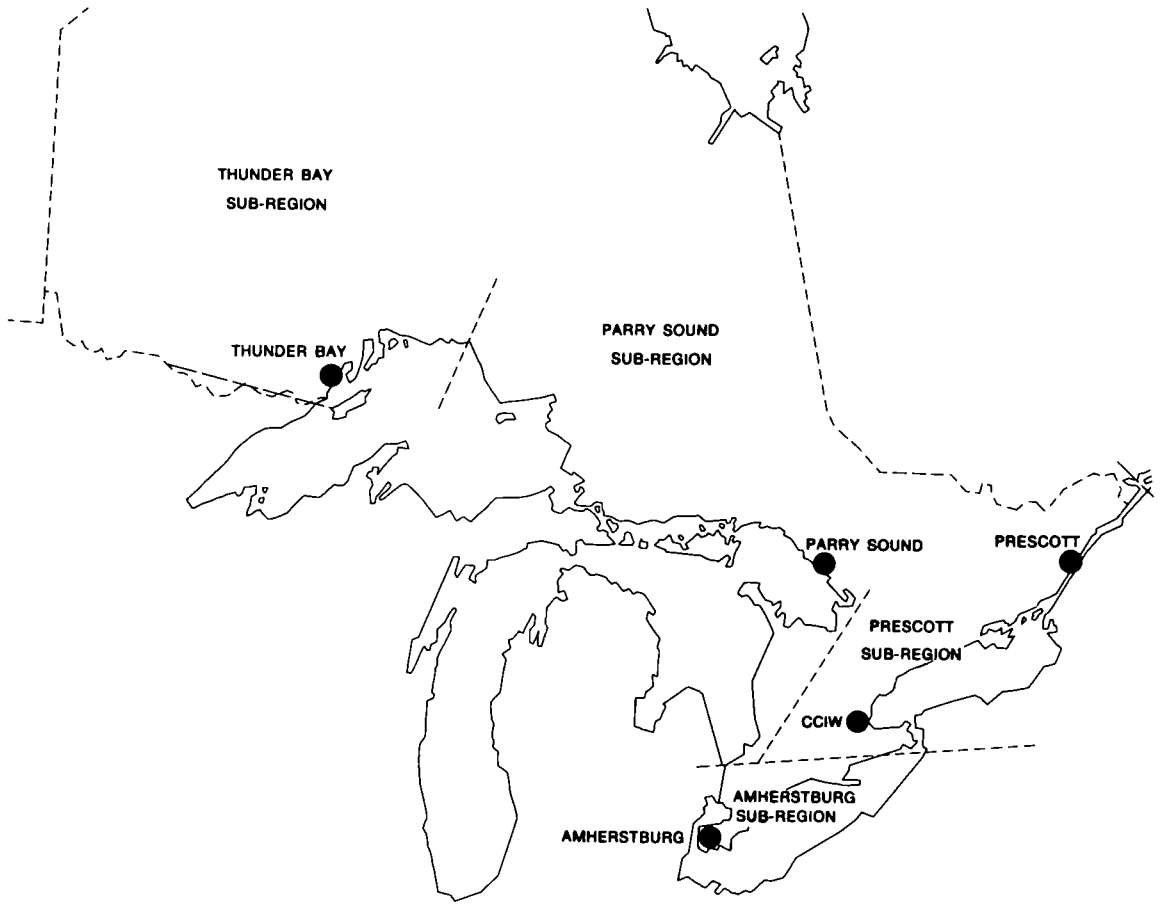


FIGURE 5

TABLE 2

(a) On-Scene and Regional Co-ordinators

Northern Region:	Regional Co-ordinator	(see figure 2)
Whitehorse sub-region	Ron Hodgkinson (YT)	
Yellowknife sub-region	John Parker (NWT)	
Inuvik-Tuk sub-region	D.P. Messereau (IAND)	
Frobisher sub-region	Barry Gunn (NWT)	
Resolute sub-region	Paul Brownlee (NWT)	
Churchill sub-region	Ray Creery (NWT)	
East Coast Region:	F.M. Weston (RD-MOT)	(see figure 3)
Saint John, N.B. sub-region	G.J.M. Williams (DM-MOT)	
Dartmouth sub-region	E. Ormsby (DM-MOT)	
Charlottetown sub-region	F.G. Osbourne (DM-MOT)	
St. John's, Nfld. sub-region	R.E. Stone (DMA-MOT)	
West Coast Region:	H.O. Buchannan (RD-MOT)	(see figure 4)
Vancouver sub-region	H.O. Buchannan (RD-MOT)	
Victoria sub-region	L.E. Slaght (DM-MOT)	
Prince Rupert sub-region	E. Harris (DM-MOT)	
Great Lakes Region:	J. Bruce (CCIW-DOE)	(see figure 5)
Parry Sound sub-region	F.K. McKean (DMA-MOT)	
Prescott sub-region	J.S. Barrick (DMA-MOT)	
Thunder Bay sub-region	R.W. Forbes (MSA-MOT)	
Amherstburg sub-region	John Bennett (MSA-MOT)	

(b) Federal Agents Acting as OSC's

St. John's Nfld.	DMA	R.E. Stone	Southside Rd. St. John's 709 722-2830 579-0792 (home)
Halifax N.S.	Regional Director	F.M. Weston	Royal Bank of Canada Bldg. 42 Portland Street Dartmouth, N.S. 902 426-3907 466-5378 (home)
Charlottetown P.E.I.	District Manager (DM)	F.G. Osbourne	Dominion Bldg. Queen's St. Charlottetown, P.E.I. 902 892-4291 (ext. 210) 894-6324 (home)
Dartmouth N.S.	DM	E.O. Ormsby	Foot of Parker St. Dartmouth 902 466-2141 466-1841 (home)

TABLE 2(b) cont'd

Saint John N.B.	DM	G.J. Williams	Ward St. Saint John, N.B. 506 693-1136 696-4736 (home)
Quebec City P.Q.	DMA	J.P. Godin	101 Champlain St. Quebec 2, P.Q. 418 694-3420 653-4733 (home)
Sorel, P.Q.	DMA	N. Paquette	15 Prince St. Sorel, P.Q. 514 743-5548 743-6359 (home)
Burlington Ontario	Director CCIW	J. Bruce	P.O. Box 5050 Burlington, Ontario 416 637-4303
Prescott Ontario	DMA	J.S. Barrick	King St. Prescott, Ontario 613 925-2865 925-2354 (home)
Parry Sound Ontario	DMA	F.K. McKean	28 Waubeck St. Parry Sound, Ontario 705 746-2196 746-2877 (home)
Pt. Arthur Ontario	Marine Sub-Agent	R.W. Forbes	323 Post Office Bldg. Pt. Arthur, Ontario (Thunder Bay) 807 345-6311 344-2649 (home)
Vancouver B.C.	Regional Director	H. Buchannan	7th Floor, Prescott Bldg., 549 Howe St. Vancouver, B.C. 604 544-1388
Prince Rupert B.C.	DM	E. Harris	Seal Cove, Prince Rupert, B.C. 604 624-9146 624-6347 (home)
Victoria B.C.	DM	L.E. Slaght	1230 Government St. Victoria, B.C. 604 388-3292 383-6161 (home)
Hay River N.W.T.	DM	J.K. Rose	Box 155, Hay River, N.W.T. 874-2406 874-2537 (home)

TABLE 3

Canadian Forces Operations Centre - Ottawa

The CFCO Duty Operations Officer may be reached by calling the Ottawa Government Operator, Area Code 613 232-8211 or directly by calling Area Code 613 992-2708 or 992-4535.

Canadian Switched Network (CSN) users may reach the Duty Operations Officer by calling any of the following numbers:

261-2911
261-2912
752-2805
752-2806

General Purpose Autovon users may reach the Duty Operations Officer by calling:

827-1441
827-1442

3.0 PREPAREDNESS

Probably the first step in the implementation of a contingency plan is to become aware of the possible dangers which might suddenly become an acute emergency and even a major disaster or catastrophe. The old saying that "forewarned is forearmed" applies fully to the possibilities of pollution.

Since the Federal Contingency Plan will cover all geographical regions of the country, the preparedness which is needed must be specifically adapted to the situation in each of the main regions and in more detail to their sub-regions.

Instances of pollution can be of many kinds and on different levels of seriousness depending on the particular material which becomes a pollutant. Obviously, the scale and variety of sources will pose problems which will vary in different locations. The following outlines the information needed in order to be prepared to cope with a pollution incident:

a) The On-Scene Co-ordinator (OSC) must have an on-going assessment of the threats in his area.

b) In the event of a threat becoming a reality, the OSC must have an up-to-date assessment of the implications for the users of the affected waters and for the environment itself.

c) To combat a pollution incident effectively, a fire brigade philosophy is mandatory.

The OSC will need at least the basic element of a ready-trained team, backed up with materials, equipment and communications, which have been practised. He must also have information about additional supplies available in his region, as well as specialized personnel who can be called upon immediately to provide expert services.

d) Finally, preparedness will require that preventive measures be instituted and applied through standards and well-enforced regulations which should carry penalties commensurate with the seriousness of the danger.

3.1 Inventory of Local Hazards

The OSC for each region or sub-region must compile a list of potential pollutants which are moved through or stored in his area (Table 4).

a) Materials in motion

It is evident that materials in motion are subject to greater hazards than those in storage in warehouses, tanks or bins. Particular care should be taken therefore that a thorough compilation be made of all possible pollutants which are normally shipped to, out of, or through the area. This will of course cover all types of transportation facilities such as tankers, both normal and cryogenic, bulk carriers, general and containerized cargo ships, lake freighters and barges, railroad

and highway transports for liquids, coarse and fine solids, liquified gases and gases under high-pressure and pipeline movements. Movements by air are small in volume but could be very important because of the specialized nature of the cargo, for instance, radioactive material which could become a dangerous pollutant in case of a crash.

The information required, in relation to cargo movements, will involve a compilation of shipping routes covering coastal waters, rivers, canals, lakes, railroad rights-of-way and freight terminals, highways and local roads used by the shippers of potential pollutants and the ground below regularly used air routes. In the case of coastal waters, shipping routes which come within at least 100 miles of the coastline should be listed because of the potential hazards associated with crude petroleum or its products which float and can be transported to the shore by currents and wind action. In this connection, meteorological and oceanographic data on prevailing winds, sea states and currents will be helpful in qualifying the seriousness of possible spills.

b) Materials in storage

Stored materials, although less likely to be involved in pollution incidents than materials in transit, nevertheless present hazards because of the quantities which may be involved and which can be suddenly released due to mechanical failure of the container caused by deterioration, corrosion, decay, fires, floods, explosions or other calamities. The location, size, capacity and age of each storage installation, together with

safety precautions and maintenance standard in use, should be catalogued with the assistance of industry, together with the type of material stored. This information will help to pinpoint possible sources of danger and could be used to stimulate more frequent and more thorough inspections of the equipment.

c) Materials in process

Another class of materials which can be considered potential pollution hazards consists of those semi-finished or intermediate products which are formed within a plant, are moved to other sections of the plant and are eventually consumed in the process without being stored in appreciable quantities or for an appreciable length of time. Equipment failures, spills, leaks, overflows or other accidental occurrences could release some of these possibly toxic materials into drains, sewers and eventually into large bodies of water. The presence of these materials and their properties should be catalogued, so that specific remedial measures may be made available in close proximity to the potential hazard.

3.2 Inventory of Local Water Uses

Pollution of coastal waters, rivers, canals, lakes, ponds, and reservoirs will be more or less serious depending on the uses which are made of the water (Table 5).

a) Domestic water supplies

The first and most important use of water, because of its great potential for harmful effects, is for domestic consumption. Pollution of the water supplies by poisonous

substances could cause serious and even fatal results before the population using the water could be alerted. For this reason "shut-off" procedures should be known and an inventory list of the location of water supplies must be available and kept up-to-date. As well, the special attention of OSC's must be directed to potential sources of pollution located close to these water supplies. Pollution can be caused by storm sewer outfalls from industrial installations or by combined domestic and storm sewer flows where no separate systems have been installed. Furthermore, ground drainage of spills may not reach sewer installations but may eventually flow into domestic water supplies over the ground surface or by way of drainage ditches. All these possibilities should be known to the OSC's in order that immediate measures can be taken to contain polluting spills.

b) Industrial water supplies

Of second importance among users of water are industries where water is part of the process or comes in contact with the products.

The main danger is, undoubtedly, where polluted water is used in food processing. This situation, of course, can be disastrous if food is poisoned or tainted by contact with the pollutants. Not only will this result in economic loss of product and livelihood for employees, but as in the case of domestic water supplies, could result in serious sickness and even fatalities before the situation is properly recognized and dealt with.

Pollution by process water not used for food processing, can be serious economically, but is not likely to have any effect on the health of the population. In these cases pollutants can cause serious process difficulties such as corrosion and side reactions or could introduce intolerable levels of impurities in the products. In any event, the polluted water could force the shut-down of the plant until the water supply situation has been cleared up and contamination has been eliminated from the plant equipment and materials in process.

Water used in steam boilers must be specially treated to reduce deposits and foaming, both of which interfere with efficient production of steam. Pollution of the water by chemicals or petroleum products could shut down boilers and cause severe dislocation of electrical generation or industrial plants.

Cooling water is the least susceptible to serious effects from pollution. Because this water often circulates in pipes, sometimes of very small diameter, any pollution which could cause clogging or corrosion and products reducing heat transfer would interfere with the operation of plants requiring cooling water.

c) Commercial fisheries

The commercial fishery industry in Canada is entirely dependent on the chemical and physical condition of the water environment, not only for the well-being of the fish but because of the large volumes of water used in processing. About 80,000

persons in Canada are employed in this industry and depend on it for their livelihood. Any toxic contaminant which could kill the fish or make them unsuitable for human consumption would strike a serious blow to the industry and its work force as shown by the effect of mercury pollution recently discovered. In cases where the ecology is seriously disturbed by pollution, it may take generations before the damage is repaired, if indeed, it is not permanent.

d) Wildlife users

Increasing pressure is being brought to bear on the authorities to protect wildlife from the dangers of pollution. The necessity for protecting wildlife and the local ecology is important because it provides commercial values in tourism, sport and recreation. It also provides a livelihood for many people who seldom have another occupation to fall back on in case of serious pollution incidents. Fish and wild birds are important in the ecology of a region. Serious pollution could easily upset the natural life balance involved and cause serious deterioration of economic and aesthetic values.

e) Recreational users

When considering pollution of water it must be remembered that many lakes, rivers and the ocean provide recreational facilities for swimming, motor-boating, sailing and water-skiing. These cannot be properly enjoyed in polluted waters which contain poisons or irritants or which are covered with oil or water-in-oil emulsions. In the case of oil spills, coastlines and beaches may become covered with the oil

pollutants. Wharves and boats may be smeared and defaced for the same reason. These effects will cause serious complaints by the local population who are deprived of these facilities or who may be faced with unexpected cleanup costs.

f) General

For all the preceding pollution incidents, a strict priority list must be established in advance. Keeping in mind the sudden nature of pollution contingencies and the rapidity with which the pollutant can spread on the surface, in solution or by emulsion or suspension because of winds and currents, it will usually be impossible to protect all users of the contaminated water. Priorities must be established, subject to periodic revision, through consultation with local municipal authorities, industrial associations, chambers of commerce, tourist associations, fish and game societies, etc., so that a well-understood consensus can be arrived at. These priorities should apply both to immediate protective measures and to subsequent cleanup work.

3.3 Inventory of Local Countermeasure Facilities

The success of the contingency plan will not only depend on continuing knowledge of what and where trouble might suddenly arise, but also on up-to-date awareness of what is readily available locally to combat the pollution (Tables 6 and 7). This would normally cover supplies, equipment and personnel, within the federal, provincial, municipal and private sectors. The OSC should have or know where he can obtain the necessary equipment and material to combat incidents.

For example, in the case of an accident involving a cargo of crude oil, he may need some or all of the following: salvage and recovery facilities, containment devices, burning agents, absorbents, dispersants and sinkers. The secondary pollution potential of any item of the last four classes of materials must be considered and evaluated in the context of the situation in which they are to be used. In the case of chemical spills, the supplies needed will vary in different regions depending on the type of chemicals which are made, stored or transported. Effective combatting agents will be found listed for each type of pollutant in the publication "Oil and Hazardous Materials: Emergency Procedures in the Water Environment" (see Chapter 7.0 of this Manual).

The list of equipment available should include means of transportation for both personnel and supplies via air, land and water and heavy equipment such as bulldozers, steam shovels or other earth-moving machinery to build dikes, fill in ditches, cover up the spill or whatever manoeuvre may be deemed necessary. In case it is necessary to dispose of contaminated materials such as earth, sand, gravel, rocks, etc., and absorbent materials such as straw, sawdust, peat moss, etc., disposal areas should be agreed upon in advance with the cooperation of municipal, provincial or federal authorities.

Of great importance, especially when dealing with major contingencies, is a properly and efficiently organized communication system. For the sake of preparedness, an inventory of available equipment is essential (see Table 6, item B,e).

As far as personnel is concerned, the necessity of bringing in help from various levels of government and industry

will depend on the severity of the contingency. In order to foster a spirit of cooperation at this point, it will be helpful if the personnel concerned have already been made aware of the Contingency Plan, the responsibilities and duties of the OSC and the authority which he is given by the government. It is the OSC's own responsibility to decide what may be required as soon as he can assess the problem. Regardless of the magnitude of the pollution, the OSC's should be able to draw on the immediate service of a trained public relations man. This man is useful because of the need to explain the situation to the local population and to press, radio and television representatives in order that a true picture may emerge without the troublesome spreading of rumours. In this way, early cooperation of the local population can be enlisted instead of having to spend valuable time in allaying unfounded fears and doubts.

In all cases, be it supplies or equipment, since it is impossible to have all possible requirements in storage awaiting a contingency which, it is hoped, will never take place, and since quantities stored may be insufficient to tackle the task, an up-to-date list of suppliers should be available for immediate communication to arrange and expedite deliveries.

In the case of personnel, up-to-date telephone numbers and addresses of people available or their replacements should be within easy access at all times.

3.4 Preventive Measures

Most accidents can be prevented if sufficient thought and common sense is applied to the transport, handling and storing of potential pollutants.

Preventive measures could start with an education campaign for those local sources of pollution which may have been lax in their methods of operation, in order to develop a strong consciousness of the potential dangers and of the importance of pollution to themselves and to their environment. This could take the form of talks, conferences, seminars, films or other means of putting the message across. The cooperation of local industries might be enlisted to allow a yearly inspection by competent authorities to assure that proper maintenance is being used and that the mechanical condition of the equipment and storage facilities handling potential pollutants is such that mechanical failures can be anticipated and prevented.

Finally, the local population should be made aware of the dangers which are inherent in the handling of the chemicals and petroleum products present in their area. Without causing undue alarm, they should be instructed to conform strictly to restrictions suddenly imposed by the OSC after an emergency arises. They should know, for instance, that petroleum products float on water and can be distributed to household basements or that hydrocarbon vapors can spread over ground or through sewers and that explosions can only be prevented by complete absence of flames or sparks in the home or on the street.

They should know that contaminated water can be not only sickening or irritating but also deadly, and that orders not to use such water must be strictly observed until they are relaxed.

Other occurrences involving volatile materials such as chlorine or ammonia may well require rapid evacuation of whole areas especially those situated downwind from a spill. Prompt action by the population in these cases could prevent discomfort, permanent injury or even death.

To quote another old saying, "an ounce of prevention is worth a pound of cure" and this cannot be more appropriate than in the case of toxic chemical pollutants.

TABLE 4
Inventory List of Local Hazards

A - Pollutants

a) Crude Oil
b) Petroleum products
c) Toxic chemicals
d) Irritants
e) Foul-smelling chemicals
f) Foul-tasting chemicals
g) Radioactive materials
h) Liquified gases (cryogenic)
i) Pressurized gases
j) Others

B - Conditions of pollutants

a) In motion: Shipping Routes -

1 - Coastwise (up to 100 miles)
2 - Rivers
3 - Canals
4 - Lakes
5 - Railroads, right-of-way and freight terminals
6 - Highways and road transport terminals
7 - Local roads
8 - Ground below airlanes
9 - Airports
10 - Pipelines

b) In storage:

1 - Wharf warehouses
2 - Railroad freight terminals
3 - Road transport terminals
4 - Air transport terminals
5 - Plant warehouses
6 - Bulk storage facilities

c) In process:

1 - In petroleum refineries
2 - In chemical plants
3 - In mineral ore treating, smelting or concentrating
4 - In manufacturing and fabricating plants
5 - In pulp and paper mills
6 - In others

TABLE 5
Inventory List of Water Users

A - Domestic water users

a) Location of users

1 - Cities
2 - Towns
3 - Villages
4 - Farms

b) Source of water

1 - Rivers
2 - Lakes
3 - Reservoirs
4 - Wells

c) Means of entry of pollutants

1 - Plant outfalls
2 - Storm sewers
3 - Domestic and storm sewers when combined
4 - Pipeline leakage
5 - Airborne (crashes)
6 - Drainage ditches
7 - Surface drainage

B - Industrial water users

Same as above but including sea water and streams unfit for domestic uses.

C - Commercial fisheries

a) Areas

1 - Open sea
2 - Tidal waters
3 - Rivers
4 - Lakes

b) Companies

1 - Fishing
2 - Processing

c) Fishes

1 - Groundfish
2 - Pelagic and estuarial
3 - Shellfish
4 - Freshwater fish

TABLE 5 cont'd

D - Wildlife users

a) Mammals

1 - Salt water: whales, seals, porpoises, dolphins, etc.
2 - Fresh water: beaver, otter, mink, muskrat, etc.
3 - Land: all species of terrestrial mammals

b) Fishes

1 - Groundfish: cod, flounder, sole, haddock, etc.
2 - Pelagic and Estuarial: herring, salmon, mackerel, etc.
3 - Shellfish: clams, oysters, lobsters, scallops, shrimps, etc.
4 - Freshwater: whitefish, perch, smelts, pickerel, salmon, trout, bass, etc.

c) Birds

1 - Sea waterfowl
2 - Game ducks
3 - Migratory game birds
4 - Others

E - Recreational users

a) Water areas

1 - Ocean
2 - Rivers
3 - Lakes
4 - Marinas
5 - Reservoirs

b) Land areas

1 - Beaches
2 - Parks
3 - Others

F - General

a) Priorities for protection
b) Priorities for counteraction
c) Priorities for cleanup

TABLE 6
Inventory of Local Countermeasure Facilities

A - Supplies

a) Petroleum spills

1 - Peat moss, straw or other absorbents
2 - Sea beads or other burning aids, including ignition compounds
3 - Detergents and other dispersing agents, preferably non-toxic
4 - Sinking agents, such as specially treated sand
5 - Others

b) Chemical spills

1 - Neutralizing or converting compounds
2 - Absorption and adsorption agents
3 - Others, depending on the type of possible chemical pollutants in the area

B - Equipment

a) Safety

1 - Gas masks
2 - Fireproof clothing
3 - Protective clothing against corrosive or radioactive chemicals

b) Transportation

1 - Boats, tugs, barges, motor-boats, floating platforms
2 - Trucks, motor cars, snowmobiles
3 - Regular airplanes, helicopters
4 - Others

c) Mechanical

1 - Heavy earth-moving equipment such as dredges, drag-lines, steam-shovels, ditchers, bulldozers, plows, graders, etc.
2 - Loaders, conveyors, spreaders, sprayers, etc.
3 - Booms, fences and skimmers
4 - Portable equipment, such as pumps, compressors, boilers, generators, fire-fighting, etc.
5 - Hand tools such as shovels, picks, rakes, etc.
6 - Diving equipment
7 - Others

d) Disposal

1 - Land-fill areas
2 - Dumps
3 - Unused quarries
4 - Old mines or caves
5 - Others

TABLE 6 cont'd

e) Communications

1 - Voice equipment such as radio of all types, walkie-talkies, telephones, loud-hailers, megaphones, etc.
2 - Printed work or picture equipment such as telegraph, telex, telephoto, television, etc.
3 - Others

f) Miscellaneous

1 - Meteorological services where flying is involved
2 - Scientific equipments as required by the scientists of different departments, agencies, universities or research institutions
3 - Others

C - Personnel

a) Law and order

1 - Local chief of police
2 - Local fire chief
3 - Nearest provincial police office
4 - Nearest RCMP detachment
5 - Nearest armed forces
6 - Others

b) Operations

1 - Assistant OSC (if any)
2 - Designated person in each company or industrial installation where supplies or equipment may be stored or made immediately available
3 - Armed forces for specialized equipment and experience
4 - Others

c) Health and welfare

1 - Local or nearest hospital
2 - Local or nearest ambulance service
3 - Local or nearest doctors
4 - Nearest health officer
5 - Nearest veterinarian
6 - Others

d) Public relations and communications

1 - Appointed public relations officer and assistants
2 - Local or nearest radio station(s)
3 - Local or nearest television station(s)
4 - Local or nearest daily or weekly newspaper(s)
5 - Printer(s) for notices, posters, hand-bills, etc.
6 - Others

TABLE 7
Sources of Information

A - Federal Government

a) Atlas of Canada, Dept. of Energy, Mines and Resources (1957) New Edition in preparation.

b) Emergency Measures Organization, National Resource Analysis Center Office of Emergency Planning, Dept. of National Defence.

c) Dept. of Supply and Services, Emergency Supply Planning Branch, Planning Division.

d) Dept. of Energy, Mines and Resources, Mineral Resources Branch, Operators Lists.

e) Various publications of the Dominion Bureau of Statistics.

B - Provincial Governments

a) Economic Atlases of provinces
b) Departments of Industry and/or Resources

C - Municipal Governments

a) Assessment office
b) Water and sewer departments

D - Others

a) Industrial associations
b) Chambers of commerce
c) Fish and game societies
d) Tourist bureaus

4.0 COUNTERMEASURES TECHNOLOGY

Technical data in this chapter are provided as an aid to On-Scene Co-ordinators. The technology described has been developed in response to experience gained from previous spills. However, as no two situations are the same, the OSC will need to improvise and select the methods best suited or most readily available in a given instance.

Oil, as a specific pollutant, deserves special attention due to its wide use and shipment in bulk quantities. There are, however, many industrial and agricultural chemicals which pose a significant threat even in relatively small quantities. The OSC must be prepared to defend against spills of any toxic substance.

The major part of this section is devoted to oil spill technology. However, the Canadian Chemical Producers Association is prepared to provide technical advice on countermeasures for their products on a 24-hour basis. The communication system for contacting this source of expert advice is detailed in Chapter 2 and in the publication "Transportation Emergency Assistance Plan (see Chapter 7.0 of this Manual).

Most foreign substances spilled into water have a polluting capacity to some extent, some more serious than others. It is very important to know what effect a given substance will have on the usefulness of water for a variety of purposes, e.g., drinking, processing, swimming, wildlife habitat. Research, currently underway in several countries, is directed to establishing these effects for a wide range of potential pollutants. The U.S. Federal Water Quality Administration

(F.W.Q.A.) publication "Oil and Hazardous Materials: Emergency Procedures in the Water Environment" (see Chapter 7.0 of this Manual) is a first step toward a comprehensive catalogue of these properties. Similarly, the "state of the art" of oil spill cleanup is changing rapidly with new equipment, technology and chemical agents appearing on the market with increasing frequency. To keep holders of this manual informed, it is planned that pertinent summaries of new developments will periodically be made available.

4.1 Techniques and Equipment for Handling Oil Spills

The characteristics of the oil spilled, the location and extent of the spill, and existing environmental factors will influence the decisions on how an oil spill should be handled.

The first item of importance, of course, will be to stop or minimize the source of the oil spill. Subsequently, consideration can be directed to limiting the influence of the oil. The following method(s) are normally used for control, recovery and cleanup of oil spills, although the terminology may differ:

A. Confinement - using physical or pneumatic barriers to limit the spread of the spilled oil.

B. Containment - using materials or chemicals that serve to trap the oil or change its form so that its spread is minimized and collection is simpler.

C. Removal - using various techniques to either physically recover the oil or destroy it.

D. Disposal - using surface active agents to break up an oil slick into fine, dispersed droplets that are more

susceptible to the effect of natural forces for ultimate decomposition; or using sinking agents to remove oil from the water surface.

E. Restoration - it is possible that harbours, beaches, rocks, waterfowl and other flora and fauna will be in need of cleanup, so that a wide variety of techniques are possible.

To determine the preferred method for handling an oil spill, it is essential to have as much prior knowledge as possible of the following:

1. Government pollution control regulations and attitudes toward use of chemicals.
2. Area environmental conditions.
   a) Water body
      - Present conditions
      - Flow rate
      - Velocity of current and direction of flow
      - Water use (local fishing, recreation, etc.) and classification
      - Wave heights
      - Tidal variations
   b) Wind conditions
      - Velocity and frequency
      - Direction frequency
3. Equipment, materials, and manpower available.
   a) Barriers
      - Floating booms
      - Air bubble barriers

b) Oil removal equipment

- Stationary skimmers
- Floating skimmers
- Skimming vessels
- Vacuum trucks
- Vacuum barges

c) Cleanup (waterside)

- Absorbents
- Dispersants
- Sinking agents
- Application equipment, e.g., tugs, lighters, barges, work boats, spray plans, helicopters

d) Cleanup (shore)

- Earth moving equipment
- Absorbents and equipment
- Steam cleaning equipment
- Detergents and equipment
- Burning equipment

e) Manpower available

- Own
- Other industry
- Local fire, police, port, Coast Guard, etc.
- Contractors

There is no standard procedure for handling an oil spill. It is possible under certain favourable conditions, i.e. offshore winds and currents, remote locations, etc., that no specific cleanup action is warranted and natural forces will be

allowed to take effect. Any or all of the above mentioned methods may be applicable. Containment or confinement are usually the first steps tried, since they are intended to control the spread of oil. However, in some instances they may be omitted completely. For example, it may sometimes be considered more practical, more economic, and less damaging to the environment, if a spill were allowed to come ashore on a little-used or off-season beach and only cleanup methods were used. Since there are so many variables involved in each spill situation, a general knowledge of techniques and equipment available is necessary.

4.1.1 Confinement

Booms

Commercially available oil spill booms generally consist of weighted fins which extend both above and below the water surface and are kept afloat by some type of buoyancy device. Booms can also be wood floats, logs, rubber floats and canvas covered cork. Recent experiences have shown good success using chain link fencing supported by drums. The fencing has been covered with evergreen boughs or burlap. A boom can be used to encircle an oil slick in an open area or be stretched across a river or estuary and anchored, for the protection of either the upstream or downstream area.

Experience has shown that presently available booms are satisfactory where current, wind and wave conditions are relatively mild. Approximate environmental limits are 1.5 knot current and 2-foot waves. Some vendors have claimed that their

products have successfully performed under more adverse conditions. However, extensive testing has not been able to substantiate such statements. Excessive current causes the skirt of a boom to lift which enables the confined oil to flow under. However, even in high currents, booms have been used successfully by placing the boom at an angle to the current and thus reducing normal forces on the boom. Excessive wave action has caused oil to wash over the top of the fin because of the small freeboards provided. Both current and wave action cause twisting and stress at the boom joints and anchors.

Booms should be readily available to permit quick placement, light enough to be handled with minimum manpower, yet substantial enough to contain oil in the area while considering current strength and rough water.

If the boom is completely free to drift, it will probably orient itself parallel to the wave crests in an elongated cigar shape. Such action minimizes the area available for retaining oil. Therefore, due to this behaviour in waves and the tendency to drift in excessive wind conditions, booms are usually anchored to maintain their position.

New spill boom designs are appearing on the market with increasing frequency. To aid in their evaluation the following guidelines are suggested. An oil spill boom should ideally have the following characteristics to give satisfactory performance:

A. Sufficient freeboard to prevent overtopping by waves.

B. Adequate skirting to confine the desired quantity of oil.

The boom must be sufficiently weighted so that the skirt will not be lifted by current and wave forces within the design criteria.

C. Adequate flexibility to permit the boom to bend sufficiently under the action of waves and current. Either flexible joints or a completely flexible boom is required.

D. Sufficient mechanical strength to withstand the forces imposed by the environment. Some target sea state should be selected as the design basis.

Air Curtain Barriers

Underwater bubble barriers are a relatively recent development. This type of barrier appears to have considerable merit for fixed installations in sheltered waters and has the advantage that entry and egress of ships is unimpaired. Portable systems are in the development stage.

Compressed air distribution from a submerged pipe causes local upwelling with a resultant surface current flowing in both directions perpendicular to the bubble curtain. As long as this flow toward the oil is not exceeded by the current or overcome by the wind forces on the oil, the barrier will contain a spill. The natural current of the water affects the rising air plume by causing it to lean over. If the tilt (lean) is more than 30 degrees from the vertical, the plume will break up and the overall effectiveness is diminished. This technique has been proven effective in currents of 0.6 knots or less.

Chemical Barriers

There has been relatively little study on the possibility of preventing the spread of oil on the water's surface by use of chemical agents. One researcher has proposed that if fatty acid is spread at the periphery of an oil spill, the spreading force of the fatty material will repel the non-polar petroleum and push it into a smaller area. Surfactants are being developed that could accomplish this.

Use of this technique is presently not recommended.

4.1.2 Containment

Sorbent Materials

There is a range of natural and processed materials which may be used as oil sorbents including straw, peat moss and polyurethene foam. Generally, these are spread onto the surface of the oil and subsequently the oil-soaked sorbent is recovered.

In handling a spill of light and heavy components, rapid deployment of sorbent materials is necessary. Prompt action will contain the oil before the volatile fractions evaporate and the viscosity increases. Quick recovery is also important because an oil-in-water emulsion will form in time due to wave agitation. Once the oil has formed this emulsion, it is difficult to absorb, but may be easier to recover by mechanical techniques.

The absorbed oil may be recovered from some materials by squeezing. Others require disposal of the oil by burying or burning; however, some of the absorbents can be reused once the oil is burned away. A disadvantage of such materials is their

susceptibility to wind action and tendency to drift easily. This makes collection difficult unless adequate confinement is provided.

Oil Gelling Chemicals

Chemicals have been developed which will convert oil slicks into gelled masses. Once the oil has been congealed, it can be harvested from the water surface and burned or processed to reclaim the oil. Of two such available products one turns oil into a stiff gel and the other coats the oil slick with cobweb-like plastic threads by spraying, thus forming a manoeuverable, coherent mass. Both methods require a significant amount of chemical and are expensive as well as being potentially toxic.

4.1.3 Removal

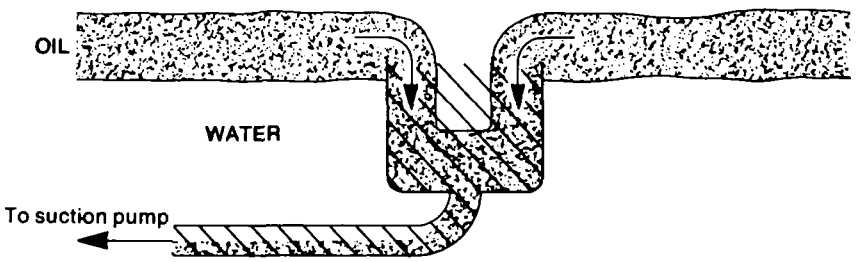
Mechanical Equipment

Several mechanical devices are presently being routinely used to recover oil from the surface of the water. However, their operation is limited to harbors and waterways only mildly agitated by waves and/or currents and their recovery rates are comparatively low. The low recovery rates are due to the small size of units which were designed specifically to handle small harbor spills. The following types of skimmers have been developed to date (Figure 6):

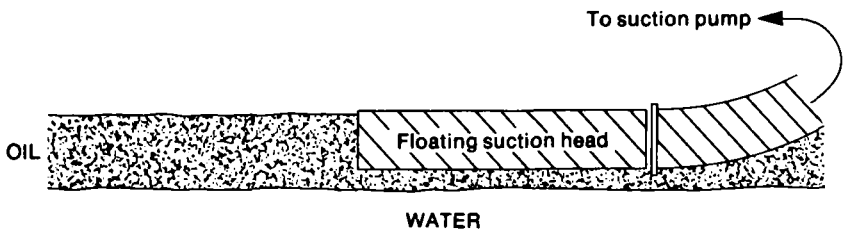
A. Suction devices to lift oil from water.

B. Equipment employing rotating cylinders or endless belts to which oil adheres or is absorbed and is subsequently removed by scraping or squeezing.

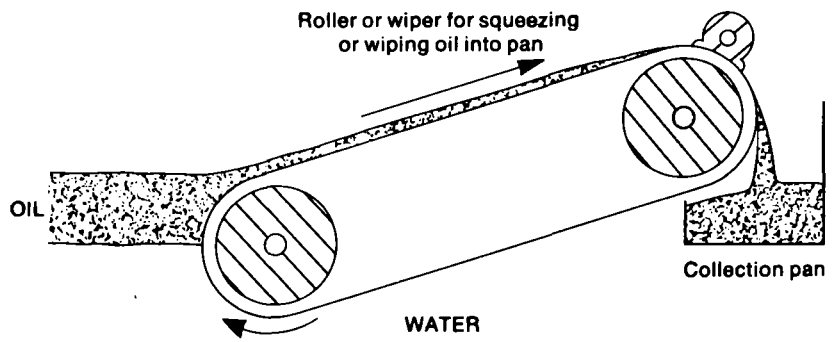
THREE TYPES OF SKIMMER



1. Weir type



2. Floating suction type



3. Absorbent surface type

FIGURE 6

C. Weir skimmers that recover spilled oil by drawing it off a weir which is properly adjusted to minimize the intake of water.

Burning

Burning techniques have had only limited success to date. Once oil is on the water, burning becomes increasingly difficult due to evaporation of the more volatile components, rapid heat transfer to the water (decreasing the oil temperature to below the flash point), and to the lack of oxygen supply to all but the edges of the slick. Unsuccessful attempts were made to ignite small slicks, which were believed to be reasonably thick, around the "Torrey Canyon". Pyrotechnic devices containing sodium chlorate were employed in these attempts with no sign of ignition of the oil. However, some encouraging results were obtained with "wicking agents" on weathered oil from the grounded "Arrow" in Nova Scotia waters.

In certain locations, the disposal of spilled oil by burning may result in an air pollution problem.

Biological Degradation

Research has shown that hydrocarbons are biodegradable. The rate of microbial oxidation is influenced by the kind and abundance of microorganisms present, the availability of oxygen, temperature, nutrients, and the degree of dispersion of oil in water.

In general, emulsified materials, oils absorbed on solids, and thin films of oil are much more susceptible to decomposition than are thick layers of oil. Recent speculation

regarding the possibility of seeding oil slicks with microorganisms which feed specifically on the oil requires study to ascertain the feasibility and practicality of this method.

4.1.4 Disposal

Dispersants

One function of a dispersant is to speed up the natural tendency of an oil slick to spread or "flatten out". When mixing energy or turbulence is applied to a dispersant-treated slick, the intact film tends to break up into minute, dispersed droplets; the dispersant then functions to maintain the oil in the dispersed form. Such energy or turbulence may be provided by wind, waves, work boats, helicopter prop wash, or high-velocity fire hose. The dispersant may eliminate the oil slick and may assist in the ultimate decomposition of the oil by bacterial action and by other natural forces. However, on the other side of the coin, chemical dispersants may in themselves or in combination with the hydrocarbon be toxic, impart taste and/or odors to waters or taint the flesh of fish. The chemically dispersed oil may result in such a high oxygen demand in the waters that aquatic life may be impaired.

Where the most compelling requirements are the protection of wildlife, protection of high value resort areas, or removal of a fire hazard and where the equipment necessary to physically contain and remove the oil spill from the water cannot be rapidly deployed or would be ineffective under existing environmental conditions, dispersants should be considered. The

reluctance to recommend the use of chemicals on harbor and coastal waters stems from the toxic effect of chemicals on fish and other marine life, and most certainly extreme caution should be exercised in waters that are used or will be potentially used as potable supplies.

Many commercial products are available specifically for dispersing oil. They usually consist of an aromatic solvent with about 10 to 25 per cent of detergent emulsifier added. Investigators have found that these dispersants were toxic at concentrations above 1 to 10 ppm. New products have been developed which are water based and therefore, less toxic.

Sinking Agents

A sinking agent is a powder or fine granular material of high true density which admixes with the oil, adheres to it, and sinks it. In general, sinking agents should only be considered for use in deep water beyond the normal fishing grounds and/or breeding areas.

Several substantial problems with the use of sinking agents are evident. First, logistics of supply and dispersal of the agent is difficult, particularly in the case of large spills. Second, the sunken oil may have adverse effects on marine life. Third, resurfacing also poses a considerable problem. Fourth, it is more effective with relatively thin oil films.

Disposal of Recovered Slicks

The techniques which presently can be employed to deal with recovered oil are those which are employed in the treatment

of refinery wastes. The most extensive coverage of recommended practice is Volume One of the "Manual of Disposal of Refinery Wastes" published by the American Petroleum Institute. Most of the basic unit processes therein can effectively be employed to treat the recovered oil-water or oil-water soil mixtures. The manual can be obtained by writing the A.P.I., 1271 Avenue of the Americas, New York, New York 10020, U.S.A.

4.1.5 Restoration

Beaches

Oil saturated sandy beaches may be cleaned in the following order of preference:

A. Physical removal of the contaminated sand, gravel or stones by hand or machinery.
B. Absorption of the oil by absorptive materials, e.g., straw, cellulose fibres, etc.
C. High pressure water washing of freshly deposited oil may be helpful in reducing accumulations.
D. Chemical cleaning.

High viscosity oils and crudes tend to lie on the surface of a beach. Where oil spots or balls of oil and sand are widely dispersed, the surface may be pushed into windrows using wooden squeegees where they can be bulldozed up and removed. Earth-moving equipment can make rapid progress on uninterrupted stretches of beach.

Opinions expressed in the wake of the "Torrey Canyon" incident state that spraying oiled sand with a concentrated detergent usually causes the oil to penetrate deeper into the sand. This leaves the top surface deceptively clean.

The prime concern in any application of chemicals for beach cleaning should be the toxicity of compounds being used and their effect on the immediate environment. Responsible regulatory agencies should be consulted to ascertain whether the chemical being considered is acceptable.

Dry straw, one of the most readily available sorbents, is light to handle and has large surface areas that oils adhere to readily. It is easy to rake up and either burn or bury.

Rocky Coasts, Seawalls and Structures

Physical removal is not practical and sorbents are marginal on cleanup of solid surfaces such as rocks, breakwaters, etc. The preferred methods are simple water washing or chemical treatment. However, in water washing the removed oil may redeposit.

For viscous tar-like oil clingage, a fast-acting cleaning agent is required. This chemical must possess some degree of solvency to cut the oil film as well as being a surface active agent. Some petroleum solvents are effective but are toxic to marine life, and much caution must be observed if they are to be used. In pollution-sensitive areas, non-toxic products may be mandatory. They are applied in concentrated form directly to the oil surfaces, allowed to soak into the deposit and flushed with a high pressure stream of water.

Claims have been made that oil stained walls can be cleaned by burning the oil with high temperature, oxy-propane flame. In field application, several important disadvantages came to light. The necessary equipment included gas cylinders

which were clumsy and difficult to transport. It was expensive to use, and the rate at which the oil was burned appeared far too slow in relation to the vast area which needed cleaning. Although the wall was left very clean, the high temperature caused the surface of the wall to spall. Burning oil off walls using flame-throwers was also unsatisfactory because of the slowness of the method and the excessive quantity of fuel used.

Waterfowl

Assistance in the treatment of stricken waterfowl may be provided by conservation groups. Appropriate support of this activity should be extended by the oil spill team on the scene.

The requirements of the basic treatment include warmth suitable for a warm-blooded animal, food suitable for the species involved, immediate cleaning of the adhering oil, and a period of rehabilitation prior to release.

Many methods of removing oil and tarry deposits from waterfowl plumage have been attempted. Soap and water usually have little value in removing oil and tar. Some solvents used to clean birds cause considerable irritation of the skin. The loss of natural oils from the plumage and the breaking of the interlocking mechanism of the feathers often requires the birds to be retained for a week or more before they can be released.

Manual procedures are involved and time consuming. Several ingredients applied singly or in combination include: dry shampoos of Fuller's earth or powdered chalk, butter, margarine, vegetable oils, Neat's foot oil, oleic acid, commercial detergents, and sulfonated castor oil. A Swedish preparation has appeared on the market, which cleans the bird

and adds wax to the feathers. Larodan 127 functions similarly to the combined washing and waxing of cars. It is distributed by Skandinavisk Oljeservice A.B. Goteborg, Sweden.

4.1.6 Summary of Techniques for Treating Oil Spills

Our survey of the literature concerning oil spills indicates that certain techniques for dealing with oil spills are superior to others in some situations. These are presented here in condensed form.

Suggested Methods for Cleanup

Volatile Oil Spills

Fire is the major hazard and is the primary concern when gasoline and light solvents are spilled in water. Initial effort should be directed toward preventing the freshly spilled oil from spreading among boats, under docks, etc. and to eliminating ignition sources.

In open water, volatile oils should be allowed to spread. The spreading increases evaporation which decreases the fire hazard time and speeds the removal of oil from water.

Nonvolatile Oil Spills

1. Spill Size: Less than 10 barrels

   A. Water condition: calm, current less than 2 knots, open or enclosed water, wind velocities up to 10 knots.

      Locations : Any

      Containment : a) Booms, if available

      b) Air barrier, if available

Pickup : a) Sorbent material (e.g. straw, polyurethane foam)
b) Skimmers
c) Vacuum tanks

B. Water Condition: Waves 2 feet or greater, current greater than 2 knots, open or enclosed water, wind velocities over 10 knots.

Locations : River crossings, river docks, canal docks, bays, open sea.

Containment : None

Pickup : Sorbent material (e.g. straw, polyurethane foam), providing waves and current permit.

2. Spill Size: More than 10 barrels

A. Water Condition: Calm, current less than 2 knots, open or enclosed water, wind velocities up to 10 knots.

Locations : Harbors, slips, reservoirs, bays, slow streams and canals.

Containment : a) Booms
b) Air Barriers

Pickup : a) Skimmers
b) Vacuum tanks
c) Sorbent material (e.g. straw, polyurethane foam)

B. Water Condition: Waves greater than 2 feet, current greater than 2 knots, open or enclosed water, wind velocities over 10 knots.

Locations : River crossings, river docks, canal docks, bays, open sea.

Containment : Nets and barriers to contain oil soaked sorbent material, providing waves and current permit.

Pickup : Sorbent material (e.g. straw, polyurethane foam)

5.0 POLICY

5.1 Fisheries Service Policy

The Fisheries Service of the Department of the Environment has been provided a set of interim guidelines concerning those dispersants and chemicals which might be considered for use in the consequence limiting phase of an oil spill. The guidelines are as set out in the following:

INTRODUCTION

1. Chemicals are used to disperse, gel, sink, absorb, or facilitate the burning of oil. With the exception of gelling agents, chemicals have been used in a number of major incidents, singly and in combination, with varying results. Each major incident differed as to the circumstances, i.e. the source, type of oil, nature of the marine environment and proximity of the shoreline.

DEFINITIONS

2. Dispersants - are intended to increase the surface area of an oil slick and emulsify or disperse oil globules thoughout the larger volume of water, thereby aiding in accelerated degradation of oils by microbiological means. The chemical dispersants do not themselves destroy oil. They vary considerably in toxicity, effectiveness, and ability to stabilize the oil after extended periods of time. Technology for proper application of dispersants over large oil slicks with necessary mixing is currently lacking. Use appears far more critical in freshwater harbour and estuary areas and in proximity to shore. Particular care must be exercised where water supply might be affected.

The desirability of employing dispersants in the open sea remains doubtful although their use here is potentially more promising pending additional field data. After widespread dispersant use, reports led to the conclusion that dispersants or the dispersant-oil mixture cause much more damage to aquatic life than oil alone. On beaches, they actually compound the problem by adding to the amount of pollutants present, by causing the oil to penetrate more deeply into the sand, and by disturbing the sand's compactness so as to increase beach erosion through tidal and wave action.

3. Floating Absorbents - include a wide range of materials with oil-attracting and water-repelling characteristics such as straw, peat, etc., and certain plastic products. While they have unique advantages over other methods of clean-up such as limiting the rate of slick spreading or facilitating clean-up, they have a number of disadvantages which include delivery and application and collection and dispersal of the oil-absorbent mass. Considerable mixing or interaction of the oil and absorbent is very desirable for maximum uptake of oil. Collection and disposal of the oily mass poses greater problems than the dispersal of the oil-water emulsions due to their bulk.

4. Sinking Agents - adhere to the oil, resulting in subsequent absorption and sinking of the mass. Care must be exercised in the use of these, as the oil mass can form a layer or blanket on the bottom, causing adverse effects on bottom-using organisms. It appears there might be some advantage in using these outside heavier fishing zones and where there will be minimum adverse effects on the coastal marine environment.

5. Gelling Agents - are applied over the surface or periphery of an oil slick. It is claimed that gelled oils recovered in this manner may be profitably reclaimed, i.e. mixed with fuel oil and burned as replacement fuel.

6. Burning Agents - an attractive and inexpensive means of disposing of large amounts of oil. Although present techniques have not proved very successful, it is considered that burning should only be used in situations where the oil is sufficiently distant from the shoreline or other property so as not to create a fire hazard.

USE OF CHEMICALS

7. In considering the use of chemicals with oil spills, a number of factors must be carefully borne in mind. Of first importance is the effect of the chemical or oil-chemical mixture on the water environment. The introduction of toxic chemicals in the water or on the shore face can result in lasting damage to valuable species. It is important not to make it invisible but to minimize its effect upon the environment.

RESTRICTIONS ON CHEMICALS USED FOR TREATING OIL SPILLS

8. Chemical agents should not be used in any place unless:

a) In the judgement of the on-scene commander, their use will prevent or substantially reduce a hazard to human life or important fire hazard to property.

b) In the opinion of the responsible federal or provincial agency, it is necessary to prevent or reduce a threat to a major population segment of a vulnerable species of water fowl.

c) In the opinion of the responsible federal or provincial agency, their use would cause less loss of environmental quality than other available methods of dealing with the oil spill.

9. To make a valid and objective decision regarding the use of chemical agents, the on-scene commander will need advice on the relative values involved from those agencies most directly concerned. DCOs and Regional technical staff must be prepared to proceed to the spill area immediately, if necessary, in order to make a full assessment of all the fisheries values which might be at stake, e.g. oyster or clam beds, juvenile salmon, etc.

URGENT SITUATION

10. There may be an urgent requirement to take countermeasures because of a threat to human life or a fire hazard (para. 8a above). In this situation, if local Fisheries personnel are unable to contact Headquarters in time, they may agree to the use of a chemical dispersant but only to the extent necessary to remove the threat.

POLICY ON DISPERSANTS

11. Except as noted in para. 8 above, it will be the policy of this Department that chemical dispersants SHOULD NOT BE USED ON:

a) Any distillate fuel oil

b) Any spill of oil less than 200 barrels in quantity

c) Any shore line

d) Any waters less than 100 feet deep

e) Any waters containing major fish populations or large breeding or migration areas for species of fish or marine life which may be damaged or reduced in market value by exposure to dispersants or dispersed oil.

f) In any waters where winds or currents are of such nature that dispersed oil mixtures would likely - in the judgement of the departmental representative in charge - be carried to shore areas within 24 hours.

12. NOTWITHSTANDING THE ABOVE, dispersants MAY BE AUTHORIZED by Regional Headquarters if other control methods are judged to be inadequate or infeasible, provided information has been given to the Department in sufficient time prior to its use for adequate tests to be carried out.

13. The following is a short list of trade names of chemical agents which are known to the Service:

Gamlen

Corexit

Polycomplex A

Energy Plus

Cestic 365

Ameroid No. 1

XZIT Spill-Gone

Diachem-Micro D

Diasol

Basic H

6.0 Acknowledgements

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7.0 Related Publications

Interim Federal Contingency Plan for Combatting Oil and Toxic Material Spills. Prepared by Marine Operations of MOT, 1970. Available from Marine Pollution Officer, Ministry of Transport, Ottawa, Ontario.

Oil and Hazardous Materials, Emergency Procedures in the Water Environment. U.S. Dept. of Interior, Federal Water Pollution Control Administration, Northeast Region, North Atlantic Water Quality Management Center, Edison, N.J., Oct. 1968. Reprint available from Mr. Fred Barber, Dept. of the Environment, Marine Sciences Branch, 615 Booth St., Ottawa, Ont.

Report of the Task Force - Operation Oil. In three volumes. Issued by the Ministry of Transport, Ottawa, Ont.

Transportation Emergency Assistance Plan. Issued by the Canadian Chemical Producers Association, Suite 2121, Tower A, Place de Ville, Ottawa 4, Ontario.