United States
Environmental Protection
Agency

Region 10
1200 Sixth Avenue
Seattle WA 98101

Superfund Response and Investigations Section

EPA

Oil and Hazardous Substances Response Manual

REPORT

OIL OR HAZARDOUS SUBSTANCE SPILLS
TOLL FREE DAY OR NIGHT
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ASSISTANCE

OIL AND HAZARDOUS SUBSTANCE SPILLS
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by

Ecology & Environment, Inc.

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1.0 INTRODUCTION

The Congress has declared that it is the policy of the United States that there should be no discharge of oil or hazardous substances into or upon the navigable waters of the United States or its adjoining shorelines, or into or upon waters of the contiguous zone (Sec. 311 (b) (1) of the Federal Water Pollution Control Act).

The Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), provides liability, compensation, cleanup, and emergency response for hazardous substances released into the environment. The environment as defined by CERCLA includes: the navigable water, the waters of the contiguous zone, the ocean waters, any other surface water, ground water, drinking water supply, land surface or subsurface strata or ambient air within the United States.

These policies and provisions are carried out through a coordinated effort by Federal and State departments and agencies, as outlined in the "Region 10 Oil and Hazardous Substances Pollution Contingency Plan" for the waters of Washington, Oregon, and Idaho. This Response Manual is a sub-part of the overall Region 10 Contingency Plan. Its purpose is to give the responding Federal and State officials a convenient "quick" reference guide of duties, cleanup techniques, and resources that may be called upon to mitigate and control the effects of an oil or hazardous substance response.

2.0 FEDERAL LAWS

2.1 FEDERAL WATER POLLUTION CONTROL ACT

The Federal Water Pollution Control Act, as amended (also called the Clean Water Act), represents the latest water pollution control legislation and contains several elements relative to pollution by oil and hazardous substances. The basic authority for spill prevention and response programs originates from Section 311 of the Act. Section 311 provides the overall framework for spills of oil and designated hazardous substances, including national policy and responsibilities. Section 311 (b) (5) provides that: "Any person in charge of a vessel or of an on-shore facility or an off-shore facility shall, as soon as he has knowledge of any discharge of oil or hazardous substance from such vessel or facility...immediately notify the appropriate agency of the United States Government of such discharge. Any such person who...fails to notify immediately such agency of such discharge shall, upon conviction, be fined not more than $10,000 or imprisoned for not more than one year or both". The "appropriate agency" is indicated in Section 4.1 of this manual.

It is the policy of the United States that the spiller assumes complete financial responsibility for removal actions. If the Federal On-Scene Coordinator (OSC) determines that timely and/or adequate removal actions are not being carried out, then the Federal Government will initiate cleanup. The Government may then bring action against the responsible party to recover all cleanup costs up to the liabilities set by Federal Law. A spill cleanup must be done to the satisfaction of the Federal OSC.

2.2 COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT OF 1980 (CERCLA)

This act significantly broadens the scope of spill reporting and response. Specifically, the Act requires that the National Response Center be notified of any release of a reportable quantity of a hazardous substance to the environment.

The definition of hazardous substances has been expanded to include: those already designated under Section 311 of the Federal Water Pollution Control Act (FWPCA), hazardous wastes defined under Section 3001 of the Solid Waste Disposal Act, toxic pollutants listed under Section 307 of the FWPCA, hazardous air pollutants listed under Section 112 of the Clean Air Act, substances pursued under Section 7 of the Toxic Substances Control Act, and any substances subsequently designated pursuant to Section 102 of Superfund. The definition does not include petroleum. A listing of these substances can be compiled by obtaining copies of 40 CFR Parts 117 and 302. Section 102 of CERCLA requires the United States Environmental Protection Agency (EPA) to establish reportable quantities for all hazardous substances. However, until they are established, CERCLA sets a reportable quantity of one pound, except for those substances of which reportable quantities were previously assigned under Section 311 of the FWPCA.

Therefore, any substance designated as hazardous according to the laws cited above, when released to the environment in reportable quantities of one pound or greater (unless a different quantity has been established either by the EPA or has been designated by Section 311 of the FWPCA), must be reported to the National Response Center. Failure to notify could result in a fine in accordance with the applicable provisions of title 18 of the United States Code or imprisonment of not more than 3 years (or not more than 5 years in the case of a second or subsequent conviction), or both.

Requirements for spill cleanup and the responsibilities of the On-Scene Coordinator (OSC) are similar to those under Section 311 of the FWPCA.

2.3 SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA)

This act serves to increase the existing aspects of spill reporting and response. Not only does it significantly strengthen EPA's authority in the removal, remedial and enforcement actions established by CERCLA, it also creates a formal process for State involvement during the cleanup at remedial action sites. SARA also establishes various new statutory authorities including Underground Storage Tanks and Emergency Planning and Community Right-to-Know.

Specifically, SARA addresses the issue of remedial action by directing the EPA to consider the use of alternative treatment or resource recovery technologies, as opposed to disposing of hazardous substances in landfills. In the event of removal action, the chosen method should contribute to the efficient performance of any long term remedial action. Section 209 of the Act gives EPA the authority to conduct a program of research, evaluation, testing, development and demonstration of alternative or innovative treatment technologies.

SARA addresses the problem of Leaking Underground Storage Tanks (LUST) in Section 205 of the Act in which Subtitle I of the Solid Waste Disposal Act (SWDA) is amended to add new authorities relating to Federal and State involvement. States are required to conduct two separate inventories and submit their findings to EPA. The Act authorizes EPA or a State to require the owner or operator of a LUST to undertake corrective action or to undertake corrective action themselves when any releases of petroleum occur. Costs incurred for such corrective or enforcement action will be funded by the LUST fund. Corrective action undertaken by EPA or a state may include temporary or permanent relocation of residents, provision of alternative household water supplies and a exposure assessment.

Title III of SARA deals with Emergency Planning and Community Right-to-Know. The emergency planning sections provide State and local governments with the capability of handling emergency situations. This is accomplished by requiring State governments to designate an emergency response commission comprised of various public agencies as well as private groups. The State Commission must in turn appoint local emergency planning committees which are responsible for the development of an emergency response plan. The National Response Team (NRT) is responsible for publishing guidance on emergency response planning known as the Hazardous Materials Emergency Planning Guide and Checklist for Hazardous Materials Contingency Plans. Community Right-to-Know reporting requires owners/operators of facilities to supply information to the State Commission, local emergency planning committees, and local fire departments on the manufacture, use and storage of chemicals present at their facilities. The information must

also be available to the general public.

2.4 RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

This Act addresses problems related to the generation, disposal, and management of waste materials in the United States. This response manual relates to those portions of the Act dealing with hazardous wastes. Regulations have been promulgated by EPA which serve to: identify hazardous waste both by characteristics and by sources; develop the cradle-to-grave manifest and tracking systems; and implement a permit system and facility standards for the treatment, storage, and disposal of hazardous wastes.

The regulations require that generators, transporters, and disposers of hazardous wastes must obtain EPA identification numbers. During spill situations where hazardous waste is recovered and transported to a disposal site, the shipment must be accompanied by a manifest which includes the EPA identification number of the generator and each transporter. These identification numbers are necessary prior to transporting the materials off site. In order to avoid delay in obtaining these numbers, EPA has established a special procedure for rapid issuance of numbers. The EPA Regional Office will issue provisional numbers to generators and transporters during emergencies, when rapid transportation of hazardous waste to an authorized waste management facility is necessary. These identification numbers and further information concerning the RCRA Act can be obtained by contacting:

U.S. Environmental Protection Agency,
Region 10 Chief, Waste Management Branch
1200 Sixth Avenue, Seattle, WA 98101
(206) 442-2782 or the
RCRA Assistance Line 1-800-424-9346

3.0 NATIONAL AND REGIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLANS

The National and Regional Oil and Hazardous Substances Pollution Contingency Plans have been developed in compliance with the Federal Water Pollution Control Act, Section 311 (c)(2), CERCLA, Section 105 and SARA, Section 105. These Plans provide for a coordinated and integrated response, including containment, dispersal and removal by departments and agencies of the Federal and State governments to protect the public health and environment and minimize adverse impacts due to oil and hazardous substance discharges. The Plans also promote the coordination of the Federal and State response systems by developing local government and private capabilities in handling environmental incidents.

3.1 ON-SCENE COORDINATOR

The On-Scene Coordinator (OSC) is the Federal official predesignated by the EPA or United States Coast Guard (USCG) to provide on-scene coordination and direction of all aspects of a spill and subsequent removal actions. The OSC is predesignated as part of the planning and preparation for response to pollution incidents. EPA normally provides OSCs for inland waters and USCG normally provides OSCs for coastal waters. However, this function may be delegated to other State or Federal officials where appropriate. The OSC maintains responsibility to ensure that the proper initiation, containment, countermeasures, cleanup, and disposal actions take place. An official from any agency with responsibility under the Regional Contingency Plan may assume the role of the OSC until the predesignated OSC arrives.

3.2 REGIONAL RESPONSE TEAM

The Regional Response Team (RRT) serves as the regional body for planning and preparedness actions prior to pollution discharges and for coordination and advice during a pollution discharge. The RRT is composed of regional representatives of participating Federal, State, and local government agencies. Activation of the RRT will normally occur when a major or significant release of oil or hazardous substance occurs. During a pollution emergency the RRT members shall insure that the resources of their respective agencies are made available to the OSC. Both the National and Regional Plans contain the responsibilities and the functions of the OSC and RRT and are available for review at the EPA and USCG offices.

3.3 SPILL RESPONSE PHASES

The actions taken to respond to a pollution discharge can be separated into five relatively distinct classes or phases. For descriptive purposes, these are: Phase I - Discovery and Notification; Phase II - Evaluation and Initiation of Action; Phase III - Containment and Countermeasures; Phase IV - Removal, Mitigation and Disposal; and Phase V - Documentation and Cost Recovery. It must be recognized that elements of any one phase may take place concurrently with one or more other phases. The OSC initiates and directs Phases II, III and IV.

3.3.1 Phase I - Discovery and Notification

Notification is the first response action to an oil or hazardous substance spill. The notification and dissemination of information will be in accordance with the applicable regional and local plans, but should include the necessary steps to safeguard life and property and the notification of other agencies, for example, fire departments, police departments, etc.

3.3.2 Phase II - Evaluation and Initiation of Action

Identification of the material spilled is of utmost importance during spill incidents (see Section 5.0). If the identity of a spilled material is not known, it is recommended that the spill not be approached by the OSC and/or his designated representative until the material can be properly identified and the hazards and safety precautions known. Otherwise, the spill should be treated as if it were a highly toxic substance and should be approached only with full protective gear employed.

If the nature of the potential hazard of a spill is unknown, every effort should be made to determine the nature and extent of the spill prior to exposure of cleanup personnel. In the long run, time spent in making such a determination may be more than compensated for by making swift, concerted and appropriate action possible when the problem is properly defined.

Many, if not most, hazardous substances are soluble or miscible in water. Thus, evaluation of containment/cleanup efforts will be much more difficult than with oil spills. In addition, the evaluation of the magnitude of the spill, the potential hazard and the environmental impact will be more difficult and can be expected to require more on-scene response effort than required for oil alone.

3.3.3 Phase III - Containment and Countermeasures

These are defensive actions to be initiated as soon as possible after discovery and notification of a discharge. These actions may include public health and welfare protection activities, source control procedures, salvage operations, placement of physical barriers to halt or slow the spread of a pollutant, emplacement or activation of booms or barriers to protect specific installations or areas, control of the water discharge from upstream impoundments and the employment of chemicals and other materials to restrain the pollutant and its effects on water related resources (see Section 6).

3.3.4 Phase IV - Cleanup, Mitigation and Disposal

This includes actions taken to recover the pollutant from the water and affected public and private shoreline areas, and monitoring activities to determine the scope and effectiveness of removal actions. Actions that could be taken include: the use of sorbents, skimmers and other collection devices; or the use of reaeration or other methods to minimize or mitigate damage resulting from dissolved, suspended or emulsified pollutants; or special treatment techniques to protect public water supplies or wildlife resources from continuing damage (see Section 6).

Pollutants and contaminated materials that are recovered

in cleanup operations shall be disposed of in accordance with procedures agreed to at the State or local level (see Section 7).

3.3.5 Phase V - Documentation and Cost Recovery

This includes a variety of activities, depending on the location of, and circumstances surrounding, a particular discharge. Recovery of Federal removal costs and recovery for damage done to Federal, State or local government property are addressed in this phase, as well as citizen suits for recovery of private losses. The collection of scientific and technical information of value to the scientific community as a basis for research and development activities and for the enhancement of

understanding the environment may also be considered in this phase. For purposes of enforcement and establishing liabilities, it is imperative that the collection of samples and necessary data be performed at the proper times during the case (see Section 9).

4.0 SUMMARY OF ACTIONS TO BE TAKEN BY THE SPILLER

When a spill has occurred which is in violation of the Federal Laws (see Section 2.0), the responsible party must take certain actions which can be classified as follows.

4.1 REPORT IT

The Act requires that any person in charge of a facility responsible for discharging will notify the appropriate agency of the United States Government as soon as he has knowledge of any discharge of oil or hazardous substance. The appropriate agencies to notify are as follows:

Federal

	National Response Center	800-424-8802
or		
	U.S. EPA: Seattle	206-442-1263
or		
	USCG: 13th District, Seattle	206-442-5850
	COTP, Seattle	206-286-5540
	COTP, Portland	503-240-9317

State

Idaho, EMS		800-632-8000
	or	208-334-2241
Oregon, DEQ	(from inside state)	800-452-0311
	(from outside state)	503-378-4124

Washington, DOE	(Olympic Peninsula & South of Tacoma)	206-753-2353
	(Puget Sound North of Tacoma & San Juan Is.)	206-867-7000
	(East of Columbia R.)	509-456-2926
	(Central Washington)	509-575-2490
Alaska, DEC		907-465-2600
	and	907-465-2653
	In Anchorage: Dial 211 ask for	Zenith 9300

4.2 CONTAIN IT

Containment of the spilled material is of extreme importance since the effectiveness and cost of cleanup will usually be directly related to the effectiveness of containment. For this reason, containment must be undertaken as soon as possible after discovery of the spill. The first step is to locate the source and make an effort to stop the flow of material. Containment equipment should then be established well below the leading edge of the spilled material to insure ample time for installing the containment equipment. In many cases, a series of containment devices will be required. Whenever possible, containment should be accomplished before the material reaches water. Once oil has reached water, recovery is much more difficult. Most other hazardous substances are nearly impossible to recover or treat once they have entered a water body.

Spills involving hazardous materials may result in the release of chemical substances into the air. Airborne emissions can produce hazardous or toxic atmospheres which may have adverse affects on the health and safety of the response personnel and the public. Containment of airborne emissions is usually impossible; however, airborne hazards can sometimes be predicted and controlled if the substances involved and weather conditions are known. The containment method used to control airborne emissions is dependent on the situation and the state of the contaminant involved (i.e., vapor, gas or particulate).

An oil or hazardous substance spill which occurs on soil can be contained by a wide variety of methods. The containment method chosen in this situation will depend on the substance spilled and the permeability of the soil. The containment method used should prevent spread of the substance and facilitate the cleanup process.

4.3 CLEAN IT UP

The Act also requires that the responsible party remove the spilled material and conduct cleanup to the satisfaction of the Federal OSC (see Section 3.1). Therefore, after the material has been adequately contained, resources should be assembled to accomplish a satisfactory cleanup. This may involve using company employees and equipment or it could

require the assistance of a contractor who specializes in spill cleanup. (See Section 6 for specific techniques related to containment and cleanup.)

5.0 IDENTIFICATION AND ASSESSMENT OF SPILLED MATERIALS

In the event of a discharge, the spiller should be able to provide information concerning the identification of the material. However, if the spiller is unknown or not available, then other clues may be useful in determining the type of material spilled. These include:

1. Characteristics of the container
   - o Container shape
   - o Markings and colors
   - o Placards and labels

2. Characteristics of the spilled material
   - o Physical state
   - o Type of odor emitted
   - o Color
   - o Turbidity
   - o Behavior in water
   - o Irritability to eyes
   - o Fuming
   - o Flaming
   - o Foaming
   - o Gas emitting
   - o Reactions

3. Shipping papers for transportation related spills

Every vehicle related incident should be considered to be a potential hazard because of the material the vehicle may be carrying, even though it is not placarded. This is because the law does not require that vehicles carrying certain materials be placarded, even though they may be extremely dangerous under certain circumstances. (For example, hair spray usually considered to be relatively harmless, is very flammable and explodes when subjected to heat.) There are numerous other products which, when packed under pressure in aerosol cans, are potentially dangerous.

In case of an accident or spillage, the first person at the scene should ascertain from the driver of the vehicle, conductor of the train or pilot of the plane, the type of material being transported. If the driver, conductor or pilot is unconscious or dead, an attempt should be made to retrieve the shipping papers from the location indicated in Table 1 to determine the type of material aboard. If unable to locate shipping papers, or obtain the name of the commodity from the containers, contact the carrier or shipper involved to get this information. The attempt to retrieve the shipping papers or name of the commodity from containers, should ONLY be undertaken if it can be accomplished without undue risk to

emergency personnel.

The type of material being transported in a tank truck can be determined by the shape and specification of the tank truck. The motor carrier's (MC) number, indicates the tank trailer construction specifications as established by the Department of Transportation. A permanently affixed metal identification plate on the tank trailer should specify information including: the DOT MC specification, carrier's serial number, manufacturer's name, date of manufacture and nominal capacity.

If the identification plate is inaccessable, the type of commodity can be identified by the tank trailer shape. Figure 1 briefly illustrates the most common tank trailers used in the transport of hazardous materials.

TABLE 1

SHIPPING PAPER IDENTIFICATION CHART

Mode of Transportation	Title of Shipping Paper	Location of Shipping Papers	Responsible Person
Highway*	Bill of lading	Cab of vehicle	Driver
Rail**	Waybill Consist	With conductor	Conductor
Water	Dangerous Cargo Manifest	Wheelhouse or pipelike container on barge	Captain Master
Air	Air Bill with Shippers Certification for Restricted Articles	Cockpit	Pilot

* Manufacturer's data sheets generally available from driver in addition to bills of lading.

** STCC (Standard Transportation Commodity (Code) Number is used extensively on rail transportation shipping papers.

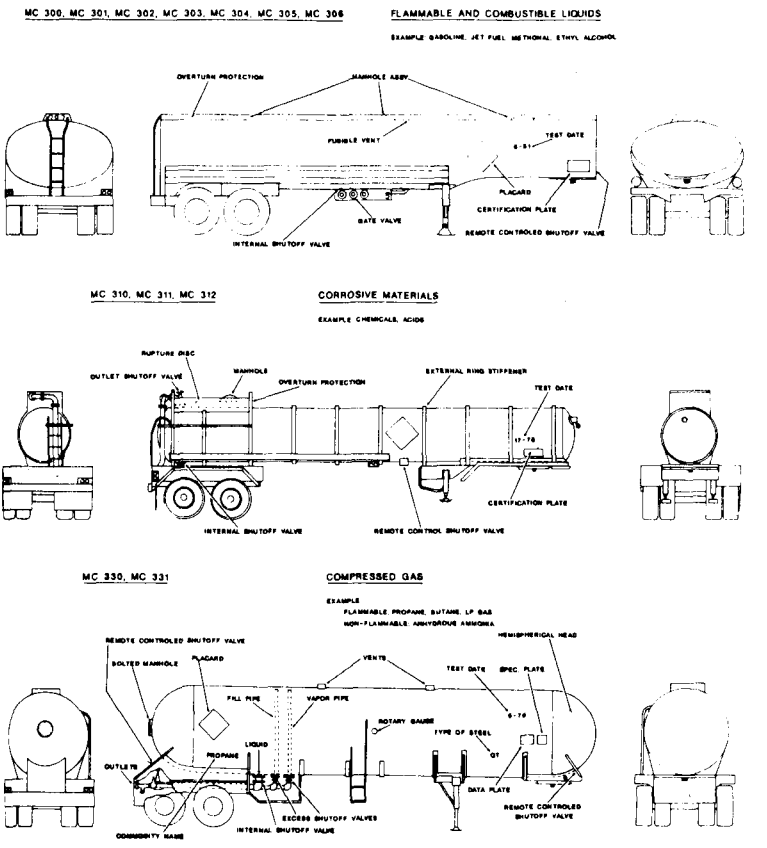


Figure 1. Common Tank Trailers.

When identifying hazardous substances, great care must be taken in copying names of materials since even minor spelling errors can have serious consequences in determining the hazardous properties of the spilled material.

Unidentified materials must be approached as though they are highly toxic and full protective gear should be used.

Table 2 provides a general classification of hazardous materials commonly transported.

The following format will be of assistance in establishing the identity of the material and the magnitude of the spill:

Establish the type of spill - The first step is to determine what type of spill is involved by identifying the source of the spill. The following types of spills are possible.

1. Trains
   - o Tank car
2. Trucks
   - o Tank
   - o Trailer
3. Bus
4. Aircraft
   - o Cargo
   - o Passenger
5. Ship
   - o Dry Cargo
   - o Tank Ship
   - o Com. Pass. Vessel
   - o Fishing Vessel
   - o CG Vessel
   - o Pleasure Craft
   - o Tugboat
   - o Unidentified
6. Barge
7. Pipeline
   - o Offshore
   - o Onshore
8. Storage Tank
   - o Offshore
   - o Onshore

Identify the spilled material:

1. Are hazardous placecards visible on vehicle or container?
2. If so, what are contents identification or warnings relating to dangers (poisonous, explosives)?
3. Identification numbers on tank, cars, trucks, etc.?
4. Is shipping paper available?

Record easily visible physical properties - Observation of the following properties of the spilled material can confirm an identification or possibly identify the specific chemical involved. However, the OSC must approach the spill cautiously and not endanger himself and others in determining the characteristics. If a certain physical property cannot be readily identified, gather other information that can safely be obtained.

1. What is the spill state?
   - o Solid (powder, pellet, granular)
   - o Liquid
   - o Gas

2. Is there a noticable odor from a safe distance? (pleasant, almond, ammonia, benzene, fragrant, lysol, vinegar, sweet)

3. What color is it?

4. It is turbid?
   - o Opaque
   - o Clear
   - o Cloudy
   - o Other

5. If it is in water, is it soluble?
   - o Float
   - o Sink
   - o Mix (soluble)

6. Does it cause your eyes to water?

7. Is it reacting?
   - o Fuming
   - o Flaming
   - o Foaming
   - o Is a gas being given off?
   - o Is another noticeable reaction occurring?

Magnitude of the Spill - The OSC can establish the magnitude of the spill by considering the following:

1. What number, type and size of individual containers have released the material?

   - o Metal drums Height_____ Diameter_____
   - o Fiber drums Height_____ Diameter_____
   - o Carboys Height_____ Diameter_____
   - o Bags
     Paper Length_____ Width_____ Height_____
     Polyethylene Length_____ Width_____ Height_____
   - o Cylinders Length_____ Width_____ Height_____
   - o Boxes Length_____ Width_____ Height_____
   - o Other Dimensions:_____

2. If large tank trucks, tank cars, barges or ship holds are involved, the approximate size can be estimated by pacing off a similar distance at a remote location.

   Size:_____X_____X_____

   Often the tank cars and trains are labeled so the capacity is apparent. This information should be recorded. _____gal.

   Other technical data are available in the following reference volumes:

   a. OHM TADS - EPA

   b. Chris Manuals - U.S.S.G.

   c. Fire Protection Guide on Hazardous Materials - NFPA

   d. Hazardous Materials - Emergency Action Guide - U.S. Department of Transportation

   e. CHEMTREC

   f. Chemical Manufacturer

3. Additonal Notes:

TABLE 2

GENERAL CHARACTERISTICS AND EXAMPLES OF HAZARDOUS MATERIAL

GENERAL CATEGORY DOT CLASSIFICATIONS	EXAMPLES	GENERAL HAZARDOUS PROPERTIES
Explosives and Blasting Agents		
Class A Explosive	Dynamite, Dry TNT, Black Powder	Sensitive to heat and shock
Class B Explosive	Propellant Explosives, Rocket Motors Special Fireworks	Contamination could cause explosion Thermal and mechanical impact potential
Class C Explosive	Common Fireworks, Small Arms Ammunition	
Blasting Agent	Ammonium Nitrate-Fuel Oil Mixtures	
Gases (Compressed, Liquefied or Dissolved under Pressure)		
Flammable Gas	Liquefied Petroleum Gas, Acetylene, Hydrogen	Explosion potential BLEVE Vapor-air
Nonflammable Gas	Carbon Dioxide, Sulfur Dioxide, Anhydrous Ammonia	Flammability hazard
Cryogenic	Ethylene, Nitrogen	Liquified gases — cold temperatures — frost-bite-high expansion ratio
Flammable and Combustible Liquids		
Flammable Liquid	Acetone, Gasoline, Methyl Alcohol	Flammability hazard
Pyroforic Liquid	Aluminum Alkyls, Alkyl Boranes	Explosion potential BLEVE Vapor-air
Combustible Liquid	Fuel Oils, Ethylene Glycols	Potentially corrosive, toxic, thermally unstable
Flammable Solids		
Flammable Solid	Pyroxylin Plastics, Magnesium-Aluminum Powder	Readily ignite and burn explosively. Some spontaneously
Water Reactive	Sodium and Potassium Metals, Calcium Carbide	Water reactive potential Toxic and corrosive potentials
Spontaneously Combustible	Phosphorus	
Oxidizers and Organic Peroxides		
Oxidizer	Ammonium Nitrate Fertilizer, Hydrogen Peroxide Solution	Supply oxygen to support combustion of normally nonflammable materials
Organic Peroxide	Benzoyl Peroxide, Peracetic Acid Solution	Explosively sensitive to heat, shock, friction Potentially toxic
Poisonous and Infectious Substances		
Poison A	Arsine, Hydrocyanic Acid, Phosgene	Harm from inhalation, ingestion, absorption
Poison B	Aniline, Arsenic, Methyl Bromide	
Irritant	Tear Gas, Xylyl Bromide	Flammability potential
Etiologic Agent	Anthrax, Botulism, Rabies, Tetnus	
Radioactive Substances		
Radioactive Material	Plutonium, Cobalt, Uranium Hexafluoride	Harm: Particulate — alpha and beta particles Radiation — gamma rays Internal and external
Corrosives		
Corrosive Material	Acids — Hydrochloric Acid, Oleum Sulfuric Acid Bases — Caustic Soda, Caustic Potash	Harm: Disintegration of tissues, external Fuming potential Oxidizing effect Splatter potential
Other Regulated Materials		
ORM A	Dry Ice, Carbon Tetrachloride	Toxic
ORM B	Quicklime, Metallic Mercury	Corrosive
ORM C	Oakum, Bleaching Powder	
ORM D	Consumer Commodity	
ORM E	Hazardous Substances — Pentachloro-phenol, Adipic Acid — and Hazardous Wastes	

6.0 CONTAINMENT AND CLEANUP TECHNIQUES

Upon arriving at a spill scene the investigator should observe the physical situation and, if necessary, take appropriate safety precautions. It is preferable to know the materials spilled before leaving the office. This will allow time to check the hazards of the materials involved in the spill, and what precautions and actions would be required during cleanup operations.

Once the identity and danger of the spilled material has been assessed, various methods of containment and/or cleanup may be appropriate. It is the policy of EPA that mechanical containment and removal methods be used whenever possible unless they would endanger life or property, or unless other more effective and readily available methods are feasible.

While it is recognized that there are many adequate methods available to mitigate the effects of an oil or hazardous substance spill, the methods presented here are offered as a guide to assist Federal and other responding personnel in carrying out their responsibilities. For purposes of discussion, the techniques are divided into three categories: 1) those for materials which float on water, such as oil; 2) those for materials which are soluble or miscible in water or which are heavier than water (most hazardous substances fall into this category); and, 3) those for spills on land or in air.

Field problems associated with hazardous substances can be very complex and may require assistance beyond the scope of this manual. Questions regarding hazardous substances should be referred to the EPA Regional Office, or other sources such as the chemical manufacturers, Chlorine Institute, etc. (see Appendix A).

Note: Whenever dealing with oil and hazardous materials, give proper attention to their fire reactivity and explosion hazards as well as the chemicals' toxic properties. Safety of the public and responding personnel shall be of utmost consideration for the Federal OSC.

6.1 CLEANUP TECHNIQUES FOR FLOATING MATERIALS

The cleanup techniques used for floating material can involve the use of either mechanical or chemical means to collect or remove spilled oil or floating hazardous substances (see Table 3). The use of mechanical methods such as skimmers, booms and sorbents is preferred. It should be kept in mind that early stoppage of the spill source and quick containment will greatly reduce the scope of the cleanup operations and environmental damages.

TABLE 3
CONTROL METHODS FOR SPILLS IN WATER
FLOATING SPILLS

METHOD	APPLICATION OR CONSTRUCTION MATERIALS	USE	ADVANTAGES	DISADVANTAGES
Booms	Varies; need deployment device	Not too much current	Used on large area; many varieties	1. Only in wave < 2-4 feet 2. Current speed < 0.7 knots
Weirs	Weir & boat	Calm	Not easily clogged; collects & contains	Not used in rough water
Pneumatic Barriers	Air compressor diffuser deployment method	Only in shallow water	Do not create a physical barrier to vessels	1. Not in rough water 2. Only shallow water 3. Only thin layers of materials
Spill Herding Methods	Chemicals on water; spray or prop. wash	Protect shore & facilities	Useful in rough water	1. Not easily obtainable 2. Not 100% effective

6.1.1 Booms

Booms are used to contain spills of floating materials in water, and to facilitate clean-up operations. Booms can be used to keep the oil and hazardous materials in a small area or to keep these materials out of a particular area. This latter approach is used to protect vulnerable natural resources and private property such as a marina.

Generally, booms are most effective as a containment device in calm waters, however, they will lose their effectiveness in currents above 1 mph (see Figures 2 and 3). In situations where the current is above 1 mph, the boom should be used as a deflection device, moving the oil to a quiet collection area. This is done by placing the boom at an angle to the flow of the floating material, this angle being usually less than 45-degrees. An increase in the current requires a longer boom length and a decreasing angle of deflection.

Booms are usually susceptible to two kinds of failure while they are deployed: 1) entrainment and 2) splashover.

Entrainment is the loss of oil under the skirt, due normally to a combination of increased headwave thickness and water current. Figure 3 illustrates what happens to cause this undesirable effect.

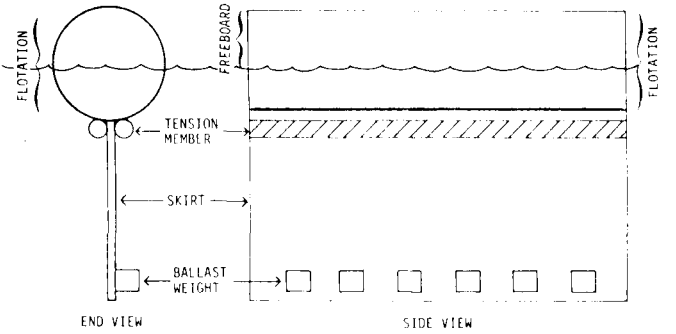


Figure 2. The basic components of an oil contaminant boom.

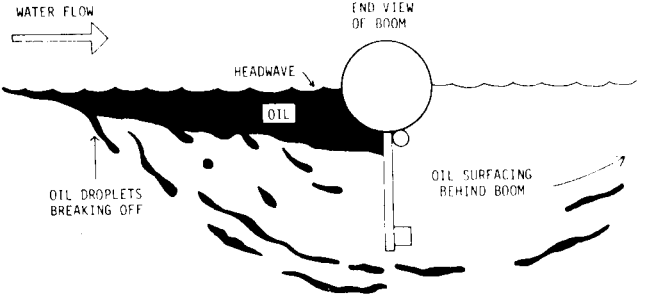


Figure 3. Heavy waves and currents may wash spilled oil under the booms; this type of failure is known as "entrainment."

Entrainment can be accelerated by either of two separate events or a combination of external inputs. One event is the increase of water current velocity. This event has a tendency to push the skirt off the vertical and to decrease the amount of contained oil (Figure 4). The second event is high winds, which can cause a similar loss of vertical integrity. If sufficient freeboard is present the top of the boom is pushed toward the water surface. Sometimes, the boom may actually lie flat on the water with a subsequent loss of previously contained oil (Figure 5).

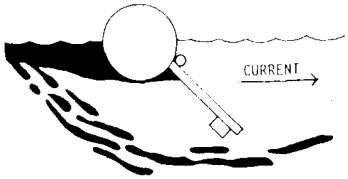


Figure 4. Entrainment increased due to fast current.

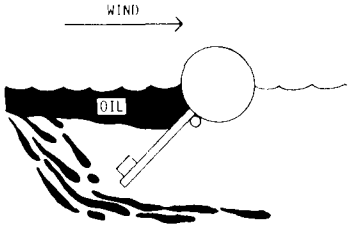


Figure 5. Entrainment increased due to high wind with normal current.

The problems associated with entrainment are completely situational and require individual analysis. Entrainment problems due to fast current can be partially countered by decreasing the angle of the boom to the bank. Problems associated with the effect of wind on boom integrity are often more difficult. In order to maximize containment of the spilled product it is often necessary to balance "trade-offs" in boom deployment strategies related to both wind and current problems.

The wind and the water conditions are primary influences on the second type of failure, which stems from the splashover of the boom. Splashover is directly affected by boom design, freeboard height, angle of approach of waves to the boom, and the size and interval of the waves. Any combination of these factors causes the oil to go over the top of the boom. The solution, again, is site-specific, and the amount and direction of movement of the boom to minimize this splashover should be determined on a case-by-case basis. In choppy sea conditions, some oil will probably spill over, but redeployment of the boom may not be necessary unless large quantities are being lost.

Regardless of the type used, booms can be effective only if positioned or deployed in a manner consistent with local conditions.

The most valuable element in boom deployment is a sound working knowledge of local waterways. Knowledge of currents, tides, natural catch areas, water depth, etc., is invaluable in effecting a more rapid response. A second element necessary for timely, effective deployment is the availability of ready support equipment. If the water body is large enough to require a boat for boom deployment, it is important to have a towing bridle available that can adequately handle the leading edge of the boom.

The following examples demonstrate various techniques that are widely used to contain oil with booms under different stream conditions (Figures 6, 7, and 8). The effectiveness of the illustrated solution will be dependent on many site-specific factors. In the case of most rivers, currents usually subside at or near the banks. Because of reduced flow in these areas, some containment can normally be expected nearshore. As can be seen, all of these deployment techniques require the securing of an anchor on the leading edge of the boom. A recommended method for anchoring the boom is shown in Figure 9.

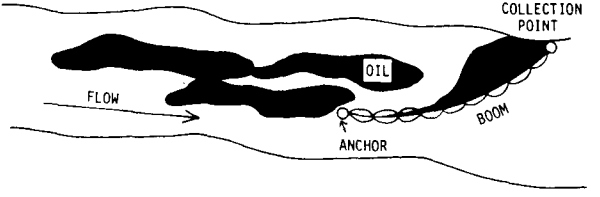


Figure 6. Small river with moderate depth of 15 to 20 ft (4.6 to 6.1 m) and slow current of 1.0 to 1.5 kn (1.8 to 2.8 km/h).

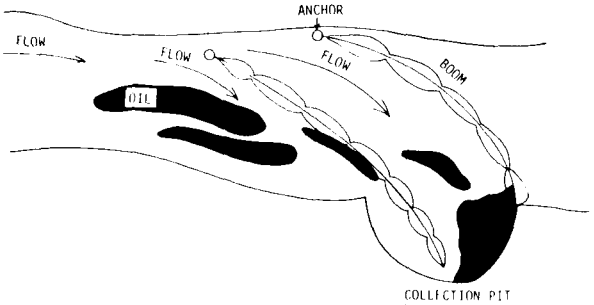


Figure 7. Small river with moderate depth of 15 to 20 ft. (4.6 to 6.1 m) and moderate to fast current of 3 to 4 kn (5.6 to 7.4 km/h).

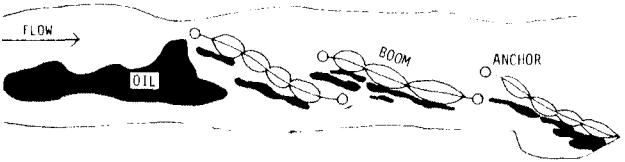


Figure 8. River of moderate to deep depth and fast current.

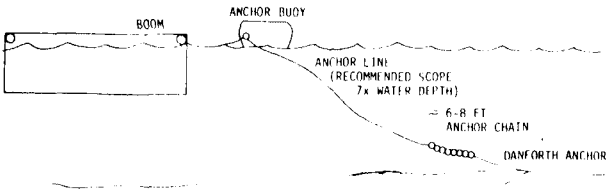


Figure 9. Normal configuration for anchoring booms.

Estuaries and bays are usually affected by tides, which create special problems in containment. The change in direction and flow rate of currents can cause contained oil to

move away from the boom and be lost. The best solution is a back-moored boom. Oil is allowed to collect in a boom that is deployed in the usual manner and a second boom is then placed on the backside to contain any backflow due to tidal or wind change (Figure 10).

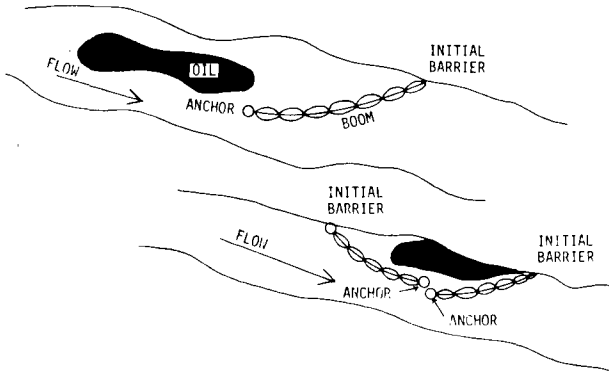


Figure 10. Back moored boom technique for containing spilled oil in tidal-influenced estuaries and bays.

6.1.2. Earthen Dams

Earthen dams are a second type of barrier. This measure is used most frequently on small creeks or tributaries, but could be effectively used on slightly larger water bodies if the flow rate is slow (less than 0.5 knots (kn)). Earthen dams are very easy to construct, using a bulldozer, dragline, or backhoe. The primary objective is to allow the water to pass downstream while containing the oil. Water passes through an inverted siphon or inclined pipe, which is placed below the water surface (Figure 11).

It should be remembered that physical barriers, whether booms or dams, are intended to restrict the spread of oil and decrease contamination. With regard to booms, almost anything that floats can be strung together to assist in the endeavor. Items that have been used in the past with varying degrees of success include bales of hay, telephone poles, and 55-gallon drums. In all oil spill situations, rapid response is the key to an effective operation, and containment must be accomplished as soon as possible, using the best available resources.

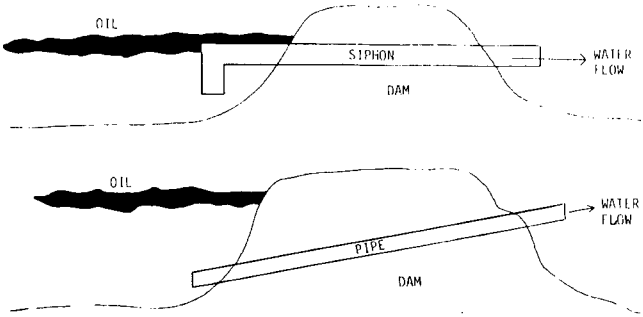


Figure 11. Earthen dam barriers with inverted siphon and inclined pipe for the containment of spilled oil.

6.1.3 Skimmers

Assuming that efforts to contain the discharged oil have proved successful, recovery of the spilled oil is initiated. Removal is usually accomplished with the use of mechanical devices called "skimmers".

Skimmers, as the name implies, are designed to collect, or skim, the floating product from the surface of the water. Skimmers can be grouped into four basic categories: (1) vacuum or suction type, (2) weirs, (3) dynamic inclined plane, and (4) oleophilic belts, drums, and disks.

6.1.3.1 Vacuum or Suction-Type Skimmers

The suction-type skimmer is a simple device in terms of both design and operation. A suction head and pump are involved, and these devices simply vacuum the oil from the surface of the water. One example of a suction-type skimmer head is called a "duck bill" (Figure 12). The primary advantages of using this device are its adaptability to most environmental situations, its ability to handle almost all types of oils, and the simplicity of operation in most water depths. Its disadvantages include a tendency to become clogged with debris, and the need for continual maintenance during recovery operations to prevent clogging and allow efficient skimming.

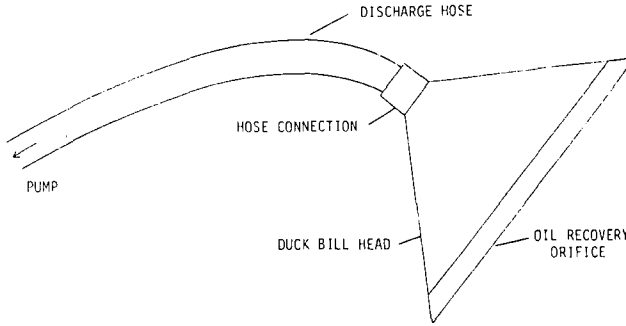


Figure 12. Illustration of a suction-type skimmer head for removing spilled oil.

6.1.3.2 Weir Skimmers

Weir skimmers are probably the most widely recognized type of recovery device available today. In addition, they are the most widely available type of skimmer used for pollution recovery operations.

Weir skimmers consist of four primary components: (1) a flotation device to suspend the skimmer in water, (2) a reservoir to collect the oil, (3) a device to adjust the skimming level to minimize the quantity of water entering the reservoir, and (4) some method to empty the reservoir, either by positive displacement pumps or suction (Figure 13).

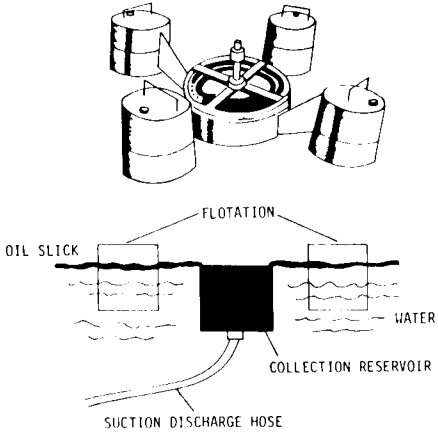


Figure 13. Vertical and lateral views of the components of the weir skimmer.

The idea behind this device is commonly referred to as the "waterfall" principle. The collection reservoir is submerged to the level of the oil/water interface, at which point, gravity forces the oil into the reservoir, creating a "waterfall" effect. The advantages of this type of skimmer include its high mobility and good recovery efficiency in relatively calm water. The weir is susceptible to being clogged with debris, but a screen can be placed around the unit to minimize this problem.

6.1.3.3 Dynamic Inclined Plane Skimmers

Dynamic inclined plane skimmer use an inverted, continuous belt; that is, a belt that runs from high to low, as opposed to normal conveyers which run from low to high (Figure 14). The belt takes the oil below the surface of the water. The oil leaves the belt and floats upward to a reservoir, where it is collected and pumped to a storage container. Like oleophilic skimmers, which are discussed later, dynamic inclined plane skimmers have good recovery efficiency and are available in a variety of sizes. Both types have restrictions on maneuverability and loss of efficiency when trash or debris is present.

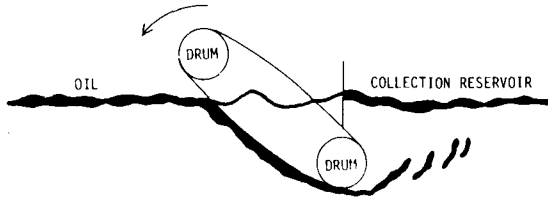


Figure 14. An illustration of the dynamic inclined plane skimmer in operation.

6.1.3.4 Oleophilic Skimmers

Oleophilic skimmers are operated on the principle of oil absorption. The term "oleophilic" means strongly attracted to oil, i.e., oil-absorbant. Almost all of the oleophilic components of this type of skimmer have the characteristic of being hydrophobic, i.e. water-resistant. The common denominator of all oleophilic recovery devices is the passing of the "absorbing" material continuously through the spilled oil. The oil adheres to the surface and is removed from the water. At this point, the oleophilic member is wiped or squeezed by rollers or blades and the oil is deposited in a reservoir. The product in the reservoir is then pumped into some type of holding container.

Oleophilic skimmers are the most sophisticated recovery devices available today, usually employing several different mechanical systems, which require varying levels of preventive maintenance and highly trained operators for use.

The rotating disk, or drum systems, as shown in Figure 15, are noted for very efficient recovery of oil in deeper water where little or no debris is present. Available in various sizes, the larger models normally require extensive logistic support.

The most widely used oleophilic skimmers are of the belt and rope type. These devices operate very efficiently in both thick and thin slicks, and are usually capable of recovering sheens. Their ability to remove oil mixed with small amounts of debris remains almost as efficient as removal in debris-free environments.

Because oleophilic belt skimmers require the use of some sort of vessel for staging and employment, they are difficult to operate in close quarters or in shallow water. Figure 16 shows a typical "continuous belt" installation.

The oleophilic rope employs the same basic principle as

the "belt"; i.e, a continuous process of "absorption" by the oleophilic component, squeezing by a roller or wiper system, and reentry into or upon the oil in the water.

6.1.4 Chemicals for Spill Oil Cleanup

The use of chemicals must be in accordance with Annex X of the National Oil and Hazardous Substances Contingency Plan. A list of accepted chemicals can be found in the NCP Product Schedule. Questions relating to the use of these chemicals should be addressed to the EPA or USCG OSC.

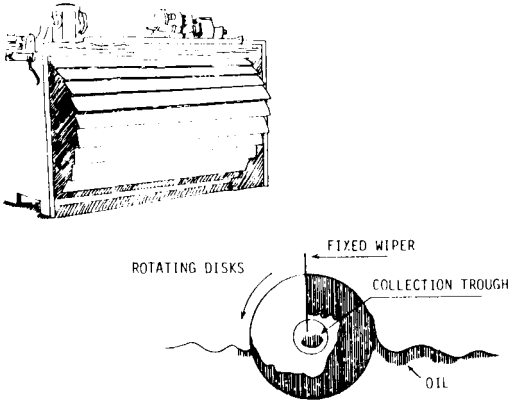


Figure 15. Oleophilic drum skimmer.

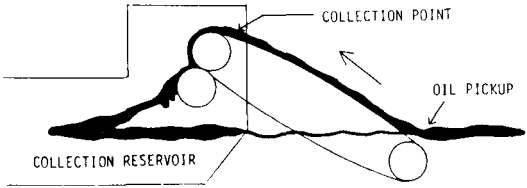


Figure 16. A continuous-belt oleophilic skimmer for recovering spilled oil on the surface of the water.

6.1.4.1 Dispersants

The Federal OSC, on a case-by-case basis, can approve the use of chemical dispersants on any spill if it is determined they will prevent or substantially reduce the hazard to human life or substantially reduce explosion or fire hazard to property. All other cases must be approved by the EPA RRT representative after consultation with appropriate Federal and State agencies. In all cases, appropriate application rates and methods must be used.

6.1.4.2 Collecting Agents

The OSC may authorize the use of surface collecting agents on minor, medium and major discharges on a case-by-case basis if their use will result in the least overall environmental damage or interference with water uses, and greatly enhance removal actions.

6.1.4.3 Burning Agents

The use of burning agents may be authorized on a case-by-case basis by the OSC with approval from the RRT, State, and local air pollution control agency. However, it must be recognized that burning-off is potentially one of the most dangerous treatment operations. It should only be considered when it can be determined that the risks to people would be greater if burning were not attempted.

6.1.4.4 Biological Additives

Biological additives, such as bacteria cultures, have proven successful in degrading a variety of chemical wastes. The success of this method is dependent upon many factors, therefore each case must be evaluated individually.

6.2 CLEANUP TECHNIQUES FOR HAZARDOUS SUBSTANCES

Methods for controlling spills of hazardous substances are shown in Tables 4 and 5. Techniques discussed in Section 6.1 may also be applicable for hazardous substances which float. The "Spill Handling Thought Guide" for treatment of hazardous spills is shown in Figure 17. This guide is extremely useful as an aid in determining the proper course of action.

Candidate schemes for the treatment and disposal of hazardous substances include: 1) Carbon Adsorption, 2) Filtration, 3) Ion Exchange, 4) Gravity Separation, 5) Neutralization, 6) Coagulation Precipitation, 7) Reduction, 8) Oxidation, 9) Dilution and Dispersion, 10) Incineration, and 11) Mobile Treatment Technologies. These treatment schemes can be achieved either in a batch mode or in a flow through process depending on the nature of the hazardous materials containment. Consideration should also be given to whether the material can be discharged to a municipal treatment plant without creating a

TABLE 4: CONTROL METHODS FOR SPILLS IN WATER - SOLUBLE OR MISCIBLE SPILLS

METHOD	APPLICATION OR CONSTRUCTION MATERIALS	USE	ADVANTAGES	DISADVANTAGES
Sealed Booms	Boom, Device to anchor	Contain depth limited volumes leaking containers	Contain entire depth of water	1. Deployment difficult 2. Not used for large bodies 3. Difficult to get good seal
Diversion of Uncontaminated Flow	Earthmoving Equipment	Special area where topography is right	1. Can put cleaned water into diverted stream 2. Used for flowing water	1. Difficult to move large amounts of earth 2. Clear area needed 3. Impermeability of ground
Diversion of Contaminated Flow	Block entrance with sandbags, sealed booms or dikes	Special area where topography is right	1. Can put clean water back into stream 2. Used for flowing water	1. Difficult to move large amounts of earth 2. Clear area needed 3. Impermeability of ground 4. Adverse environmental impact
Gelling Agent	Gels, Dispersion Devices; experienced personnel needed	If small volumes	1. Stop flowing contaminant 2. Stop permeation	1. Hard to obtain 2. Can't use in large area 3. Must haul to dispose
Containment of Entire Waterbody	Diking Materials, Earthmoving Equipment, Sandbags, etc., Lining	For entirely contaminated area	1. Can allow containment of large waterbody 2. Materials on site 3. Easily constructed	1. Not all waterbodies have containable overflow 2. Permeability 3. May be an unstable condition

TABLE 5: CONTROL METHODS FOR SPILLS IN WATER - HEAVIER THAN WATER SPILLS

METHOD	APPLICATION OR CONSTRUCTION MATERIALS	USE	ADVANTAGES	DISADVANTAGES
Natural Exca-vations & Dikes	none	Where a natural barrier exists	No constuction needed	Can't control area which contains the spill
Constuction of excavations & dikes	Dredges, hydraulic or vacuum pumps Divers with pumps place concrete/sandbags around to form dike if bottom material is not sufficient.	If bottom can be moved	Material is on site	1. Hard to construct 2. Stirred up bottom may cause dispersion and increased turbidity

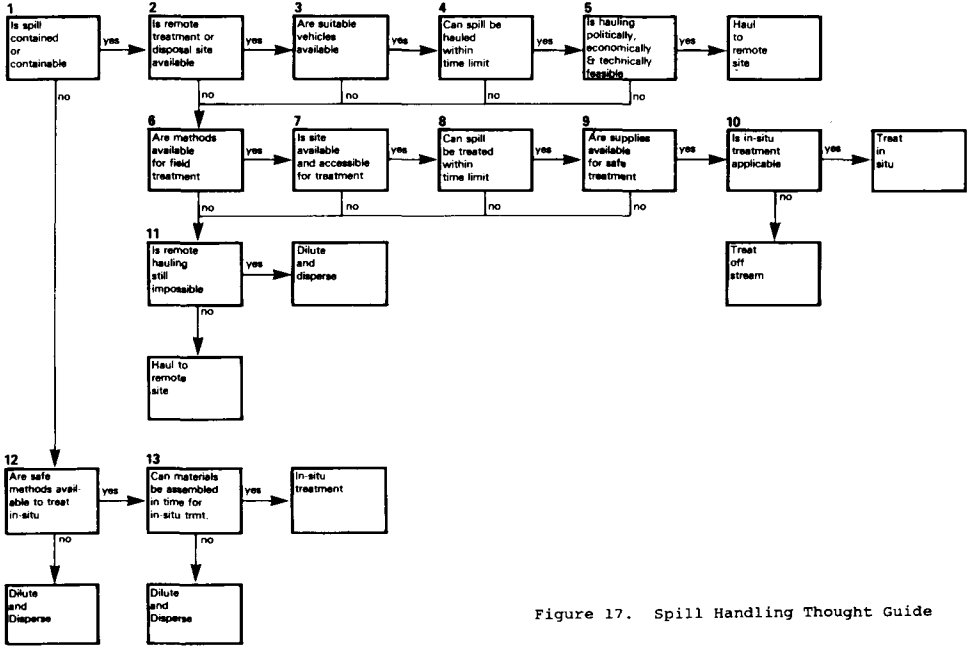


Figure 17. Spill Handling Thought Guide

major impact to the system. This may be prior to, or following, treatment of hazardous materials on site. Also, due to the high solubility of most hazardous substances, success of any treatment scheme is dependent on quick containment of the spilled materials.

6.2.1 Carbon Adsorption

Carbon adsorption is a physical process which removes organic matter and some inorganic chemicals from water by the attraction and accumulation of these contaminants onto the surface of activated carbon particles. Activated carbon has an extremely large surface area per weight (500-1000 m^2 per gram) and can effectively remove significant amounts of organic compounds from liquids or gases by adsorption. Activated carbon is produced from many materials including wood, coal, lignite, etc. The adsorption process and its effectiveness is dependent on the nature of the material being adsorbed and on the type of carbon used. In general, concentrations of greater than 1000 mg/l of a contaminant require excessive detention times and excessive quantities of carbon. The amount of carbon needed to adsorb a given chemical must be established by field testing. When the capacity of the carbon has been exhausted the carbon must be replaced and the spent carbon disposed of. Table 6 gives general guidelines for the adsorbability of various organics on activated carbon. In-situ use of carbon would generally involve the addition of powdered activated carbon directly to the spill site. Effective mixing of the carbon with the contaminated water in question is essential for effective adsorption to occur. Offsite treatment would involve pumping the contaminated water through a granular carbon column.

6.2.2 Filtration

Filtration is designed to remove particulate matter by passing the contaminated water through a layer of porous media such as sand. The treatment may be employed as a pre-treatment prior to passing the water through a carbon adsorption column or ion exchange system, or as a polishing step for removal of a particulate after a chemical reaction. While various types of media are used in filtration, a simplified mode for field application would generally consider a gravity or pressure flow dual media filter column. During a filter run, the head loss will gradually increase due to accumulation of solids within the filter media. When the head loss reaches the limit set by the hydraulic conditions of the filter design, the filter run will stop and the filter is backwashed.

In some cases the effluent quality from the filter may control the termination of the filter run. Filters may be backwashed with sorted filter effluent, in which case the backwash waste after removal of a suspended solid is retreated and refiltered. In-situ filtration may involve permitting water to pass, by gravity, through a built-up sand or coal bed.

Continuous filtration will usually involve bringing in a portable filter for direct application at the site. The basic components of a typical filter are shown in Figure 18.

TABLE 6
INFLUENCE OF MOLECULAR STRUCTURE
AND OTHER FACTORS ON ADSORBABILITY

1. An increasing solubility of the solute in the liquid carrier decreases its adsorbability.

2. Branched chains are usually more adsorbable than straight chains. An increasing length of the chain decreases solubility.

3. Substituent groups affect adsorbability:

Substituent Group	Nature of Influence
Hydroxyl	Generally reduces adsorbability; extent of decrease depends on structure of host molecule.
Amino	Effect similar to that of hydroxyl but somewhat greater. Many amino acids are not adsorbed to any appreciable extent.
Carbonyl	Effect varies according to host molecule; glycoxylic and more adsorbable than acetic but similar increase does not occur when introduced to higher fatty acids.
Double Bonds	Variable effect as with carbonyl.
Halogens	Variable effect.
Solfonic	Usually decreases adsorbability.
Nitro	Often increases adsorbability.

4. Generally, strongly ionized solutions are not as adsorbable as weakly ionized ones; i.e., undissociated molecules are in general preferentially adsorbed.

5. The amount of hydrolytic adsorbtion depends on the ability of the hydrolysis to form an adsorbable acid or base.

6. Unless the screening action of the carbon pores intervene, large molecules are more adsorbable than small molecules of similar chemical nature. This is attributed to more solute-carbon chemical bonds being formed, making desorption more difficult.

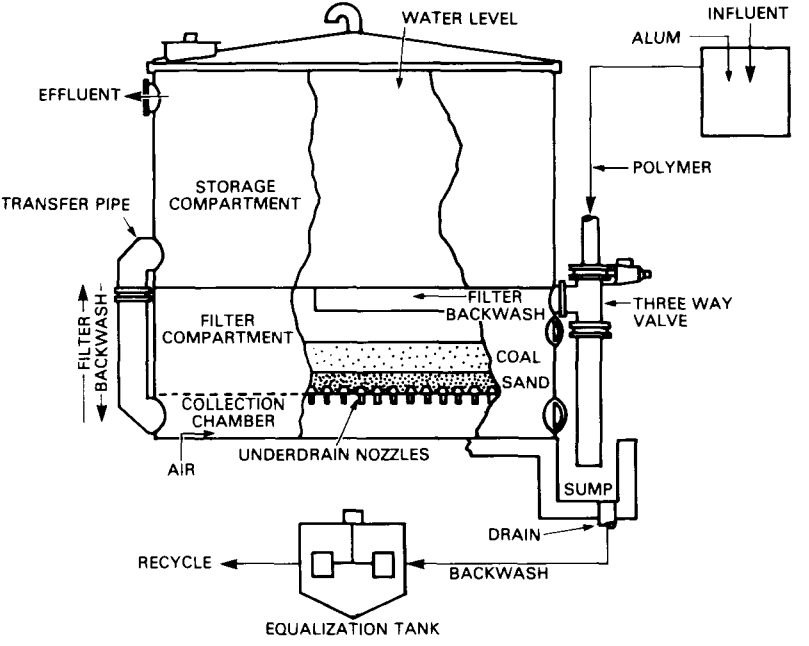


Figure 18. Typical Automatic Granular Media Filter

6.2.3 Ion Exchange

Ion exchange is a process in which ions held by electrostatic forces to functional groups on the surface of a solid are exchanged for ions of a different species in

solution. The ions are exchanged until the resin is exhausted and then the resin is regenerated with a concentrated solution of ions flowing in a reverse direction or replaced with new resin. The process takes place on a resin which is usually made of a synthetic material. Various kinds of resins are available (including weakly acidic and strongly acidic ion exchange resins and weakly and strongly basic ion exchange resins depending on the application involved). The best type of resin is established mainly by the specific contaminant to be removed, the amount of wastewater involved and other ionic demands on the resin. Ion exchange treatment can be accomplished by off-site pumping of the wastewater in question through an ion exchange column with the ability to either regenerate or replace the resin when it becomes exhausted. In-situ treatment in a manner similar to carbon adsorption would involve mixing the resin with the wastewater in a suitable containment area.

6.2.4 Gravity Separation

Gravity separation involves removal of suspended solids with a specific gravity greater than water by the process of sedimentation, or the removal of particles with a specific gravity less than water by floatation. Sedimentation is removal of solid particles from a suspension through gravity settling. The process may be used as a pretreatment and concentration step to reduce the load on subsequent processes, thereby utilizing a natural concentration procedure. Various factors affect the rate of settling including particle size and shape, density and viscosity of the water, and the presence of other materials in the water. The rate of settling, while predictable using theoretical equations, should employ a field testing procedure. While sedimentation may involve the removal of hazardous solid materials it is most often associated with the coagulation process (see Section 6.2.6). Floatation is used to separate the materials with a specific gravity less than water. The contaminant rises to the top and is skimmed off periodically.

6.2.5 Neutralization

Neutralization is a process in which hydroxyl or hydrogen ions are added to a corrosive solution to produce an approximately equal balance of acidic and basic constituents (pH 7). The process is used to reduce the acidic character of a spilled chemical by addition of caustic soda (NAOH), lime ($Ca(OH)_2$) or soda ash (NA_2CO_3). Alkaline wastewaters are neutralized by the addition of hydrochloric acid (HCL) or sulfuric acid (H_2SO_4). Strongly basic NAOH, strongly acidic H_2SO_4 and HCL must be added very carefully to avoid creating a violently exothermic reaction. Complete and continuous mixing of the contents is especially important to avoid pockets of concentrated chemicals in the liquid. The other neutralizing agents considered are weaker acids and bases which react slower than the strong acids and bases. The amount of neutralizing

chemical required should be determined by a bench scale test.

6.2.6 Coagulation Precipitation

Coagulation precipitation is a process which removes pollutants by reacting these materials to form an insoluble product (see Figure 19). This process results in a chemical reaction of the contaminant to remove it from solution, rather than adsorption on another media (activated carbon). Effective precipitation requires a series of steps; (1) chemical addition, (2) rapid mix, (3) addition of coagulant, (4) flocculation, (5) sedimentation and, in some cases, (6) filtration as shown in Figure 18. Each precipitation reaction may not require all of these steps. Precipitation is used to remove many types of metal cations and some anions such as fluorides and sulfides. The agents involved in precipitation reactions may include calcium, sodium hydroxide, sodium bicarbonate, sulfate and sulfide. These reagents are added at a certain pH. The amount of these reagents required to precipitate a particular constituent are determined by running a bench scale test. Coagulation involves the addition of a coagulant such as ferric chloride, aluminum sulfate or organic polyelectrolytes in order to precipitate specific wastewater constituents.

6.2.6.1 Ferric Chloride As Coagulation Aid

This compound is effective in clarifying both organic and inorganic suspensions. For best results, the final pH should be above 6 which may require the addition of caustic soda during the coagulation process. Large suspensions require $FeCl_3$ dosages of approximately 50-500 mg/l although larger doses may be needed for very high concentrations or alkaline suspensions. If the wastewater is low in alkalinity, lime may be needed to raise the pH to 6 or higher. Excessive dosage of ferric chloride will result in a brown colored effluent which should be avoided.

6.2.6.2 Alum As Coagulation Aid

Aluminum sulfate (Alum) is effective in clarifying both inorganic and organic suspensions. Control of solution pH to within a range of 6.5 to 7.5 is generally crucial for proper alum use. If a suspension is to be treated, alum dosages of 100-1,000 mg/l should be effective. Huge dosages may be needed for concentrated or highly alkaline suspensions. As with ferric chloride, suspensions with low alkalinity may require the addition of lime or caustic soda to produce a final pH range of 6.5-7.5.

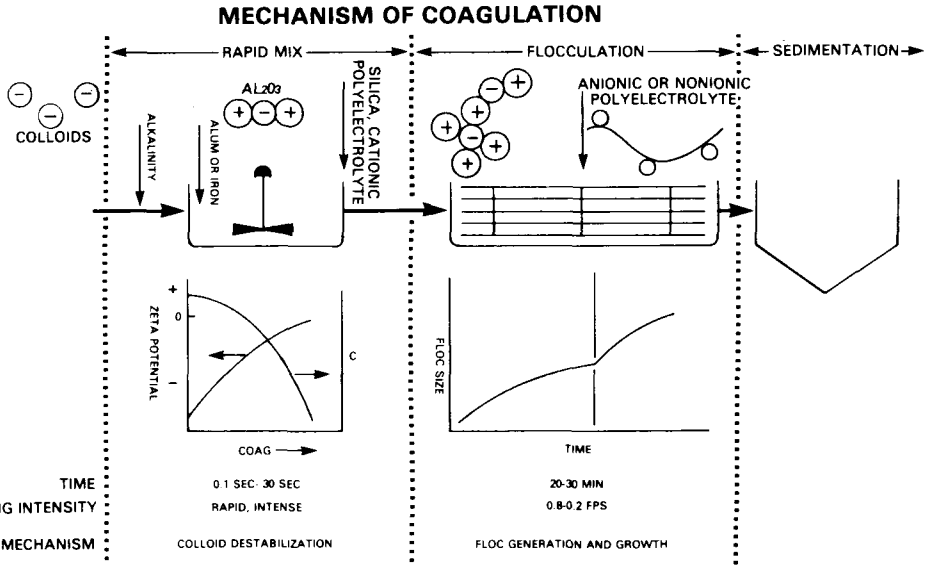


Figure 19. Mechanism Of Coagulation

6.2.6.3 Organic Polyelectrolytes As Coagulation Aid

Polyelectrolytes are available in cationic, anionic, or nonionic form and may be effective alone when flocculating suspensions of inorganic materials. These polyelectrolytes are usually not effective alone for flocculation of organic suspensions, but can be used in conjunction with alum or ferric chloride. Polyelectrolyte dosages vary with both the type of charge on the polymer and the type of suspension to be treated. Cationic polyelectrolytes are generally added in higher dosages, 1-10 mg/l in dilute suspensions, while anionic and nonionic dosages are added at approximately 0.5-5 mg/l. When the solution is concentrated and the suspension concentration is greater than 1,000 mg/l, add 1-300 mg/l of cationic polyelectrolyte, or 1-100 mg/l of anionic or nonionic compound.

6.2.7 Reduction

Reduction reactions are only applicable to a small number of compounds. Sodium bisulfite has been recommended as the most suitable reducing agent. However, other chemicals, including sodium sulfite and sodium metabisulfite, can also be used. Reduction is used as a pretreatment for chromium compounds to change them to the chromous state for precipitation. This reaction must occur at low pH, so adjustment to pH 2 to 3 with acid is recommended. Reduction is also used for either sodium or calcium hypochloride. A reducing agent can be added until an acceptable chlorine residual is measured. Excess reducing agent can be removed by addition of more wastewater or aeration. Determination of the amount of reducing agent, i.e., sodium bisulfite or its equivalent, is determined by a small bench scale testing procedure.

6.2.8 Oxidation

Oxidation reactions are more common than reduction and more agents can be used. Chlorination and aeration are two ways to oxidize materials. Chlorination reactions are the most commonly used to oxidize cyanide to the less toxic cyanate and then to carbon dioxide and nitrogen. These reactions are most effective at alkaline pH so both sodium hydroxide and hypochlorite are commonly added. Chlorine is more safely added in the form of liquid hypochlorite in concentrations of 5-6%. Dosages are determined by a bench scale test. Aeration is another method for oxidation. Air can be used as an oxidizing agent and is more available, but not as strong as chlorine or chlorine compounds. In general, air is introduced in the form of bubbles which rise to the surface. As they travel through the water (column), the oxygen in the air is transferred from the bubble into the water where it can oxidize the hazardous compound. This technique is only useful for easily oxidized materials.

6.2.9 Dilution and Dispersal

Only after all other possible alternatives have been investigated and found not to be feasible is the method of handling by dilution and dispersal to be considered. This method must be used only as a last resort to minimize local hazards. Care must be taken to determine if this method is feasible in that mixing the hazardous chemical with water may cause undesirable side reactions or by-products. Once it has been determined that dilution and dispersal is the only action available, then additional water sources must be brought to the spill site. Water should be added to the stream at a turbulent spot to allow complete mixing with the hazardous material. Care should be taken not to exceed the capacity of the waterbody and thereby extend the hazard past its natural boundary. Dispersion can also be induced by creating mixing zones in the waterway and reducing the pockets of concentrated contaminant which may exist.

Tables 7 and 8 provide information relative to treatment chemicals and chemical reactions. Table 9 lists general sources for treatment chemicals.

6.2.10 Incineration

Incineration is a process which converts hazardous wastes to a less toxic state by means of high-temperature thermal oxidation or combustion. Although not a new technology, its application has recently become more popular and is most commonly used to treat liquid organic wastes. The two major types of incinerators available in the U.S. are known as "liquid injection" and "rotary kiln".

Liquid injection systems are capable of incinerating complex mixtures of liquids, gases and slurries. They vary in configuration, but all generally function by atomizing wastes in a liquid form, then injecting the mixture into a combustion chamber where it is incinerated. Air forced into the chamber ensures complete combustion by providing the necessary oxygen and mixing medium.

Rotary kiln systems are capable of incinerating solids and sludges, as well as liquids and gases. These systems operate by a slow rotation of the kiln, promoting athorough and complete incineration of the contents. Due to the characteristic low heat content of solids and sludges, these types of materials are generally mixed with high BTU liquid wastes to facilitate the incineration. Most systems of this nature employ a secondary combustion chamber within the kiln that provides further assurance of complete oxidation.

When performing any type of thermal destruction, several factors must be considered. Each incinerator is permitted by RCRA and/or TSCA to burn specific and unique types of wastes. PCB's for example, can only be incinerated by a small number of

TABLE 7
TREATMENT CHEMICAL INFORMATION

Chemical	Use	Strength	Common Dosage, mg/l	Field Mix Time*	Field floc time
Ferric chloride	Organic Inorganic	25-100 mg/ml solution	1000mg/l, 50-500 mg/l + lime to pH 6 or greater	Complete dispersal of chemical (approx. 2-5 min)	5-15 min
Alum	Organic Inorganic	25-50 mg/ml solution	1000 mg/l, SS 100-1000 mg/ml + CaO or NaOH to pH 6.5 to 7.5	Complete dispersal of chemical (approx. 2-5 min)	5-15 min
Polyelectrolytes	Inorganic	0.5 - 1% solutions		Complete dispersal of chemical (approx. 1-2 min)	5-10 min
Cationic			SS <1000 mg/l 1-10 mg/l SS >1000 " 1-300 "		
Anionic			SS <1000 " 0.5-5 " SS >1000 " 1-100 "		
Nonanionic			SS <1000 " 0.5-5 " SS >1000 " 1-100 "		
Alum & Poly	Inorganic/ organics to increase strength of floc	---	Alum 100-1000 mg/l Poly 1-10 mg/l	Complete dispersal of chemical (approx. 1-2 min) then poly & mix about 1 min	2-5 min 5-10 min
Ferric chloride & Poly	Inorganic/ organics to increase clarity	---	Ferric 50-500 mg/l Poly 1-10 mg/l	Complete dispersal of ferric (approx. 1-2 min) then poly & mix about 1 min	2-5 min 5-10 min

** If required flocculation time exceeds the maximum time, try a higher chemical dosage.*

TABLE 8
CHEMICAL REACTION OPERATING PARAMETERS

Process	Type	Mixing Time (min)	Endpoint	Chemicals
Chemical Sedimentation	Rapid Flocculation	1-5 5-15 depends on rate and process height	Clarified water and good settling	Ferric Chloride Aluminum Sulfate Polyelectrolytes
Neutralization	Rapid	10-30, Use 30 min for lime addition	Add to pH 7, use pH paper or meter to check	Calcium Hydroxide Calcium Oxide, Sodium Hydroxide, Sodium Carbonate, Sulfuric Acid, Acetic Acid, Hydrochloric Acid
Precipitation	Rapid Flocculation None	1-5 5-10 30-60 depends on rate and process height	Varies to a pH or until residual of reactant or until clarified	Calcium Hydroxide, Sodium Hydroxide, Sodium Carbonate, Sodium Biocarbonante, Sodium Sulfate, Sodium Sulfide, Potassium, Chloride
Oxidation	Rapid	10-30	to a HOCl residual of 1 mg/l	Sodium Hypochlorite
Aeration	Air mix	Depends on test	D.O. measure to 70% of saturation or other	Air
Reduction	Rapid	10-30	Large ORP change/ Cr+6 --- Cr+6 is yellow to green HOCl reduction, no	Sodium Bisulfite, Sodium Sulfide

TABLE 9
GENERAL SOURCES FOR VARIOUS TREATMENT CHEMICALS

Chemical	Sources
Acetic acid	Plastic or electronic industries, grocery distributors (vinegar)
Alum	Water treatment plants
Ammonium salts	Hospitals, dye manufacturers
Anion exchangers	(must specify pollutant) water softener suppliers
Bottom pumps	Fire departments, EPA Regional offices, Coast Guard
Calcium carbonate (limestone, practically insoluble in water)	Cement plants
Carbon	Water treatment plants, sugar refineries
Cation exchangers	(must specify pollutant) water softener suppliers
Charcoal	Hardware stores, grocery distributors
CO_2	Soft drink dealers, compressed gas dealers
Epsom salts	Drug stores, groceries
Ferric or iron salt ($Fe\ CL_3$)	Water treatment plants, photography shops
Lime	Cement plants
Peat moss	Nurseries, florists
Sodium bicarbonate (baking soda)	Grocery distributors, bakeries
Sodium carbonate (soda ash)	Grocery distributors, bakeries
Sodium chloride (table salt)	Grocery distributors
Sodium sulfate	Dye manufactures
Sodium thiosulfate	Photography shops, tanneries, pulp mills

TSCA-licensed facilities, generally of the rotary kiln type. Furthermore, destruction and removal efficiency (DRE) rating standards have been established for all facilities licensed by RCRA. DRE ratings of at least 99.99% are generally required for thermal destruction of hazardous organic materials in RCRA-licensed facilities. Additional factors for consideration include the substance viscosity, heating value, chlorine content, heavy metals content and ash content.

The current popularity of thermal destruction as a process of waste management has led to the rapid development of alternative methodologies. Examples include the circulation bed combustor, the advanced electric reactor, the vertical tube reactor, as well as the utilization of molten salt or super-critical water to provide the heat. Although few of these systems are currently in use, their future looks promising.

6.2.11 Mobile Treatment Technologies

In the past few years, treatment of hazardous wastes on site has developed into a more viable means of disposal. The requirement to evaluate and, if feasible implement alternative treatment technologies has sparked an increased interest in the development of mobile treatment. Although experience with the use of mobile systems at Superfund sites is limited, these technologies are being used with greater frequency for both emergency response and remedial actions. EPA has sponsored development of various types of mobile treatment units for emergency response situations including: a carbon adsorption/sand filter system, a rotary kiln incinerator, an in-situ containment/treatment unit, a soil washer system, an activated carbon regeneration system, a flocculation-sedimentation system, a reverse osmosis treatment system and an independent physical/chemical wastewater treatment system. Many mobile treatment units are designed to facilitate fast response to emergency situations with the utilization of skid-mounting, prepiping and prewiring.

There are several factors which need to be evaluated prior to the implementation of a mobile treatment system, such as the technical basis of the process, the type of waste the unit is capable of treating, restrictive waste characteristics, requirements for on-site use, potential environmental impacts, cost, and commercial availability.

6.3 CONTROL OF LAND AND AIR SPILLS

6.3.1 Land Spills

Whenever possible, spills should be contained on land as long as a greater risk to life and property is not created by doing so. Successful cleanup and treatment is much more likely and considerably less expensive when the material is contained before it reaches water. Table 10 presents several methods for controlling spills on land.

In cases where the soil is particularly porous, materials spilled on land may migrate down to the water table. If this occurs, recovery is very difficult and may require the installation of wells for the purpose of monitoring movement of the material. In such cases, the technical assistance of a groundwater hydrologist or other appropriately trained individual will be required.

6.3.2 Air Spills

Air spills (vapors, mists, etc.) are extremely difficult to control. Evacuation of the affected area is often the only practical choice. However, Table 11 shows several methods which may be considered in specific cases. When using a spray mist, consideration must be given to the possible creation of a water pollution problem.

7.0 DISPOSAL PROCEDURES

After cleanup operations have removed the spilled material(s) and contaminated debris from the water or ground, the OSC's responsibilities are not over. Improper shipping and disposal of spilled cleanup waste can cause serious safety problems, as well as result in secondary pollution as bad as, if not worse than, the original spill. Therefore, the OSC must be assured that all chemical disposal is carried out in a safe and proper manner.

Disposal operations may involve the shipping of the waste materials to a state-approved land disposal site, treatment by a reliable disposal or recycling company, or sending the material to a sewage treatment plant. Land disposal has been greatly restricted by recent legislative and regulatory action. These restrictions should be carefully examined before considering land disposal. The preferred method of disposal would be to recycle to the spiller's company or to a company that can use the material in its operation.

In all cases involving the disposal of oil and hazardous substances, contact and coordination should be made with all affected parties. EPA involves the State pollution control agencies to obtain disposal sites and act as liaison between the Federal government and local agencies such as disposal

TABLE 10
CONTROL METHODS FOR SPILLS ON LAND

TYPE	APPLICATION OR CONSTRUCTION METHOD	USE	ADVANTAGES	DISADVANTAGES
Dikes:				
Earthen	Create with bulldozer or earthmoving equipment to compact earth (height depends on earth type)	Flat or sloped surface	1. Material on site 2. Construct with common equipment	1. Natural permeability of soil 2. Seepage through ground 3. Surface composition of soil not suitable in all cases
Foamed Polyurethane	Use trained personnel to construct	Hard, dry surfaces	1. Hold up to several feet of water	1. Leaks on wet ground 2. Hard to obtain dispersion device
Foamed Concrete	Used trained personnel to construct	Flat ground Slow moving spill	1. Better adhesion to substrates (clay/shale/grass)	1. Hard to obtain foam and dispersion device 2. Must set for a time period 3. Will not hold high hydraulic heads
Excavation	Bulldozer or earthmoving equipment - line if possible	Soft ground Natural cavitation	1. Material on site 2. Construct with common equipment	1. Move large amounts of material 2. Natural permeability of soil 3. Surface of soil not suitable in all cases
Excacation & Dikes	Bulldozer or earthmoving equipment - line if possible	Soft ground	1. Need less space than separate 2. Material on site 3. Construct with common equipment	1. Move large amounts of material 2. Natural permeability of soil 3. Surface of soil not suitable in all cases

TABLE 11
CONTROL METHODS FOR SPILLS IN AIR

TECHNIQUE	METHOD	USE	ADVANTAGES	DISADVANTAGES
Mist Knock Down	Spray fine mist into air	Water soluble or low lying vapors	Removes hazard from air	Create water pollution problem & must be contained in solution
Fans or Blowers	Disperse air by directing blower toward it	Very calm and sheltered areas	Can direct air away from populated areas	1. Not effective if any wind 2. Need large capacity blowers 3. Hard to control

sites, air pollution control agencies, sewage treatment plants, and others.

Extremely toxic material may require special on-site treatment, or as in the case of PCB's, either incineration or shipment to an EPA/State approved disposal site. EPA, Edison, New Jersey, has specialized equipment that may be available to treat these very toxic materials. Coordination of this activity will be conducted by the EPA Emergency Response Team.

Generators (spillers), transporters, and disposers of hazardous waste materials must obtain the appropriate EPA identification numbers as required by RCRA (see Section 2.4).

8.0 SPECIAL CONSIDERATIONS

8.1 SAFETY

8.1.1 General Precautions

It is critical that the safety of the people who arrive on the scene of an oil or hazardous material spill be considered before any action is taken. The Occupational Safety and Health Administration (OSHA), sets strict regulations regarding safety and health standards of personnel involved in environmental control and hazardous materials handling. It is recommended that response personnel become familiar with OSHA regulations and always adhere to them. All spills are considered extremely dangerous.

Safety considerations should receive priority during the decision-making process. Persons responding to spills are not expected to risk personal injury or contamination through intimate physical contact with spilled materials and vapors. Team members should assess the situation and coordinate activities from outside the high risk area. High risk areas should only be entered by trained personnel using proper personal protective gear and montoring equipment with two additional trained and properly equipped persons standing by to provide assistance.

Although the response organization utilized during an incident involving the discharge of a hazardous chemical is similar to that for one involving a discharge of oil, the state-of-the-art in technically dealing with discharges of hazardous chemicals is limited. The inherent risk of life or limb involved in dealing with certain hazardous chemicals will make available response actions unfeasible on occasion. Extreme care should be exercised when responding to spills of this nature, especially in initial stages. The following

general precautions should be taken:

1. Always approach a spill from upwind.
2. Avoid direct or indirect contact with spilled material.
3. Remove all ignition sources.
4. Restrict access to area.
5. Obtain assistance.

If a vehicle carrying flammable liquids or compressed gas is wrecked, do not drive your car near the wreckage as it may cause the material to ignite.

Keep fires, open flames, lanterns or flares, lighted cigarettes, cigars and pipes away from the scene.

Warning signals should be set-up to prevent further accidents. It is recommended that flame producing signals (flares, fuses, or open flame lanterns) not be used when an accident involves dangerous material of any type. The use of flame producing signals is specifically prohibited by the Department of Transportation for any cargo tank vehicle transporting flammable liquids or flammable compressed gas and for any vehicle transporting A or B class explosives.

Prevent leaking liquids from draining onto the highways or into sewers and streams by damming up the liquid or by digging a drainage trench or sump. Tipped containers that might be leaking should be set upright, if possible. Powdered materials should be covered with a blanket, dirt or other material to prevent airborne dispersal by wind.

Should any of the material being transported contact skin or clothing, it should be removed as soon as possible by washing. The material should be identified as soon as possible and the local or State Health Department should be contacted to see if there is a potential danger and, if so, how to handle the situation. Something that may not seem dangerous could have serious side effects. For example, materials which come into contact with a worker's pants leg may not cause illness or discomfort to an adult, but later in the home, a small child coming into contact with the contaminated clothing could incur serious illness or death. For this reason, it is IMPERATIVE that affected personnel find out how the material should be treated. If in doubt, remove contaminated clothing before entering a building and shower as soon as possible to remove any contamination that may be on the skin or in the hair.

Even though many spilled materials will be in a solid or liquid form, the greatest danger to personnel is from inhalation or exposure to airborne gases, dusts, vapors, or fumes. The dangers from vaporization, sublimation, or secondary reactions which produce toxic airborne materials cannot be over-emphasized.

Common sense and alertness will prevent most accidents, conversely, overconfidence and ignorance are the leading causes of injury.

8.1.2 Site Control

Traffic and spectators should be kept away from the accident. Do not let vehicles stop in, or pass through, the area of the spilled materials.

If hazardous or toxic vapors are escaping from a spill, it is best to take action to evacuate people from the area downwind from the spill until the spill has been cleaned up.

If the evacuation of civilian personnel becomes necessary, the procedure should be coordinated through local officials. Although the OSC may determine that evacuation may be advisable in any given situation, the responsibility to make such a decision rests with local civilian officials. Close liaison with local police and fire officials is a necessity.

Access to the control site is limited to essential personnel. The designated control site consists of the command post (upwind and outside the contamination control site), contamination reduction area, and exclusion area.

The complexity and size of the control site is dependent upon the actual site conditions and decontamination requirements. Figure 20 illustrates a control site situation.

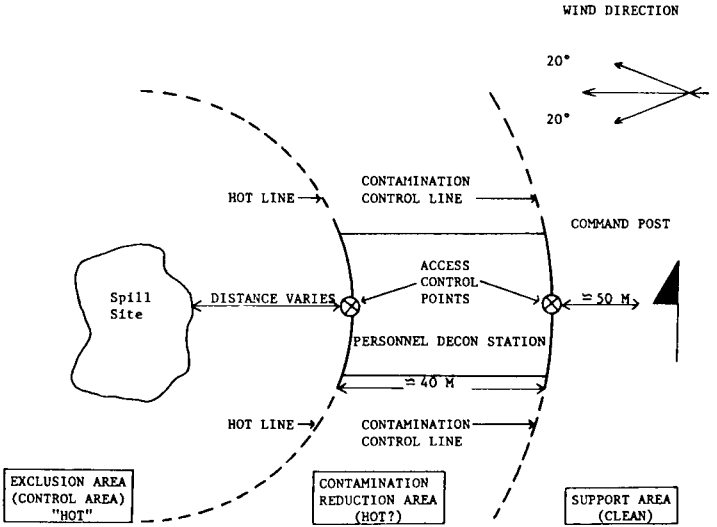
8.1.3 Equipment and Clothing

Spills of toxic materials can drastically alter the ambient environment. Consequently, an accurate assessment of hidden dangers is an integral part of safety considerations. Field monitoring equipment for oxygen deficiency, combustible and/or toxic gases and vapors, and radiation are necessary in atmospheres where these problems could be found.

It is important that personal protective equipment and safety requirements be appropriate to protect against the potential or known hazards at an incident. Protective equipment should be selected based on the type and concentration of the substance encountered and the possible route of personnel exposure. In situations where the type of materials and possiblities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the personnel protective equipment required for a safe initial entry.

The appropriate level of protection should be determined prior to the initial entry on site based on best available information. Subsequent information may suggest changes in the original level selected.

Figure 20. Field Control Site



Levels of Protection

Level A

Level A protection should be worn when the highest level of respiratory, skin, and eye contact protection is needed. While Level A provides the maximum available protection, including Self-Contained Breathing Apparatus (SCBA), it does not protect against all possible airborne or splash hazards. For example, suit material may be rapidly permeable to certain chemicals in high air concentrations or heavy splashes.

Level B

Level B protection should be selected when the highest level of respiratory protection is needed (SCBA), but percutaneous exposure to the small unprotected areas of the body (i.e., neck and back of head) is unlikely, or where concentrations are known to be within acceptable exposure standards.

Level B protection is the minimum level recommended for initial entries and should be used until the hazards have been further identified and defined by monitoring, sampling and other reliable methods of analysis. Once the site has been properly defined, personnel protection equipment corresponding with those findings should be utilized.

Level C

Level C protection should be selected when the type and concentration of respirable material is known (the material has adequate warning properties) or is reasonably assumed to be not greater than the protection factors associated with an air-purifying respirator, and exposure to the few unprotected areas of the body (i.e., neck and back of head) is unlikely to cause harm. Continuous monitoring of site and/or individuals should be established.

Since selection and use of appropriate personal protective equipment requires substantial training and experience, only qualified personnel should consider entering environments where such equipment is required. However, as a minimum, all personnel should carry the following equipment when responding to a spill incident:

1. Hard hat
2. Safety glasses
3. Safety shoes/boots
4. "Rubber" gloves
5. "Rubber" boots
6. Rain gear
7. Flashlight
8. First-aid kit
9. Road flares

8.1.4 Medical

All personnel who will be involved in field activities where there is a potential for exposure to hazardous substances must be offered pre-assignment and periodic medical exams and an appropriate medical exam after each exposure to hazardous substances, as required by 29 CER part 1910, paragraph f. The examiniation should be designed specifically to detect results of low-level exposure.

8.1.5 Training

Personnel responding to spill incidents must be thoroughly trained in both program and safety areas pertinent to their respective tasks. Program training should include a basic orientation to legislation, field procedures, agency coordination requirements, and contingency planning. Safety training should involve recognition of hazards, use and limitations of appropriate personal safety equipment, and basic first aid. This training is for the purpose of enabling personnel to recognize and avoid hazardous situations and should not be construed as encouraging deliberate exposure to hazardous substances. Periodic training and practice in use and care of safety equipment is necessary to maintain adequate skill levels.

8.2 WATERFOWL CONSERVATION

Oil and hazardous substance discharges, particularly in estuarine and near shore areas, often cause severe stress to resident and migratory bird species. The DOI representatives and the State liaison to the RRT will arrange for and coordinate actions of professional and volunteer groups in the establishment of bird collection, cleaning, and recovery centers.

8.3 ENVIRONMENTAL DAMAGE ASSESSMENT

Even though initial response to an environmental emergency does not include a formal damage assessment, the field investigator should be alert to the obvious signs of environmental harm. This could include indications of a fish kill, oiled and dying birds, and contamination of beaches and marshlands. Any signs of environmental damage should be reported to the EPA Emergency Response Team who will, in conjunction with the appropriate resource agencies, coordinate any necessary damage assessment.

9.0 SAMPLING AND DOCUMENTATION

9.1 SAMPLING PROCEDURES

The collection and subsequent analysis of samples is important in evaluating the progress of the spill cleanup. It is also important to collect samples as soon as possible after

the spill occurs for spill identification and assessment and for later use as evidence. The general sampling methodology described here may be applicable to all situations, although the EPA "Field Detection and Damage Assessment Manual" should be used as a guideline when samples are to be collected specifically for assessment or enforcement purposes.

9.1.1 Method of Sampling

There are two methods of sample collection: automatic and manual. "Automatic" sampling equipment is designed to function and collect data and/or samples in the absence of an operator. Sampling at the scene of a spill will usually be performed manually because of the emergency and temporary nature of the situation. Also, the presence of personnel on the scene may make it convenient and economical to take manual samples. Guidance on selection and use of automatic samplers can be found in other publications. The following discussion will assume manual sample collection although the theory could also apply to the use of an automatic sampler.

9.1.2 Types of Samples

There are two types of samples which can be collected for analysis: 1) Grab (discrete samples) and 2) Composite samples.

Grab or discrete samples characterize the sample media at a particular location and a particular instant in time. The purpose of a composite sample is to mix discrete samples in such a way as to represent the average characteristic either spatially or over a period of time. In addition to generating an average value, compositing is often done to reduce the analytical load placed on the laboratory.

The choice of the type of sample should depend on the objective of the sampling and the variability of the parameter of interest. If the variability of the applicable parameter of interest is low (that is, if the concentration of the parameter changes little over time), then a grab sample may characterize the quality adequately. On the other hand, if the variability is high, then a composite should be formed from grab samples taken at short intervals, or the grab samples themselves should be collected and analyzed. If nothing is known about the variability of the parameter of interest, then grab samples should be collected and analyzed initially to determine the variability of the parameter. Judgement will have to be exercised in terms of the allowed variability.

If a single sample or a small number of samples from a collection vessel are to be used, it is imperative that the contents be thoroughly mixed prior to sampling. In the case where quiescent conditions must be maintained, a number of samples at various locations throughout the process container should be taken.

9.1.3 Sample Containers

Samples must be taken in appropriate sample containers to reduce the possibility of contamination or adsorption. The container must be completely clean and equipped with a tightly fitting cap. Organic hazardous materials must be contained in a glass jar or bottle to reduce adsorption to the container walls. Specifically, oils and grease, pesticides, and short chain organic compounds should be placed into glass containers. Other materials such as metallic salts, can be stored in plastic containers with no adverse effect.

To obtain enforcement quality data, sample containers should be provided from the nearest analytical laboratory to insure use of the proper type and quality. If necessary, the bottles can be purchased from a local bottle supplier. If possible, use wide mouth containers with a lined cap except where interaction between the sample and cap material must be minimized. (Then use narrow necked containers). If commercial sample bottles can not be obtained, wide mouth canning jars can be used if an aluminum foil liner is provided. Where a plastic container is required and not readily available, distilled water can be purchased, the bottles emptied and the containers used. However, the use of these bottles is not recommended without specific instructions from the OSC.

To clean sample containers prior to reuse, the following procedures have been found to be effective:

1. Wash containers and caps with non-phosphate detergent and scrub strongly with a brush.
2. Rinse with tap water, then distilled water.
3. Invert and drain dry.
4. If additional cleaning is needed, rinse with sulfuric acid, tap water and distilled water.

In certain cases, sample bottles are further rinsed with chemicals to remove traces of materials left by previous samples. These procedures are outlined as follows:

1. Acid Rinse: If metals are to be analyzed, rinse the container with a solution of one part nitric acid to four parts water, then with distilled water. If phosphorus is to be analyzed, rinse the container with a solution of one part hydrochloric acid to one part water followed by distilled water.

2. Solvent Rinse: If oil and grease or pesticides are to be analyzed, begin with an acid-wash container, then rinse the sample container with hexane, then acetone, and distilled water. Treat the container caps similarly.

For long term monitoring however, the analytical laboratory performing the analyses should provide prepared

bottles for sampling.

9.1.4 Sample Preservation

The purpose of sample preservation is to maintain the constituents of interest in the same concentration as when the sample was collected. Even with preservation, the concentrations of the constituents may be a function of the time between sample collection and analysis. Therefore, for any given preservation method a maximum holding time is also specified. Other factors related to preservation that may affect the integrity of the sample include the type and material of the sample container, sample identification, and the chain of custody for sample handling. For the preliminary or initial sampling, icing or refrigeration of the samples should be adequate. While not effective for all parameters, icing or refrigeration is recommended as a standard technique since it comes closest to being a universal preservative and does not interfere with any analyses. The use of ice cubes and an insulated chest is usually an effective and convenient method for storage and transport of samples.

For a long term sampling program or for process monitoring samples, the laboratory performing the analyses should be consulted for specific instructions regarding preservation techniques and sample containers.

9.1.5 Sample Identification

Once the sample is taken, certain procedures must be followed to allow the identification of the sample and to record the chain of custody. It is important that these techniques be standardized and become a part of normal field procedure.

Each sample should be assigned a unique number to allow easy identification in the field and the laboratory. It is important that the number include relatively few digits so that it will not be abbreviated during successive handling. It is recommended that each person who samples be assigned a roll of peel-back labels. These labels would include the person's initials and sequential numbering. As a sample is taken and sealed, a number will be affixed to the bottle. The label should include sufficient space for added information such as date, preservative added, sampling time and location. Then the specifics regarding the sampling location, type of sample, and other pertinent facts should be recorded in the field notebook.

9.1.6 Chain of Custody

In cases of litigation, there must be proof of the chain of possession that occurs from the time of sample collection to final disposition. If a sample cannot be traced completely, the validity of the analytical result may be doubtful. Therefore, it is important that procedures for a written record

of chain of custody be included as normal field practice. A person has custody of a sample if one of the following requirements is fulfilled:

1. It is in his actual physical possession.
2. It is in his view after being in his actual physical possession.
3. It was locked up by him after being in his physical possession.
4. It was kept in a secured area, restricted to authorized personnel after being in his physical possession.

When the sample leaves his custody to another person, then a record should be made indicating that this transaction has been made.

9.2 DOCUMENTATION

The importance of keeping written records cannot be over emphasized. As documentation of the events surrounding a spill and its cleanup, these written records may have important legal implications, particularly in cost recovery or reimbursement. The records may also serve as a learning tool in that the knowledge gained from a spill can be applied to future spill situations. It is a good practice after the spill is cleaned up, and the emergency is over, to go back and assess the actions taken at the scene. Evaluation of this sort is important in improving response techniques. A record of the progress being made in the cleanup is also important in making decisions at the scene of the spill.

It is recommended that the OSC keep, in a permanently bound book, a log or diary of the chronological events from the time of notification of the spill until the cleanup and his duties are completed. All events of any significance should be recorded in the log with notations of the date and time. The information should include records of flow, operation, maintenance, sampling, fuel used, problems encountered, telephone converstions, meetings held, orders issued, weather observations, and other pertinent information. The log should be kept in a bound, sequentially numbered notebook. Entries should be made in the log immediately and the date and time indicated. No pages should be removed from the notebook. If a page is ruined, it should be marked "VOID". Important observations involving judgement and sampling records should be signed by the principal investigator and countersigned by a witness.

The important records that should be kept in the notebook can be listed as follows:

1. General events - for each day start/stop times for cleanup activities, arrival or procurement of

equipment, documentation for authorization, weather observations.

2. Treatment - volumes treated by each process, hours of operation of each process, maintenance needed and/or performed, fuel used, equipment breakdowns,ultimate disposals.

3. Sampling - records of sampling, sample preservation methods, analyses required, and destination of samples.

4. Personnel - a record of all personnel on site, their function, and the actual times present. This is especially important for those personnel, whether from a government agency or third party contractor, associated with the cleanup/treatment operation itself. It is imperative that the OSC develop an effective communication network with the personnel attending the respective operation.

5. Photographs - a record of times and locations of all photographs including a brief description of the subject.

APPENDIX A

SPILL INFORMATION

INFORMATION CONTACTS

Information Source	Type of Assistance	Access Telephone
OHM-TADS-CIS direct access user support	2,4	703-841-1200 800-247-8737
Technical Assistance Data System		206-442-1263
CHEMTREC - Chemical Transportation Emergency Center	2,3	800-424-9300
CHLOREP - Chlorine Emergency Plan	1,2,3	Through CHEMTREC (see above)
Chevron	2-Chevron Products	415-233-3737
Union Carbide, HELP Hazardous Emergencies Leak Procedure	2-Union Carbide Products	304-744-3487
Shell	2-Shell Chemicals	618-254-7331
National Argicultural Chemicals Assn.	2-Agricultural Products	503-286-4451 Stauffer Chemical Portland, Oregon
Pesticides Safety Team Network	1,2,3	Through CHEMTREC (see above)
Poison Control Centers: Poison Info. Ctr., Washington Outside Washington	2	 800-732-6985 206-526-2121
CHRIS - Coast Guard Chemical Hazards Response Information System	2,4	Natl. Response Center 800-424-8802
IRAP - Interagency Radiological Assistance Plan	1,2	Through CHEMTREC (see above)
EPA ERT - Environmental Response Team	1,2	201-321-6660

Information Source	Type of Assistance	Access Telephone
Coast Guard National Strike Force	1	Natl. Response Center or Pacific Strike Team 415-883-3311
U.S. Army Technical Escort Center, Chemical Emergency Response Team	1	EPA Regional Office or 800-826-3461

*Key: 1. Respond to scene with trained personnel if required
2. Profide information on identity, hazards, or what to do
3. Refer to knowledgeable contact
4. On-line computer available

INFORMATION REFERENCES

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American Public Health Association. Standard Methods for Examination of Water and Wastewater.

Association of American Railroads, Bureau of Explosives. Emergency Handling of Hazardous Materials in Surface Transportation. Washington DC.

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National Fire Protection Association. Fire Officers Guide to Dangerous Chemicals. Boston.

_____Fire Protection Guide on Hazardous Materials. Boston.

_____Hazardous Chemicals Data. NEPA No. 49. Boston.

_____National Fire Codes. Vol. 13, Hazardous Materials, Boston.

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Powers, Philip W. How to Dispose of Toxic Substances and Industrial Wastes. Park Ridge, New Jersey: Noyes Data Corporation.

Sax, Irving. Dangerous Properties of Industrial Materials. New York: Van Nostrand Reinhold Company.

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_____NIOSH Publication Catalog. Cincinnati, Ohio: Public Health Service.

U.S. Department of Transportation. Hazardous Materials Emergency Action Guide.

U.S. Environmental Protection Agency. Field Detection and *Damage Assessment Manual of Oil and Hazardous Material Spills.* 1977. Washington, DC: Office of Oil and Hazardous Materials.

U.S. Environmental Protection Agency. Mobile Treatment Technologies for Superfund Wastes. 1986. Washington, DC: Office of Emergency and Remedial Response.

_____Quality Criteria for Water.

_____Recognition and Management of Pesticide Poisonings.

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Windholz, E., Editor. The Merck Index. Rahway, New Jersey: Merck and Company.

APPENDIX B

CLEANUP CONTRACTORS

Contractor & Service	Phone
Airo Services, Inc. 4110 East 11th Street Tacoma, Washington 98421	24-hour hotline: 206-383-4916
Amalgamated Services, Inc. 21318 - 103rd Place S.E. Kent, Washington	206-854-6643
Baron Blakeslee, Inc. 5920 N.E. 87th Avenue Portland, Oregon 97220	503-252-3468
Chemical Processors, Inc. 5501 Airport Way South Seattle, Washington 98108	Seattle: 206-767-0350 Tacoma: 206-627-7658
Chemical Waste Management, Inc. Chem-Security Systems, Inc. Star Route Arlington, Oregon 97812	Seattle: 206-827-0711 Arlington: 503-223-1912
Coastal Tank Cleaning, Inc. 13749 Midvale North Seattle, Washington	24-hour Hotline: 206-364-4994
Crosby and Overton, Inc. 20245 76th Avenue South Kent, Washington 98031 Offices in Bellingham, Kent, and Portland. Respond primarily to land spills; backup support (vac truck, etc.) on all spills.	24-hour Hotline: 206-872-8030
Crowley Environmental Services Corporation 3400 E. Marginal Way South Seattle, Washington 98134 Booms, boats, sorbents, manpower	24-hour Hotline: Seattle: 206-682-4898 Vancouver: 206-696-0159 Oregon: 503-286-3210
Enviroproducts 8040 Southeast 36th Mercer Island, Washington	206-232-3390
Envirosafe Services of Idaho, Inc. P.O. Box 936 Mt. Home, Idaho 83647	Mt. Home: 208-587-8434 Boise: 208-384-1500 Tacoma: 206-565-4385

Contractor & Service	Phone
Fuel Processors, Inc. 4150 North Suttle Road Portland, Oregon 97210	503-222-1721
Global Diving and Salvage, Inc. 2763 13th Southwest Seattle, Washington 98134	206-623-0621
Hart Crowser, Inc. 1910 Fairview East Seattle, Washington	206-324-9530
Knapton Tow Boat Company Foot of 14th Astoria, Oregon 97103	503-325-6621
Lilyblad Petroleum, Inc. P.O. Box 1556 Tacoma, Washington 98401	24-hour Hotline: 206-527-4402
North American Environmental Inc. 2432 East 11th Tacoma, Washington	206-272-9988
Northland Services, Inc. 6425 Northeast 175th Street Seattle, Washington 98155 Barge	206-485-9502
Northwest Enviro Services, Inc. 1500 Airport Way South Seattle, Washington 98134	24-hour Hotline: 206-622-1090
PAC-MAR Services 3406 - 13th S.W. Seattle, Washington	206-872-8030
Pontius Trucking 11050 N.E. 108th Kirkland, Washington	206-762-3434
Resource Recovery Corporation 5501 Airport Way South Seattle, Washington 98108	206-767-0355
Riedel Environmental Services P.O. Box 5007 Portland, Oregon 97202 Booms, boats, sorbents, manpower, and response trailer in Portland, OR and Boise, ID.	Portland: 503-285-9111 24-hour Hotline: 800-334-0004

Contractor & Service	Phone
Risberg's Truck Line 2339 S.E. Grand Avenue Portland, Oregon 97214	503-232-7165
Roberts Environmental Services 1719 Irving Road Eugene, Oregon	503-688-4531
Ryckman's Emergency Action and Consulting Team (REACT) P.O. Box 27310 St. Louis, Missouri 63141 Response centers in Seattle, Portland, Bozeman. Hazardous materials response, toxic gas leaks.	24-hour Hotline: 800-325-1398
Safco Hazardous Waste Exchange 1221 - 188th South Des Moines, Washington 98148	206-242-3388
Shaver Transportation 4900 Northwest Front Portland, Oregon	503-228-8850
Spencer Environmental Services, Inc. 15770 Beaver Glen Drive Oregon City, Oregon 97045	503-632-7101
U.S. Ecology Inc. 509 East 12th Olympia, Washington 98501	24-hour Hotline: 206-754-3733
Van Waters & Rogers 3950 N.W. Yeon Avenue Portland, Oregon 97210	503-222-1721
Washington Chemical P.O. Box 743 Spokane, Washington 99210 Low level nuclear wastes.	509-489-9176
Wilhelm Trucking Company P.O. Box 10363 Portland, Oregon 97210	503-227-0561

APPENDIX C

LIST OF FIRMS BY TREATMENT PROCESS TECHNOLOGY

Biological

DETOX, Inc.
P.O. Box 324
Dayton, OH 45458
513-433-7394
(Evan Nyer)

Dorr-Oliver
77 Havemeyer Lane
P.O. Box 9312
Stanford, CT 06904
203-358-3664
(Dr. Paul Sutton)

OH Materials
P.O. Box 551
Findley, OH 45839
419-423-3526

Polybac Corporation
954 Marcon Blvd.
Allentown, PA 18103
215-264-8740
(William Ronyack
and Curtis McDowell)

FMC Aquifer Remediation System
P.O. Box 8
Princeton, NJ 08543
609-452-8412
(Joan Ridler)

Groundwater Decontamination
Systems
140 Route 17, North Suite 210
Paramus, NJ 07652
201-265-6727

Zimpro Inc.
Military Road
Rothchild, WI 54474
715-359-7211
(J. Robert Nicholson)

ECOVA
15555 N.E. 33rd
Redmond, WA 98052
206-882-4364

Physical/Chemical

Accurex
Cincinnati, OH
415-964-3200
(Jim Thompson)

American Toxic Disposal, Inc.
560 Seahorse Drive
Waukegan, IL 60085
312-336-6067
(William Meenan)

Andco Environmental Processes, Inc.
595 Commerce Drive
Amherst, NY 14150
716-691-2100
(Joseph Duffey)

ATW - Calweld Inc.
11300 South Norwalk Blvd.
Santa Fe Springs, CA 90670
213-929-8103
(John Royle)

Bird Environmental Systems
100 Neponset Street
South Walpole, MA 01071
(Neil D. Policow)

Calgon Carbon Corporation
P.O. Box 717
Pittsburgh, PA 15230
412-787-6700
(Joseph Rizzo)

Carbon Air Services
P.O. Box 5117
Hopkins, MN 55343
612-935-1844
(Bruce Anderson)

Chemical Processors, Inc.
5501 Airport Way - South
Seattle, WA 98108
206-767-0350
(Ron West)

Critical Fluid Systems
25 Acron Park
Cambridge, MA 02140
617-492-1631

DETOX, Inc.
Dayton , OH 45459
513-433-7394
(Evan Nyer)

Ecolochem, Inc.
4545 Patent Road
P.O. Box 12775
Norfork, VA 23502
800-446-8004
(Richard Smallwood)

EPA/Releases Control Branch
Woodbridge Avenue
Edison, NJ 08837
201-321-6677
(Richard Travers)

Ensotech, Inc.
11550 Vanowen Street
North Hollywood, CA 91605
818-982-4895
(Doug Smith)

Envirochem Waste Management Services
P.O. Box 10784
Raleigh, NC 27605
919-469-8490
(Jerry Deakle)

Industrial Innovations, Inc.
P.O. Box 830
Stockton, CA 95201
209-462-8241
(Alfred Abila)

IT Corporation
4575 Pacheco Blvd.
Martinez, CA 94553
415-228-5100
(Ed Sirota)

Chemical Waste Management
150 West 137th Street
Riverdale, IL 60627
312-841-8360
(Peter Daley)

Mobile Solvent Reclaimers
RR 1
St. Joseph, MO 64507
816-232-3972
(Larry Lambing)

Newpark Waste Treatment Systems
200A Bourgess Drive
Broussard, LA 70518
713-963-9107

OH Materials
Nationwide
419-423-3526
(Joe Kirk)

Oil Recovery Systems, Inc.
Nationwide
617-769-7600

PPM Inc.
10 Central Avenue
Kansas City, MO 66118
913-621-4206
(Fred Labser)

Resource Conservation Co.
3630 Cornus Lane
Ellicott City, MD 21043
(Lenny Weimer)

Rexnord C.R.I.C.
5103 West Beloit Road
Milwaukee, WI 53201
414-643-2762
(Richard Osantowski)

Richard Sanitary Sevices
205 41st Street
Richmond, CA 94802
415-236-8000
(Caesar Nuti)

Kipin Industries
513 Green Garden Road
Aliquippa, PA 15001
412-495-6200
(Peter Kipin)

Roy F. Weston, Inc.
Weston Way
West Chester, PA 19380
215-692-3030
(John W. Noland,
Nancy P. McDevitt)

Solidtek
5371 Cook Road
Morrow, GA 30260
404-361-6181
(Ed Shuster)

Sunohio
1700 Gateway Blvd., S.E.
Canton, OH 44707
216-452-0837
(Doug Toman)

Terra Vac, Inc.
356 Fortaleza Street
San Juan, PR 00901
809-723-9171
(Jim Malot)

Tetra Recovery Systems
1121 Boyce Road, Suite 1300
Pittsburgh, PA 15241
412-777-5235
(Ogden Clemens)

U.S. Army Toxic and Hazardous Materials Agency
Aberdeen Proving Ground,
MD 21005
301-671-2054

Solidification

Bethlehem Steel
Bldg. H-Room A110
Bethlehem, PA 18016
215-694-2424
(Robert M. McMullan)

Chemfix Inc.
1675 Airline Highway
P.O. Box 1572
Kenner, LA 70063
504-467-2800
(Robert A. Phelan)

Chemical Waste Management
Riverdale Center
150 W. 137th Street
Riverdale, IL 60627
312-841-8360
(Peter Daley)

Envirite Field Services
600 Germantown Pike
Plymouth Meeting, PA 19462
215-825-8877
(Bill Howard)

Envirochem Waste Management
975 Walnut Street
Cary, NC 27511
919-469-8490
(Jerry Deakle)

Hazcon Inc.
P.O. Box 947
Katy, TX 77492
713-391-1085
(Roy Funderburk)

Lopat Enterprises Inc.
1750 Bloomsbury Avenue
Wanamassa, NJ 08812
201-922-6600
(Lewis Flax)

Solidtek Systems Inc.
5371 Cook Road
Morrow, GA 30260
404-361-6181
(Ed Shuster)

Velsicol Chemical Corp.
2603 Corporate Avenue
Suite 100
Memphis, TN 38132
901-345-1788
(Charles Hanson)

Westinghouse Hittman Nuclear
9151 Runsey Road
Columbia, MD 21045
310-964-5043
(Robert Conner)

Westinghouse Waste Technology
Services Division
P.O. Box 286
Madison, PA 15663
412-722-5600

Thermal

DETOXCO
2700 Ygnacio Valley Road
Walnut Creek, CA
415-930-7997
(Robert McMahon)

ENSCO Environmental Services
Third Floor, First Tennessee
Bank Building
Franklin, TN
615-794-1351
(Robert McCormack)

Haztech
5280 Panola Industrial Blvd.
Decature, GA 30035
404-981-9332
(Saul Furstein)

Incinenex Corporation
P.O. Box 69
Bedford Hills, NY 10507

J.M. Huber Corporation
P.O. Box 2831
Borger, TX 79008
806-274-6331
(Jimmy W. Boyd)

John Zink Services
4401 S. Peoria Avenue
P.O. Box 702220
Tulsa, OK
918-747-1371
(Kenneth E. Hastings)

MAECORP Inc.
17450 South Halsted Street
Homewood, IL 60430
312-957-7600
(Hank Mandosa)

Modar Inc.
320 Wilcrest Street, Suite 220
Houston, TX 77042
713-785-5615
(Fred Sieber)

Ogden Environmental Services,
Inc.
10955 John Jay Hopkins Dr.
San Diego, CA 92121
619-455-2383

OH Materials
P.O. Box 551
Findley, OH 45839
419-423-3526
(Sam Insallaco)

Rollins Environmental Services
1 Rollins Plaza
Wilmington, DE 19899
302-479-2700
(Bill Philipbar)

Reidel Environmental Services
P.O. Box 5007
Portland, OR 97205
503-286-4654
(Jack Patterson)

Shirco Infrared Systems Inc.
1195 Empire Central
Dallas, TX 75247-4301
214-630-7511
(George Hay)

Trade Waste Incineration-
A Division of Chemical
Waste Management
8000 Maryland, Suite 4400
St. Louis, MO 63105
314-727-5040
(A.J. McCoy)

VerTech Treatment Services
12000 Pecos Street
Denver, CO 80234
303-452-8800
(Gerald Rappe)

Waste-Tech Services Inc.
445 Union Blvd., Suite 223
Lakewood, CO 80228
303-987-1790
(Elliott Cooper)

Westinghouse Plasma Systems
P.O. Box 350
Madison, PA 15663
412-722-5637
(Bill Mellili)

Vesta Technologies Limited
1670 West McNab Road
Fort Lauderdale, FL 33306

Winston Technology
6920 N.W. 44th Ct.
Lauderhill, FL 33319
305-748-1769
(Patrick Philips)

Zimpro Inc.
Miltary Road
Rothchild, WI 54474
715-359-7211
(J. Robert Nicholson)

APPENDIX D

OIL SHEEN REFERENCE

Standard Terms for High Viscosity Oil Films and Descriptive Appearance of High Visocity Oil on Water

Standard Term	Approximate Film Thickness 10^{-6} inches	Approximate Film Thickness 10^{-6} meters	Approximate Quantity of Oil in Film Gals. per sq. miles	Approximate Quantity of Oil in Film Liters per sq. km.	Appearance
Barely visible	1.5	0.04	25	44	Barely visible under most favorable light conditions
Silvery	3	0.08	50	88	Visible as a silvery sheen on water surface
Slightly colored	6	0.15	100	176	First trace of color may be observed
Brightly colored	12	0.3	200	351	Bright bands of color are visible
Dull	40	1.0	666	1,168	Colors begin to turn dull brown
Dark	80	2.0	1,332	2,337	Colors are much darker brown or black

Note: Each one-inch thickness of oil equals 5.61 gallons per square yard or 17,378,909 U.S. gallons per square mile.

APPENDIX E

STANDARD TERMS AND CONVERSION TABLE

Multiply by factor to obtain

Knowing	U.S. Gallon	U.S. Barrel	Cubic Feet	Liter
Gallon (U.S.)	1.0000	0.02381	0.13368	3.785
Barrel	42.0000	1.00000	5.6146	158.930
Cubic Feet	7.4805	0.1781	1.0000	28.310
Liter	0.2641	0.00629	0.03532	1.000

APPENDIX F

TELEPHONE DIRECTORY

National Response Center	1-800-424-8802
U.S. Environmental Protection Agency	
Regional Office.....24-hour number:	206-442-1263
24-hour number:	8-399-1263 FTS
Operations Office.....Idaho:	208-334-1450
	8-554-1450 FTS
Oregon:	503-221-3250
	8-423-3250 FTS
Washington:	206-753-9437
	8-434-9437 FTS
Alaska:	907-586-7619
U.S. Coast Guard	
13th District....Operations Center:	206-442-5886
	8-396-5886 FTS
MER Branch:	206-442-5850
	8-396-5850 FTS
MSO:	206-286-5550
	8-396-5550 FTS
COTP Offices Seattle:	206-286-5550
	206-286-5540
	8-396-5550 FTS
Portland:	503-240-9317
	8-422-0317 FTS
17th District	
Juneau ....MEP Branch:	907-586-7197
Anchorage.....MSO:	907-271-5137
Pacific Strike Team San Francisco:	415-883-3311
	8-556-2665 FTS
Corps of Engineers	
North Pacific Division.....	503-221-3700
	8-423-3700 FTS
Seattle District.....	206-764-3742
	8-446-3742 FTS

Portland District..... 503-221-6000
8-423-6000 FTS

Walla Walla District..... 509-522-6506
8-434-6506

Alaska District..... 907-753-2504

U.S. Attorney

Boise, ID..... 208-334-1211
8-554-1121 FTS

Portland, OR..... 503-221-2101
8-423-2101 FTS

Seattle, WA..... 206-442-7970
8-399-7970 FTS

Spokane, WA..... 509-456-3811
8-439-3811 FTS

National Oceanic & Atmospheric Administration (NOAA)

Regional Office.....Seattle: 206-442-7656
8-399-7656 FTS

National Marine Fisheries..... 206-526-6150
8-392-6150 FTS

National Weather Serv., Forecast Office. 206-526-6095
8-392-6098 FTS

Pacific Marine Mammal Laboratory..... 206-526-4047
8-392-4047 FTS

Federal Emergency Management Agency (FEMA) 206-481-8800

U.S. Fish and Wildlife Service

Regional Pollution
Response Coordinator.....Portland: 503-231-6128
8-429-6128 FTS

IDAHO

Department of Health & Walfare
Division of Environment.....Boise: 208-334-5839
8-554-5839 FTS

Division of Health..... 800-632-5945
8-554-5945 FTS

Bureau of Emergency Medical Services.... 208-334-5994
8-554-5994 FTS

(Notify for all spills)

OREGON

Oregon Emergency Management...In Oregon: 800-452-0311
(24 hours) Outside Oregon: 503-378-4124

Department of Environmental
Quality.....Portland: 503-221-3250
8-423-3250 FTS

WASHINGTON

Department of Ecology..... 206-753-2353
(Olympic Pen. & S. of Tacoma)..... 8-434-2353 FTS

(Puget Sound N. of Tacoma &..... 206-867-7000
San Juan Islands)

(East of Columbia River)..... 509-456-2926

(Central Washington)..... 509-575-2490

ALASKA

Department of Environmental..... 907-465-2600
Conservation, Central Office, Juneau.... 907-465-2653

24 Hour Telephone
In Anchorage: Dial 211 and ask for Zenith 9300
Elsewhere: Dial 0 and ask for Zenith 9300

Oil Spill Co-ops

Clean Sound Cooperative.....Seattle: 206-624-7014
Clean River Coopertive.....Portland: 503-228-4361

Hazardous Materials Disposal Sites

Envirosafe Services, Inc.

Grandview, ID: 208-834-2275
Mountain Home, ID: 208-587-8404

Chem-Security Systems, Inc.

Arlington, OR: 503-454-2777
Portland, OR: 503-223-1912

Environmental Disposal Service

Coligna, CA: 209-935-2002

FREQUENTLY CALLED NAMES AND TELEPHONE NUMBERS

Name	Telephone Number