TECHNICAL
FIELD GUIDANCE

CORRECTIVE ACTION

NOTES

Introduction - Corrective Action

Each spill incident is unique in terms of (a) the type and volume of the substances released, (b) the complexity of the spill site, and (c) the resources (e.g., equipment, labor, and working space) available to respond to the incident. A constant reevaluation of your choice of corrective action measures is necessary throughout the entire course of a clean-up effort.

This section of the manual provides guidance to help you choose which corrective action measures could be employed at a spill site. This guidance, which addresses both the shorter-and longer-term remedial measures for spill cleanup, consists of a general strategy to guide you in selecting an appropriate technology, including problem-specific discussions covering the technology options and their uses and limitations. A separate subsection is devoted to corrective action technology pertaining to the following types of spills and affected media:

-- Free Product in Structures, Sewers, and Underground Utility Lines (Subsection 6.2);

-- Vapors in Structures, Sewers, and Underground Utility Lines (Subsection 6.3);

-- Free Product on Soil Surface (Subsection 6.4);

-- Free Product on Water Surface (Subsection 6.5);

-- Soil Remediation (Subsection 6.6);

-- Ground-Water Remediation (Subsection 6.7); and

-- Alternative Water Supplies (Subsection 6.8).

You will not find in this section explicit, cookbook-like procedures and rules to apply that will, essentially, make the technology selection decision for you. You will find, however, discussions of the factors to consider when you (with the assistance of your RSE and, as necessary, BSPR Central Office staff) select the corrective action measures deemed most appropriate based on your professional judgment and experience.

In this section we also discuss exposure and risk assessments in the context of spill clean-up decisions. Spill responders do perform exposure assessments and also make risk evaluations but do not conduct quantitative risk assessments per se. These distinctions are discussed in Subsection 6.1.

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Introduction - Corrective Action (continued)

- The overriding priority for corrective action technology selection is ensuring that human health and the environment are adequately protected and that environmental damage is mitigated. This goal is achieved, in part, by ensuring that the technologies selected and their operation comply with applicable federal, state, and local requirements, including those for the handling of spill residuals and debris.

- The corrective action technologies currently available for spill management and cleanups are summarized in Part 3, Section 1, of this manual. In that section, these technologies are discussed in terms of their capabilities, relative cost, design and installation standards, and operation and maintenance requirements. We recommend that you review that section to gain a basic understanding of each spill-related technology.

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1.6 Corrective Action

The type and volume of the substances released, the complexity of the spill site, the impacts of the spill, and the resources (e.g., equipment, labor, and working space) available to respond to the incident makes each spill incident unique. It's not surprising, therefore, that sometimes a best technology choice among the available corrective action options is not clear. Consequently, it is often necessary to reevaluate the choice of corrective action measures taken throughout the course of a clean-up effort to ensure adequate protection of human health and the environment and mitigation of environmental damage.

This section of the manual provides guidance on how to structure the process by which you will select the corrective action technologies to employ at a given spill site. You will not find cookbook procedures that will automatically lead you to definitive choices. Rather, we discuss those issues you should consider to make a logical and reasonable technology choice and to evaluate the appropriateness of the technology choice made by your contractor or an RP. Ultimately, you must rely on your professional experience and judgment to make the final choices.

Subsections 6.1 through 6.8 provide additional general and problem-specific guidance on corrective action decision-making. In Subsection 6.1, we discuss the spill responder's role in conducting exposure and risk assessments. These terms can mean different things to different people. By "exposure assessment," we refer to the process of establishing the contaminant concentrations at the source of the spill, the routes by which individuals may be exposed to the contamination, and the contaminant concentrations to which individuals are being exposed. This assessment is basically what a site investigation is all about (along with establishing responsibility for the spill, if possible) and is one of the main responsibilities of a spill responder.

Spill responders also evaluate the risks posed by a spill, to a degree, but they do not conduct a "quantitative risk assessment" as we define that term. The purpose of a risk assessment is to establish quantitatively the health risk posed to an individual by exposure to a certain level of contamination over a specified (and usually prolonged) period of time. Quantitative risk assessments are usually made in the process of setting health-based quality standards. As such, these assessments are conducted by the health department or other agencies (like the USEPA) and not by spill responders. For a complete discussion of the difference between exposure and risk assessments, see Subsection 6.1.

The guidance presented in Subsections 6.2 through 6.8 covers technology options, including their uses and limitations, as these pertain to the following types of spills:

- Free Product in Structures, Sewers, and Underground Utility Lines;
- Vapors in Structures, Sewers, and Underground Utility Lines;
- Free Product on Soil Surface;
- Free Product on Water Surface;
- Soil Remediation;

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- Ground-Water Remediation; and
- Alternative Water Supplies.

Each subsection also describes proper response/clean-up procedures, specifically highlighting spill responder responsibilities, as well as applicable BSPR policies.

The corrective action technologies currently available for spill management and cleanup are summarized in Part 3, Section 1, of this manual. In that section, we review these technologies in terms of their capabilities, relative cost, design and installation standards, and operation and maintenance requirements. We recommend that you review this section to gain a basic understanding of each spill management and clean-up technology.

Selection of Corrective Action Technologies

As a general rule, you should select commercially proven technologies that are readily accessible through the contractors we hire for spill cleanup (of course, this still leaves many options to choose from). Pay attention to regulatory limitations -- such as air regulations limiting volatile emissions -- that can preclude the use of certain technologies. You may draw upon the expertise of your spill clean-up contractors concerning the performance and efficiency of different corrective action technologies, but you must be the final judge of which technology to use.

Exhibit 1.6-1 summaries those factors and issues to consider in evaluating the alternative corrective action technologies. For each area or issue, we have provided a series of questions to help structure your evaluation. Remember that ensuring adequate protection of human health and the environment is your first priority in choosing a corrective action technology. Achieving this goal extends to ensuring that the technology operates properly once it is implemented and that it complies with all relevant federal, state, and local requirements or standards.

If a significant immediate hazard exists, it might be appropriate to select technologies that provide quick results even though they may be more expensive. Alternatively, choosing a more cost-effective alternative, provided that the use of that alternative would not substantially increase long-term risk, may be appropriate for clean-up situations that do not pose significant imminent hazards that must be remedied quickly. For example, venting of soils contaminated with gasoline may be too slow a process to adequately protect human health, or the secondary impact from the released vapors may be unacceptable. Excavating this soil might, therefore, be the better alternative, even though excavation is potentially more costly.

To illustrate how you can go about structuring a logical assessment of your alternative technology choices, we discuss below the factors you need to consider to evaluate the implementability, long-term effectiveness, and cost-effectiveness of each alternative technology option.

Exhibit 1.6-1
Considerations for Selecting Corrective Action Technologies

Criteria	Factors to Consider		Questions to Ask Yourself
The Option Must Adequately Protect Human Health and the Environment	#	Properties of spilled substances	– What is the spilled substance? – What is the degree of mobility of the spill? – How toxic or explosive is the spill? – How volatile and/or soluble are its constituents?
	#	Size of spill	–To what extent have the spilled substances ontaminated the indoor or outdoor air, soil, ground water, or structures?
	#	Potential risks	–What are the immediate risks posed by the spill? –What are the long term risks posed by the spill?
The Option Must Reduce Mobility, Volume and Toxicity	#	Degree of expected reduction in mobility, volume, and toxicity	–To what extent will the option reduce the total mass, mobility, or volume of the contamination. –What portion of the spilled substance will be treated and destroyed by the option?
	#	Type and quantity of residuals remaining after treatment	–What residuals will remain? –What are their quantity and properties –What risks do treatment residuals pose?
	#	Treatment process used	–Does the treatment process address the principal threat?
The Option Must Be Feasible to Implement	#	Physical feasibility	–Are there building code restrictions? –Can the equipment fit into the space provided? –What are the difficulties and uncertainties associated with construction? –Are there site access problems? –How easy is it to modify the technology, if necessary?
	#	Technical feasibility	–What is the reliability of the technology? –What are the technology's limitations? –What are the monitoring considerations –What is the availability of treatment, storage capacity, and disposal services? –What is the availability of necessary equipment and specialists? –What are the power requirements? –Are there noise level concerns?
	#	Administrative feasibility	–What is involved in coordinating the corrective action with other agencies? –Can permits for off-site activities be obtained if required? –Are there multiple property owners who must agree?

Exhibit 1.6-1
Considerations for Selecting Corrective Action Technologies
(continued)

Criteria	Factors to Consider		Questions to Ask Yourself
The Option Must Achieve Long-term Effectiveness	#	Adequacy and reliability of controls	–What are the difficulties and uncertainties associated with long-term operation and management? –Can the technology employed effectively remove the contamination? –What is required for long-term management and monitoring? –What is the potential that technical components will need to be replaced? –What are the threats or risks should the initial remedy fail and another option must be substituted?
The Option Must Comply with Federal and State Standards and Requirements	#	Location-specific requirements	–Can the technology be approved for use at the spill site?
	#	Treatment limits	–Can the technology employed sufficiently treat contaminated materials to achieve specific limits required by Federal or State environmental laws?
	#	Technology standards	–Does the technology employed meet minimum standards specified by the implementing agency?
The Option to the Extent Possible, is Accepted by the Community	#	Public Comments	–What are the public's concerns and comments about the corrective action? –Does the technology reflect features supported by the community?
The Option Must Be Cost-effective	#	Capital Costs	–What are the relative start-up costs for site development, equipment, and residual disposal?
	#	Operation and Maintenance costs	–What are the monthly cost requirements for operating labor, maintenance materials, energy, administration, and periodic site reviews?

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Implementability

One of the more obvious criteria that a corrective-action technology must meet is that it be feasible to implement. Therefore, before selecting any remedial technology for a spill, sift through the available options to determine which ones are physically, technically, and administratively feasible. Applying these criteria can significantly narrow down the list of appropriate remedial options for a particular spill site.

The physical limitations and features of a spill site can often restrict the kinds of technologies that can be implemented at that site. You will need, therefore, to evaluate the accessibility to and physical limitations of a site before selecting a remedial action technology. It is not unusual for site-specific terrain or the location of roads, buildings, and underground or overhead utility lines to preclude the use of certain technology options that would otherwise be appropriate. For example, contaminated soil next to and/or underneath buildings cannot be excavated easily, if at all, without threatening the structural integrity of the buildings. In-situ soil treatments may be the only feasible alternative in this instance. Also, sites for which there are no sewers, streams, or other surface waters to discharge to may not offer any means for disposing of large volumes of treated ground water that cannot be reinjected into the ground. In such cases, it may be necessary to pump the treated water to tanks for transport to another location where disposal of the water is possible. Under these circumstances, it would not be advisable to use a technology that generates large volumes of treated water.

Physical limitations can also force you to exercise less than your optimal choice for where to locate a technology -- for example, when a site owner doesn't allow access to a piece of property on which you believe a free product recovery well should be located for optimum recovery efficiency.

In addition to being physically feasible, a technology must be technically feasible. Using a technology like air stripping or soil venting, for example, is not very technically feasible in the case of an older gasoline spill, since most of the volatile contaminants will have volatilized from the spill mass. The same rationale would apply to a spill of any substance that is not particularly volatile. Another example of technical infeasibility would be attempting to use a free product recovery technology designed for floating product spills when the substance spilled has a density greater than water and has passed into the aquifer and does not float on the water table.

If a remedial alternative is both physically and technically feasible, it must also be administratively feasible. For example, it may be technically feasible (and cost-effective) to discharge the effluent from an air stripper to a municipal wastewater treatment plant, but the municipality in which the wastewater treatment plant is located must grant permission to discharge. Such approval may not always be granted. A similar problem can occur if a sanitary landfill refuses contaminated soil, citing technical or space constraints or public or political pressure not to accept the soil. The most common situation constituting an administrative infeasibility is, of course, when a property owner refuses to grant access to the site or allow wells to be drilled or structures to be erected on his or her property. In short, any corrective

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action technology whose implementation would pose the kind of physical, technical, or administrative problems discussed above could render the option infeasible.

Long-Term Effectiveness

A spill cleanup may take a long time to complete. Many technology options require maintenance and monitoring to ensure they remain efficient and effective over time. However, the program workload and resources may not allow for the degree of long-term maintenance needed. Choose remedial technologies that can realistically be kept effective for long-term corrective action given the often greater resource demand of technologies that will be operative over the long term.

Cost-Effectiveness

The balancing of relative cost and effectiveness should be the last factor considered in selecting a corrective action technology after other criteria have been applied to narrow down the choices. In evaluating cost-effectiveness, consider the long-term demands for operating, monitoring, and maintaining the selected technology in addition to the initial capital costs. For example, carbon adsorption units can often involve a very low initial capital outlay and might be judged attractive on that basis alone. However, if you add in the costs of replacing the activated carbon beds over time and taking and analyzing water quality samples at some frequency, the combined costs for start-up, operation, and maintenance may exceed the cost of another, initially more expensive, corrective action technology option.

Keep in mind, especially with regard to the cost-effectiveness criterion, that you are not restricted to choosing one technology option. The cost-effectiveness of a cleanup can sometimes be enhanced by combining two or more technology options. For example, air strippers and activated carbon adsorption units are common technologies used for ground-water treatment. Each can be used alone to clean up a spill; however, using these technologies together to treat contaminated ground water can offer significant cost efficiencies. An air stripper can be used as a first-stage treatment process to reduce 90 to 95 percent of the contamination, and an activated carbon unit can be used as a second-stage treatment to remove the remaining contaminant concentration. This extra contaminant-removal capability that is realized when both techniques are used may reduce the contamination to such an extent that the final effluent can be disposed of in a sanitary sewer or discharged to surface water near the site, which otherwise would not be possible if the air stripper were used alone. Combining these technologies also can prolong the service life and reduce the operation and maintenance cost of using an activated carbon unit (i.e., the carbon bed is not used up as rapidly), and thereby increase the cost-effectiveness of the treatment system.

While we regret that we cannot provide you with step-by-step instructions that, in effect, tell you to choose technology X under site conditions A, B, and C, we do feel that the examples illustrated above will help you make a reasonable choice of technology that is based on a careful evaluation of all related factors.

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Some representative spill scenarios and the possible corrective action technology options are provided in Exhibit 1.6-2. Each of the following subsections address the proper procedures and possible clean-up options in more detail.

Exhibit 1.6-2

Representative Spill Scenarios and Possible Corrective Action Options

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SITUATION: HIGH GASOLINE CONTAMINATION IN SOIL AND FREE-DISSOLVED PRODUCT IN GROUND WATER

SITE CONDITIONS:

- # Ground water within 15 feet of ground surface.
- # Ground water used for drinking water; several wells known to be impacted.
- # Soil is moderately to highly permeable, resists caving.
- # Gasoline odors in basements; vapor concentrations near, but below, explosive levels.
- # Site is readily accessible for use of heavy equipment.

POSSIBLE CORRECTIVE ACTION STRATEGY:

User interceptor trench to collect and skim off free product. Trench also collects ground water for treatment with air stripper. Block entry of vapors into basements or vent basements or vent surrounding soils. If health department judges contamination of drinking water to be health hazard, consider providing treatment system or temporary alternative water supply. Soil excavation may be necessary.

HANDLING OF EFFLUENT(S):

Treated water from air stripper must meet quality standards for discharge to sewer and/or surface water. Alternatively, infiltration pits could be used, provided iron content doesn't present clogging problem. Air discharge from stripper should be directed away from ignition sources and may require treatment with activated carbon to meet emission limits.

SITE CONDITIONS:

- # Ground water at depth (greater than 15 feet from ground surface).
- # Ground water used for drinking water; several wells show no evidence of contamination.
- # Soil is highly impermeable, several clay layers.
- # No reports of gasoline odors.
- # Access to site is somewhat restricted.

POSSIBLE CORRECTIVE ACTION STRATEGY:

Use recovery well(s) to capture free product and withdraw ground water for treatment in air stripper. Use monitoring well network to monitor plume control and recovery. Soil excavation is necessary to remove continuing source. Monitor quality of domestic well water.

HANDLING OF EFFLUENT(S):

Treated water from air stripper must meet quality standards for discharge to sewer and/or surface waters. Air discharge from stripper should be directed away from ignition sources and may require treatment with activated carbon to meet emission limits.

Exhibit 1.6-2

Representative Spill Scenarios and Possible Corrective Action Options

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SITUATION: NEAR-SURFACE GASOLINE CONTAMINATION IN SOIL, NO FREE OR DISSOLVED PRODUCT IN GROUND WATER

SITE CONDITIONS:

- # Ground water at depth; not used as drinking water source.
- # Soils of moderate to high permeability.
- # Gasoline odors in basements; concentrations at explosive levels.
- # Very little open space; numerous buildings and other structures.

POSSIBLE CORRECTIVE ACTION STRATEGY:

Address vapor hazard by venting structures and/or venting soils. Excavate accessible contaminated soils surrounding source. Allow natural processes to degrade remaining contamination.

HANDLING EFFLUENT(S):

Air discharge should be directed away from ignition sources. Excavated soils may be treatable on site and thus could be replaced or may have to be disposed of off site.

SITE CONDITIONS:

- # Groundwater at depth, used as drinking water source; no wells affected.
- # Soils of low to moderate permeability.
- # No gasoline odors in basements detected.
- # Very little open space; numerous buildings and other structures.

POSSIBLE CORRECTIVE ACTION STRATEGY:

Excavate accessible contaminated soils surrounding source. Monitor quality of well water. Allow natural processes to degrade remaining contamination.

HANDLING EFFLUENT(S):

Excavated soils may be treatable on site and thus could be replaced or may have to be disposed of off site.

TECHNICAL

FIELD GUIDANCE

CORRECTIVE ACTION - EXPOSURE AND RISK ASSESSMENT

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Corrective Action - Exposure and Risk Assessment

GUIDANCE SUMMARY-AT-A-GLANCE

In each spill response, the decisions you make are based on your assessment of the degree of safety and/or health hazard associated with a spill of a petroleum product or hazardous substance. Each spill response, therefore, involves the application of exposure assessment techniques and can also involve an assessment of health risk. This subsection describes the application of exposure and risk assessment techniques in spill response.

Generally, spill responders concern themselves only with exposure assessments. These assessments identify the possible health and safety risk to the public and spill response personnel, the areal extent of the contamination, the populations affected by the spill, and the contaminant concentrations at all exposure points. Spill responders do not perform quantitative risk assessments. Quantitative risk assessments pick up from where an exposure assessment leaves off and involves calculation of the carcinogenic and non-carcinogenic risks for all exposure points. These assessments are conducted by the health department in consultation with BSPR Central Office staff.

The application of exposure and/or risk assessments to any type of spill can be described in the context of four different situations confronting the spill responder:

-- Situation 1: An obvious safety and health hazard exists;

-- Situation 2: Clean-up standards are available for all of the constituents of concern for comparison to site conditions;

-- Situation 3: Clean-up standards do not exist for all of the constituents of concern for comparison to site conditions; and

-- Situation 4: The cleanup is unable to achieve the established clean-up levels and there is a question as to whether the cleanup can and should be terminated.

These situations represent a range from the less complex to the more complex application of quantitative exposure and risk assessment techniques.

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1.6.1 Corrective Action - Exposure and Risk Assessment

There are different types of "exposure assessments" and "risk assessments" conducted in the context of a spill response. Spill responders perform some of these assessments themselves (perhaps with some assistance) and are involved very little or not at all in others. We explain these differences in this section and what they mean in terms of your responsibilities.

1. Types of Exposure and Risk Assessments

The terms "exposure assessment" and "risk assessment" mean different things to different people. For example, some people equate the term "risk assessment" to a personal health and safety evaluation of a spill incident to determine protective equipment requirements. We prefer, however, to use the scientific/regulatory meanings of these terms, to describe what we see as your responsibilities in conducting exposure and risk assessments. These definitions are explained below.

It is certainly true that each spill response amounts to a continual evaluation and reevaluation of the health (and safety) risks posed by a spill. Your assessment of possible exposures to a spill and the human and/or environmental risks that the spill may present starts with your evaluation of the spill report. Certain information in the report may elicit specific concerns about possible health risks that may (and often do) not require much analysis to discern. For example, you may learn that there are clear indications that a household's water supply is contaminated or that there was a spill just a few feet from a town's municipal well field. Your application of the spill response priority system described in the introduction overview of the Spill Response Program is, in effect, a form of a "risk assessment" in that it requires you to use information from a spill report or preliminary site investigation to rank spill sites (especially UST spill sites).

When you arrive on the scene of a spill, you also should perform another type of "risk assessment." We expect each spill responder to plan for and take the necessary steps to protect their personal health and safety (see Part 2, Section 1, for a discussion of health and safety protection policies and requirements) when responding to a spill. This means:

- Try to determine what material was spilled before you arrive on the scene;
- Find out what contaminants may be involved, whether they are toxic, and what symptoms indicate exposure;
- Know what measures must be taken to protect your own health and safety as well as that of the public; and
- If you don't know what was spilled, prepare for and approach the scene as if a toxic hazardous material is involved until you are able to determine otherwise.

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Following these (and other) guidelines and assessing the spill and spill scene to ensure your personal health and safety protection does entail an assessment of possible exposure to contamination and assessment of "risk." However, the site investigation phase of a spill response is very much an "exposure assessment" and most closely matches the definition of this term in the parlance of regulators and toxicologists. A true "risk assessment," generally not performed by spill responders, is discussed in below in subsection b.

a. Exposure Assessments

One of the basic purposes of the site investigation is to establish where the contamination is and to determine if anyone is being exposed to this contamination by virtue of breathing it, drinking it, or otherwise coming into contact with it. Stated more formally:

> An "exposure assessment" is the process of measuring or estimating the intensity, frequency, and duration of human exposures to a contaminant currently in the environment or of estimating hypothetical exposures that might arise from the release of a contaminant into the environment. In its most complete form, it describes the magnitude, duration, schedule, and route of exposure; the size, nature, and classes of the human populations exposed; and the uncertainties in all estimates. [1]

If no one is or may be exposed to the contamination, it is possible to judge that there is no risk and, therefore, no need to clean up the spill. The complication that often arises, however, is predicting whether someone or something might be exposed to (impacted by) the spill at a later time if the contamination is not addressed and it migrates to another exposure point (e.g., a downgradient water supply well that is presently not contaminated).

To address this possibility, exposure assessments can become quite complicated and quantitative as predictive models are used to examine possible migration pathways and to estimate possible exposure point concentrations. We do not expect spill responders to conduct quantitative assessments of possible future exposures. However, you may be confronted with evaluating such assessments as performed by spill response contractors hired by DEC or by responsible parties. For example, a responsible party may use such an assessment to support our argument that no cleanup is required or that a cleanup can be terminated given that current and future exposures are estimated to be below levels that would indicate a health or an environmental concern. In these cases, you can request the assistance of a standby contractor or of BSPR Central Office staff to help evaluate this kind of an "exposure assessment."

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Guidance on the conduct of site investigations is not covered in this section. You will find information on what to sample for, where to sample, how to sample, and so forth, in Part 1, Section 4, Site Investigation Procedures. Similarly, this section only touches upon the policy and procedures for spill close-out. This topic is covered in Part 1, Section 7, Closing-Out a Spill.

b. Risk Assessments

While you conduct an exposure assessment every time you investigate a spill site, spill responders very rarely get involved in what regulators and toxicologists call a "risk assessment." A true risk assessment requires very specialized skills and is often a more quantitative exercise than exposure assessments; however, a risk assessment uses the data generated in an exposure assessment. For example, a risk assessment may start with data on what contaminant concentrations have been detected in the drinking water to estimate the health risk if someone were to drink that water every day for 70 years. The formal definition is as follows:

> A risk assessment involves characterizing the potential adverse health effects of human exposure to environmental hazards. It includes several steps: describing of the potential adverse health effects based on an evaluation of epidemiologic, clinical, toxicologic, and environmental research; extrapolating from those results to predict the type and estimate the extent of health effects in humans under given conditions of exposure; making judgments as to the number and characteristics of persons exposed at various intensities and durations; and ultimately judging whether there is a risk to public health and what the overall magnitude of the risk is. [2]

Spill responders do not conduct this kind of a quantitative risk assessment. You do use the products of risk assessments, however, namely, the health-based standards and water quality criteria promulgated by the health department and others. These standards and criteria were developed using quantitative risk assessment techniques. If your investigation reveals the presence of a particular contaminant for which a standard does not exist, contact the local health department (who may consult with state health department) to request their assistance in evaluating what concentration of that contaminant constitutes a health risk. In these instances, you should also consult with BSPR Central Office as described below.

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2. Applications of Exposure and Risk Assessments in Spill Response

As noted earlier, the various types of exposure and risk assessments are applied to some degree in each spill response. Given our preferred definitions of these terms, spill responders do conduct exposure assessments (i.e., site investigations) and do not conduct risk assessments. Quantitative risk assessments are conducted for spill responders by the health department (local or state). Responsible parties may submit a quantitative risk assessment for review as part of their spill clean-up documentation. The health department and/or BSPR Central Office staff will review these assessments as well.

The various applications of exposure and risk assessments in the spill response process can be illustrated in the context of four situations that are often faced when evaluating contamination from a spill:

- **#** An obvious safety and health hazard exists and must be remedied immediately (Situation 1). An example of this situation would be detecting explosive vapor levels in an enclosed structure.

- **#** Clean-up standards are available for all of the constituents of concern for comparison to site conditions (Situation 2).

- **#** Clean-up standards do not exist for all of the constituents of concern for comparison to site conditions (Situation 3).

- **#** The cleanup cannot achieve the established clean-up levels and a decision must be made as to whether the cleanup should continue or be terminated (Situation 4).

Generally, as you move from Situation 1 through Situation 4, the application of exposure and risk assessment techniques becomes progressively more complex, more quantitative, more time consuming, and demands more specialized skills. In most cases, spill responders don't have the time and resources to conduct these assessments if other spills are to be addressed. Defer to other experts to conduct any predictive exposure assessment or quantitative risk assessment necessary to resolve situations 3 and 4.

a. Situation 1: An Obvious Safety and Health Hazard Exists

Some spills create safety and health hazards that are very easy to detect and that demand quick action. There is no real need to conduct any formal quantitative exposure and/or risk assessment; the hazards and risks are clear. Such situations include, for example, the need to take emergency response actions to contain a surface spill before it enters a surface-water supply, eliminate explosive vapor levels in a basement or sewer, or evacuate people from the vicinity of a burning railcar that is carrying a hazardous material product. Other examples include: almost

any spill involving a fire, free product located near an ignition source or in a public building, and gross contamination of a drinking water well. A spill responder will use a few, readily available criteria for judging that a hazard exists (or no longer exists after emergency response measures are taken), including such safety thresholds as the lower explosive limits for different volatile substances. Once the emergency has been alleviated, however, a spill can still require additional cleanup where exposure and/or risk assessments play a part.

b. Situation 2: Clean-up Standards are Available

Each investigation is directed at defining the full extent of contamination and measuring the contaminant concentrations at each point of human exposure, e.g., each domestic water supply well. Again, this is, in effect, an exposure assessment. To judge whether corrective action is warranted, it is necessary to compare these "exposure point" concentrations for each contaminant with some human health and/or environmental standard or criterion for that contaminant. If the exposure point concentration for a contaminant exceeds its standard, a cleanup is clearly warranted and should continue until the standard is met, or until a decision is reached that it is no longer technically feasible or cost-effective to continue the cleanup (see Part 1, Section 7, Closing-Out a Spill). A practical example of this situation would be comparing benzene concentrations detected in drinking water samples to the drinking water standard for this compound (5 parts per billion).

These health-based standards are usually developed through the application of quantitative risk assessment methods. There are a variety of health-based standards and other criteria available for comparison to exposure point concentrations; most are applicable to contaminants in ground or surface waters. These include:

- New York State Department of Health guidelines for organic chemicals in drinking water. These guidelines limit the concentration of principal organic contaminants[1] to 5 ug/l, the concentration of any other unspecified organic contaminants[2] to 50 ug/l, and the combined total for all such contaminants to 100 ug/l. These guidelines are for judging the quality of drinking water, but are also used as surrogate standards for chemicals contaminating non-potable surface water and/or ground water. Consult Section 6.8, Alternative Water Supplies, for a more detailed discussion of these standards.

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[1] *Benzene, toluene, m-xylene, o-xylene, and p-xylene are all members of the list of principal organic contaminants. See Table 9A of Section 5-1.52 of Chapter I of the State Sanitary Code, Part 5, Drinking Water Supplies, Subpart 5-1.*

[2] *An unspecified organic contaminant means any organic chemical not otherwise specified in Subpart 5-1 of Part 5, Drinking Water Supplies.*

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- New York State Groundwater Quality Classifications and Standards (Part 703). These regulations require that benzene not be present in detectable quantities in the ground water (i.e., defined as 1 ug/l). Other constituents of gasoline and petroleum products are not specifically addressed by this regulation, but the water quality standards require that ground waters be free of petroleum, grease, and the tastes and odors associated with petroleum products.

- New York State Surface Water Quality Classifications and Standards (Parts 701 and 702). These values can be used to establish SPDES permit water-quality-based effluent limits and to evaluate water quality data.

- USEPA Maximum Contaminant Levels (MCLs). These are federal standards for drinking water quality.

- Background ambient water quality at a location deemed unaffected by the spill.

Several of the more important available standards have been provided in Exhibit 1.6-3 as well as in Appendix E. At present, New York has no health-based or other standard for soil contamination or indoor air contamination outside of using background quality. BSPR policy concerning soil contamination is covered in Part 1, Section 6.6, Soil Remediation.

c. Situation 3: Clean-up Standards are not Available

Health-based standards or other quality criteria are not available for every possible contaminant of concern in a spill. Without a standard, you do not have the means to judge whether the contaminant concentrations detected in the air, water, or soil warrant corrective action in order to protect human health and/or the environment, nor for deciding when a cleanup could be terminated. For example, there is no standard for methyl-tertiary butyl ether (MTBE), which is becoming a more common constituent of gasoline products (to replace tetraethyl lead) and is very soluble in water.

Risk assessment techniques can be used to develop a reference standard or to quantify the degree of risk represented by the exposure point concentrations measured. Spill responders do not participate in the application of risk assessment techniques in this situation short of supplying the exposure information. It is the responsibility of the local and/or state health departments and the BSPR Central Office to provide you with the appropriate standards to apply as clean-up target levels.

Exhibit 1.6-3
Applicable NYSDEC Ambient Water Quality Standards and Guidance Values for Selected Petroleum Product Constituents in Drinking Water Supplies

Constituent	Water Classes	(micrograms/liter) Standard	Guidance Value
Benzene	A, A-S, AA, AA-S	-	1.0
	GA	ND	-
Ethylbenzene	A, A-S, AA, AA-S	-	50
	GA	-	50
Ethylene glycol	A, A-S, AA, AA-S	-	50
	GA	-	50
Naphthalene	A, A-S, AA, AA-S	10	-
	GA	-	10
Phenanthrene	A, A-S, AA, AA-S	-	50
	GA	-	50
Toluene	A, A-S, AA, AA-S	-	50
	GA	-	50
Xylenes	A, A-S, AA, AA-S	-	50
	GA	-	50
Lead	A, A-S, AA, AA-S	50	-
	GA	25	-

ND = non-detectable.

Source: Division of Water Technical Operational Guidance Series (1.1.1), Ambient Water Quality Standards and Guidance Values.

d. Situation 4: Cleanup Cannot Achieve the Established Clean-up Levels

A cleanup may appear to have reached a "dead end" (or a point of diminishing returns) when monitoring indicates little further progress is being achieved towards the clean-up level, i.e., contaminant concentrations remain above that level. This would be the case, for example, when a cleanup has been underway for several years and yet the concentration of benzene in the ground water remains at about the non-detection standard of less than one part per billion. The issue is whether the spill cleanup should continue or whether the cleanup can be terminated safely with contaminant concentrations at the levels the cleanup has achieved to that point. This situation can require the most sophisticated use of predictive exposure and risk assessment techniques.

BSPR has developed a special strategy for approaching the spill close-out decision. This strategy is discussed in full in Part 1, Section 7, Closing-Out a Spill, but is summarized in the flow charts in Exhibit 1.6-4. Basically, this strategy first involves a reevaluation of the clean-up technology implemented and is followed by a judgment regarding the technical feasibility and cost-effectiveness of continuing the cleanup. It is also possible, however, to apply quantitative risk assessment techniques to make this decision, although BSPR has not done so previously in these situations. If, for example, the clean-up level was 5 parts per billion (ppb) and contaminant concentrations had remained stable at 7 ppb for some time,[3] a quantitative risk assessment could be conducted to evaluate the risk to human health of the contaminant level remaining at 7 ppb. Such a residual risk assessment might establish that this higher contaminant level was nonetheless acceptable provided a monitoring program was followed for another year to ensure that the contaminant level did not increase. Again, spill responders would not conduct such a residual risk assessment.

e. Exposure Assessments of Alternative Remedial Technologies

Another slightly different application of exposure assessments in the spill response process is in the evaluation of clean-up technology options. As noted in the introduction to this section, choosing among different options for long-term corrective action involves weighing a variety of factors such as implementability, permanence of result, and cost-effectiveness. However, you should also be aware of how human exposure to the contamination will change when clean-up technologies are used that, in effect, transfer contamination from one medium to another. For example, when you employ an air stripper to

[3] *In instances of ground-water contamination, it is program policy to monitor contaminant concentrations for one year before judging that the concentrations are remaining stable.*

Exhibit 1.6-4

STRATEGY FOR SPILL CLOSE-OUT DECISIONS

Step I - Source Control

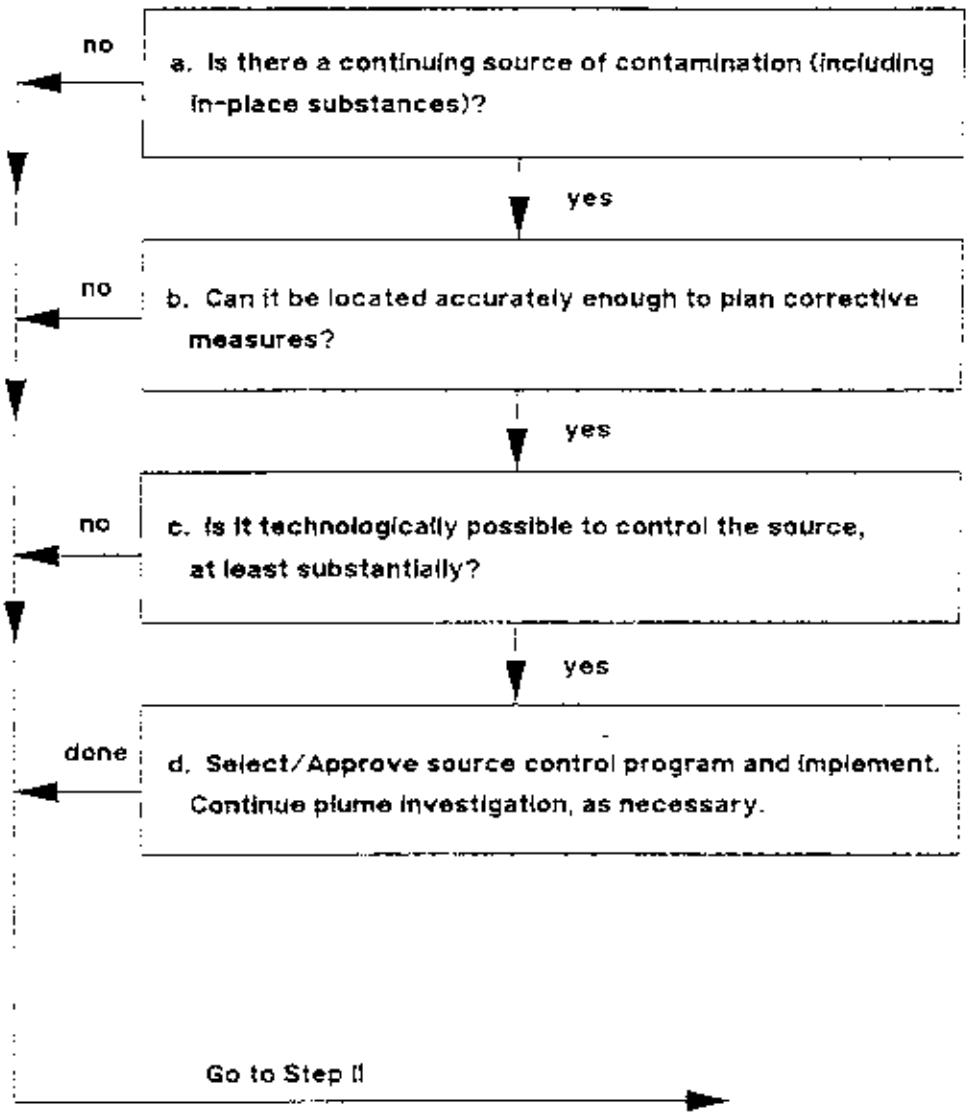


Exhibit 1.6-4
(continued)
STRATEGY FOR SPILL CLOSE-OUT DECISIONS
Step II - Plume Management

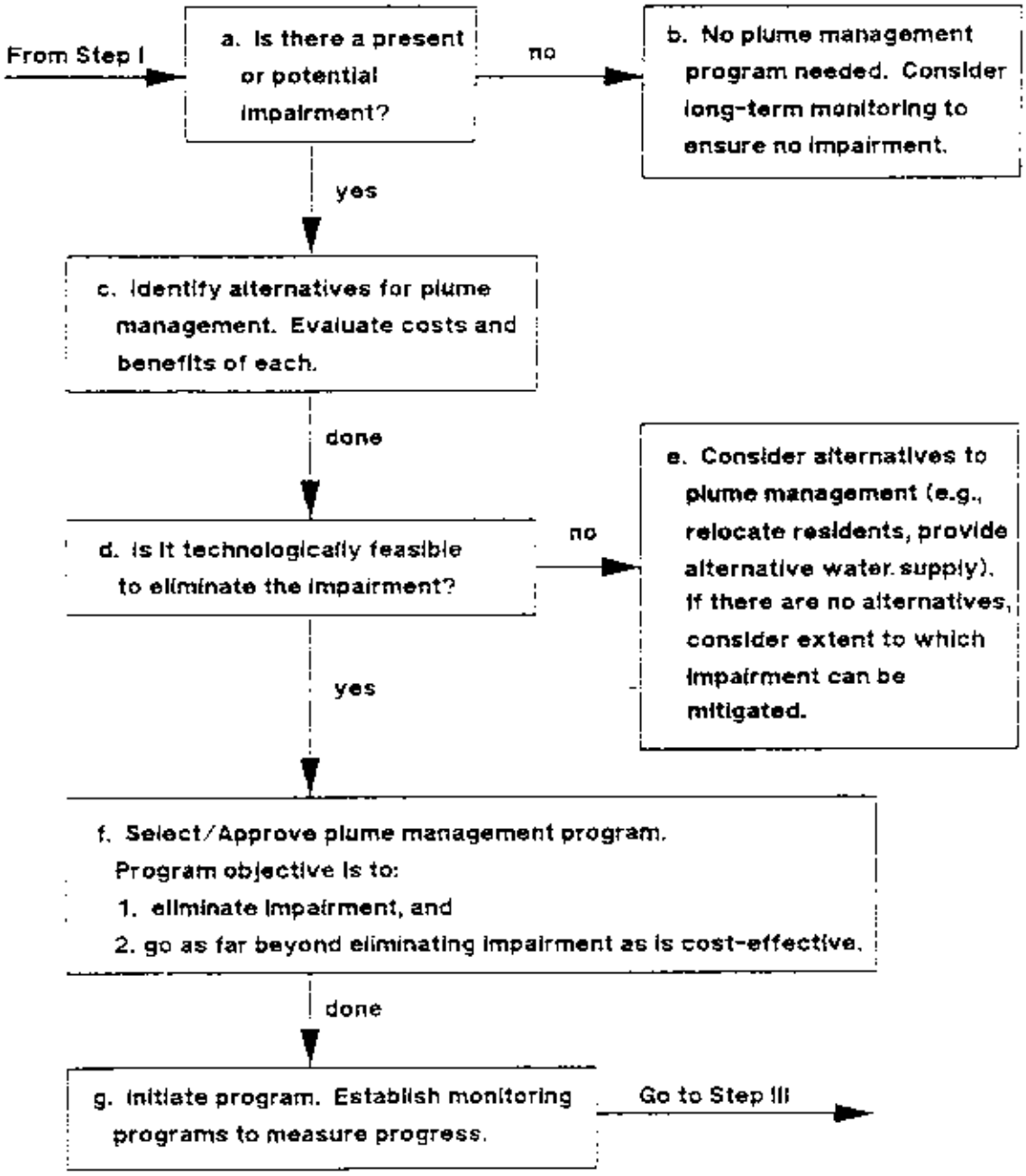
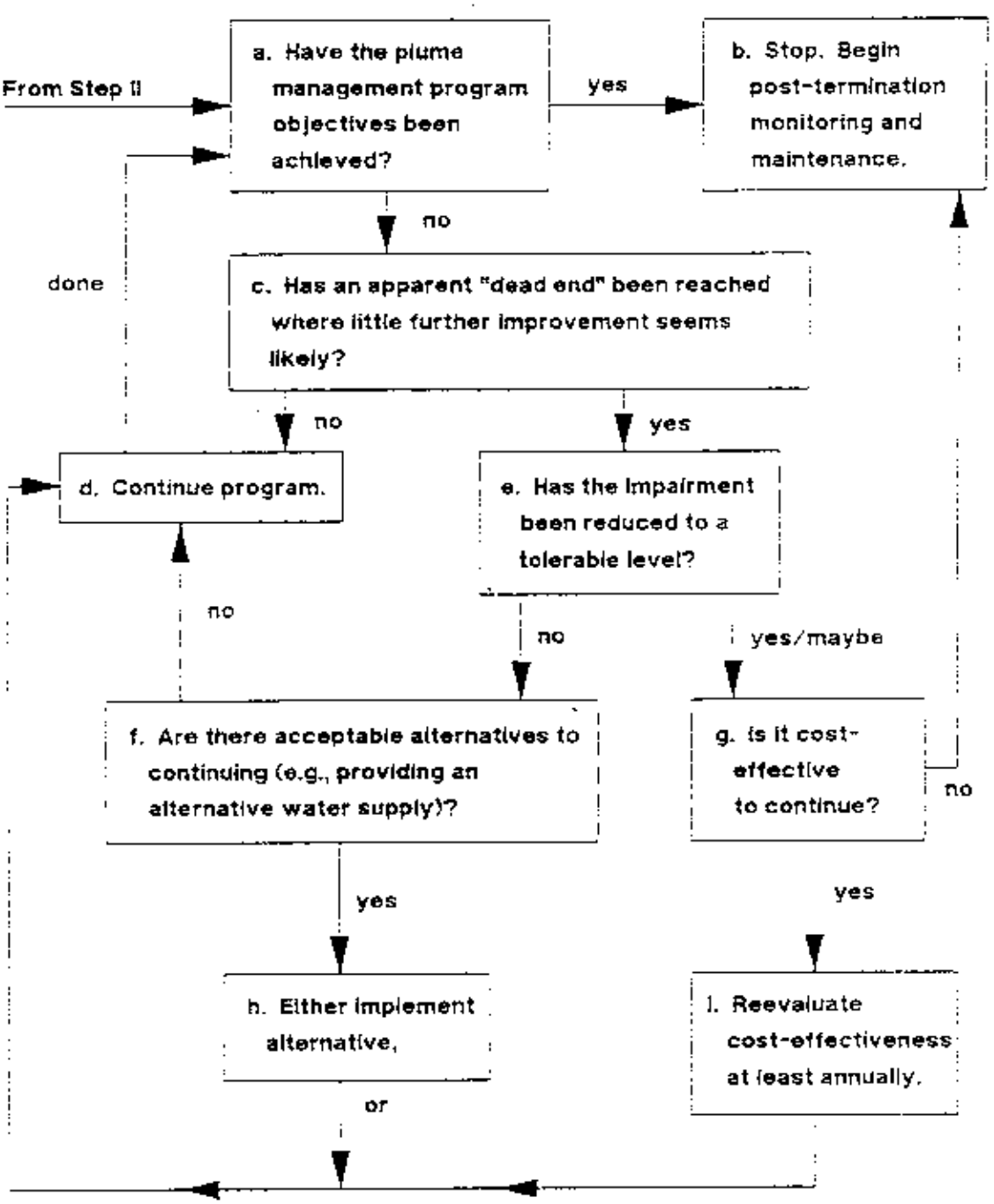


Exhibit 1.6-4
(continued)
STRATEGY FOR SPILL CLOSE-OUT DECISIONS
Step III – Termination



remove volatile contaminants from the ground water, these contaminants are transferred to the atmosphere. Make sure that the released vapors don't accumulate to explosive levels under the eaves of nearby houses and that the operation complies with air regulations for volatile contaminants. Contaminants also are transferred to the atmosphere when contaminated soils are excavated.

In evaluating different technologies for long-term corrective action, you need not prepare a formal assessment of any changes in exposure, but we recommend that you take the time to consider the possibility of any unintended impacts. In some cases, like when a SPDES or air permit becomes necessary, compliance with the regulatory process will ensure that these secondary effects are considered.

3. General Methodology for Conducting Exposure Assessment

What we call an "exposure assessment" emerges from the process of conducting a site investigation, although we may not actually delineate an exposure assessment process per se. Although there are no formal BSPR procedures or documentation requirements for exposure assessments, it may help you to have some background concerning the basic elements of the general exposure assessment methodology.

As shown in Exhibit 1.6-5, the basic exposure assessment methodology involves at least four steps:

(1) Select the contaminants of concern to you in evaluating exposure. Selecting contaminant(s) of safety and/or health concern can be a difficult decision, especially when many chemical products, like gasoline, contain many constituents (see Exhibit 1.6-6 for a listing of chemical constituents in gasoline products). Fortunately, there are reasonable rules-of-thumb you can use (Exhibit 1.6-7). For example, it would be reasonable to check for the presence of benzene, toluene, ethylbenzene, xylenes (BTEX), and methyl-tertiary butyl ether (MTBE) for a subsurface spill of gasoline, as these chemicals are quite volatile, relatively water soluble, and, in the case of benzene, a probable cancer-causing chemical. If the spill involves a leaded gasoline, you might add tetraethyl lead or total lead, ethylene dibromide, and ethylene dichloride to the list. BTEX compounds are an appropriate choice also for other refined petroleum products such as gasohol and aviation fuels. Checking for BTEX would tend to not be appropriate if the spill is a diesel fuel or fuel oils as BTEX is not present in high concentrations in these petroleum products. In this case, testing for the polynuclear aromatic hydrocarbons (PAHs) would be more appropriate.

Another special case involving the selection of indicator constituents occurs when a gasoline product spill has aged or "weathered" in the subsurface environment. Samples taken of an aged plume or from a plume that has migrated some distance from its source are likely to show different constituents than a sample taken from a recent

Exhibit 1.6-5

GENERAL EXPOSURE ASSESSMENT METHODOLOGY

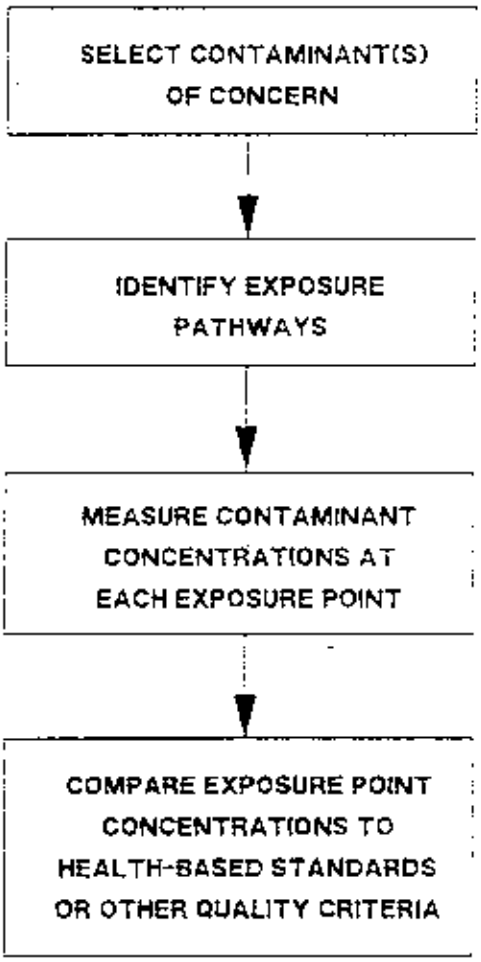


Exhibit 1.6.6

Toxicity, Chemical Characteristics, and Treatment Characteristics of Benzene and Other Selected Toxic Compounds in Gasoline

	COMPOUND	TOXICITY	MASS		PREVALENCE	FATE & TRANSPORT			TREATABILITY		MEASUREMENT		
		FINAL RQ (RQF)[1]	% VOLUME IN GASOLINE	% WEIGHT IN GASOLINE[2]	% OF GASOLINES CONTAINING CHEMICAL	WATER SOLUBILITY @ 20 degrees C (mg/l)	VAPOR PRESSURE (TORR)[3]	DEGREE OF BIODEGRADABILITY	HENRY'S CONSTANT (atm-m^3/mol)	GAC ADSORPTION COEFFICIENT (mg/l)	ANALYTICAL METHOD USED: GC	ANALYTICAL METHOD USED: GC/MS	CONFIDENCE IN DATA[4]
1.	BENZENE	454	1-2%	81	>99%	1,780	750	SOME	000669	1	602	624	+
2.	TOLUENE	45400	4.0%	1202	>99%	515	220	SOME	000637	26	602	624	+
3.	XYLENE-M	45400	5.8%	383	>99%	175	50	SOME	000704	85	602	624	+
4.	XYLENE-O	45400	5.8%	193	>99%	162	60	SOME	000704	85	602	624	+
5.	XYLENE-P	45400	5.8%	158	>99%	198	65	SOME	000704	85	602	624	+
6.	ETHYLBENZENE	45400	2.5%	170	>99%	152	70	SOME	000643	53	602	624	+
7.	NAPHTHALENE	4540	.7%	010	>90%	31.1	10^{-3}	READILY	00011	132	610	625	+
8.	PHENOL	45400	-	-	>90%	66,667	05	READILY	0454E-7	21	604	625	+
9.	EDB	454	001%	0024	<40%	4,310	110	SOME	000067	<1	601	624	0
10.	EDC	4540	001%	<0024	<40%	8,690	610	SOME	000098	<1	601	624	0
11.	TETRAETHYL LEAD	454	-	-	<40%[5]	008	02	SOME	000060	>1	ATOMIC ABSORPTION	-	0
12	DIMETHYLAMINE	45400	-	-	-	1×10^6	13460	READILY	000009	<1	MODIFIED 607	625	
13	CYCLOHEXANE	45400	<0.7%	017	-	665	770	SOME	0.0001	>1	MODIFIED 601	624	

1. THE LOWER THE RQ VALUE, THE MORE TOXIC THE CHEMICAL IS IN PURE PRODUCT FORM

2. AT 20 DEGREES C UNLESS OTHERWISE NOTED

3. AT 53 DEGREES C

4. + = HIGHLY CONFIDENT, 0 = SOMEWHAT CONFIDENT; - = NOT CONFIDENT

5. SOURCE: MAYNARD AND SANDERS, 1969

Source: Office of Underground Storage Tanks. 1987. "The Appropriateness of Benzene as an Indicator Chemical for Leaking UST Sites." U.S. Environmental Protection Agency. Prepared by Camp Dresser & McKee Inc.

Exhibit 1.6-7

Indicator Constituents for Petroleum Product Spills

Petroleum Product	Indicator Constituents and Sampling Parameters
Unleaded Gasoline	BTEX[a], total recoverable petroleum hydrocarbons (TRPH), and MTBE[b]
Leaded Gasoline	BTEX, TRPH, plus tetraethyl lead, ethylene dibromide, and ethylene dichloride
Aviation Fuels	BTEX and TRPH
Diesel Fuel & Fuel Oils	Polynuclear aromatic hydrocarbons (PAHs) such as naphthalene, anthracene, phenanthrene, and TRPH
"Weathered" Gasoline	TRPH and PAHs

[a] Benzene, toluene, ethylbenzene, and xylenes.
[b] Methyl-tertiary butyl ether.

NOTES

spill -- because the more volatile constituents, like BTEX, are likely to volatilize from the spill mass, and other constituents may have been adsorbed, hydrolyzed, or biodegraded over time. Experiments have shown that many of the major constituents in gasoline can be transformed or removed in ground water in 124 days and that all of the BTEX may be gone after 434 days [3]. BTEX, therefore, would not be a good indicator for a spill older than 1-1/2 to 2 years and may not be appropriate for spills that are as "young" as 6 months to a year old. For older spills, it is better to test for the more persistent and higher molecular weight constituents of gasoline, such as those found in the No. 2 and No. 6 fuel oils.

If you want to test for other chemicals for some spills (e.g., if chemical additives of particular concern are known to be present in the refined petroleum product), select constituents by their known or measured concentrations in the product spilled, their toxicity, and their mobility and persistence in the environment. Part 1, Section 4, Site Investigation, discusses the selection of sampling and analytical parameters in more detail.

(2) Identify the pathways for exposure to these contaminants. There are four different exposure pathways: (a) the source and mechanism of release to the environment (e.g., a leaking tank or contaminated soil), (b) the medium of contaminant transport (e.g., ground water), (c) the points of potential human or environmental exposure to the contaminated medium (e.g., a drinking water well), and (d) the human exposure route (e.g., ingestion). Each exposure pathway, therefore, describes a unique mechanism by which a population or an individual can be exposed to contaminants originating from a spill. The overall health risks posed by a spill are a composite of the risks posed by the contaminants through each potential exposure pathway.[4] Refer to Exhibit 1.6-8 for examples of different possible exposure pathways for different spill types.

(3) Measure the concentration of a contaminant at each point of human exposure. This step is basically what happens in analyzing samples of soil, surface water, ground water, drinking water, or indoor air at a spill site.

(4) Compare exposure point concentrations to available health-based standards or other criteria. If health-based standards or other quality criteria are available for a contaminant, a comparison of the exposure point concentrations to these standards determines the need to conduct a cleanup and when the cleanup can be terminated (see Exhibit 1.6-3). A more difficult situation to judge is when there are no health-based standards or other criteria for a particular contaminant of concern. The Technical Operating Guidance (TOG) 1.1.1 contains the standards you are to apply in most spill cases.

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[4] *Risks for different exposure pathways, however, are not always additive because they may represent risks to different populations and the toxicities of specific compounds may differ depending on the route of exposure.*

Exhibit 1.6-8

Possible Exposure Pathways for Different Spill Types

Spill Type and Source	Transportation Media	Exposure Point(s)	Exposure Route
Transportation Spill	Air	downwind residences	inhalation; direct contact[b]
	SW[a]	lake, river, stream	ingestion; direct contact
Aboveground Tank Spill	Air	downwind residences	inhalation; direct contact
	SW	lake, river, stream	ingestion; direct contact
	GW[c]	downgradient wells	ingestion
Underground Tank Spill	Soil Gas	nearby subsurface structures	inhalation
	SW	lake, river, stream	ingestion; direct contact
	GW	downgradient wells	ingestion

[a] SW = surface water
[b] Either to product or soils
[c] GW = ground water

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TOG 1.1.1 is provided in Appendix E to this manual, and is discussed in more detail in Part 1, Section 6.8, Alternative Water Supplies.

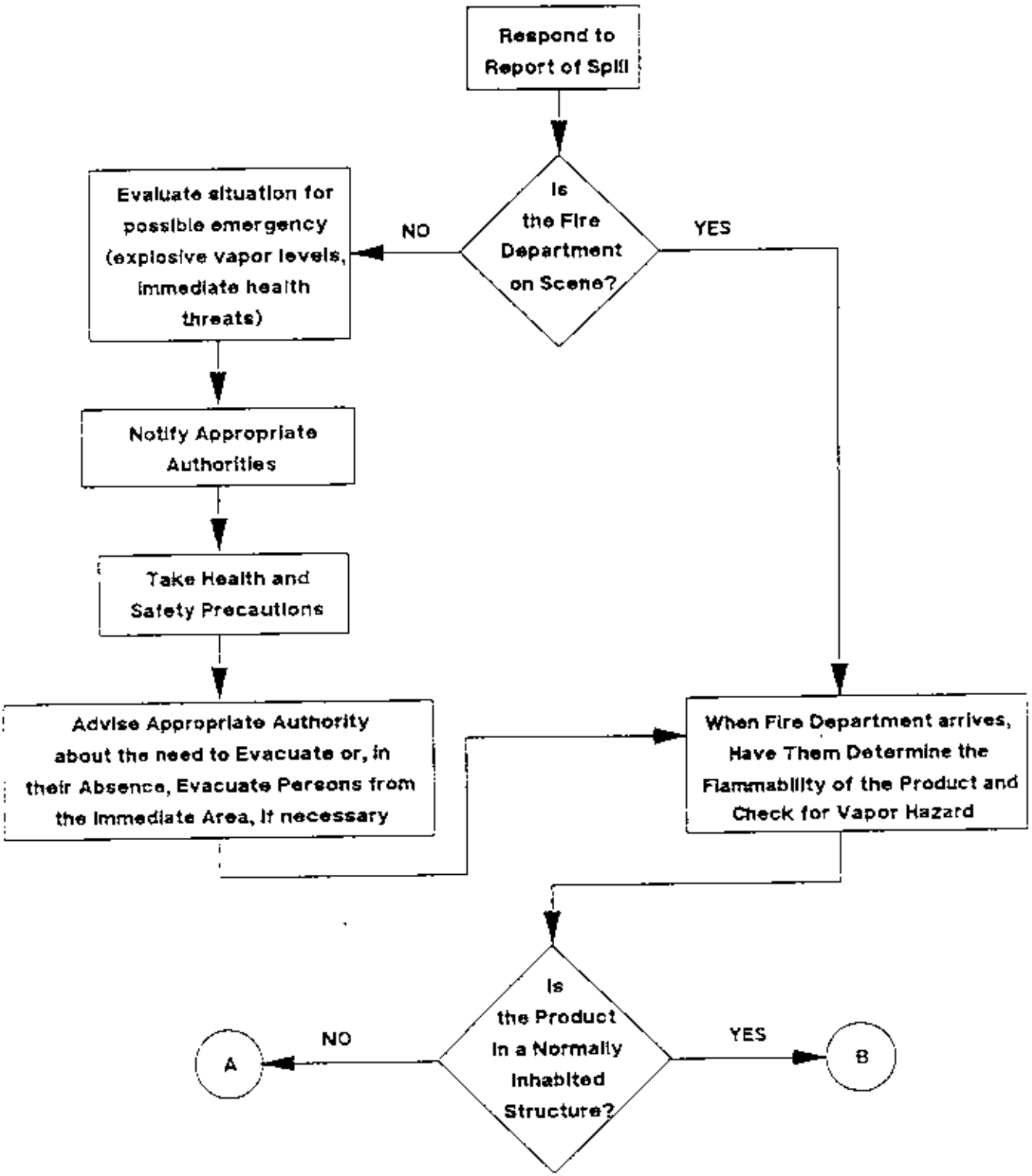
TECHNICAL

FIELD GUIDANCE

CORRECTIVE ACTION - FREE PRODUCT IN STRUCTURES, SEWERS, AND UNDERGROUND UTILITY LINES

PRODUCT IN STRUCTURES, SEWERS, AND UNDERGROUND UTILITY LINES

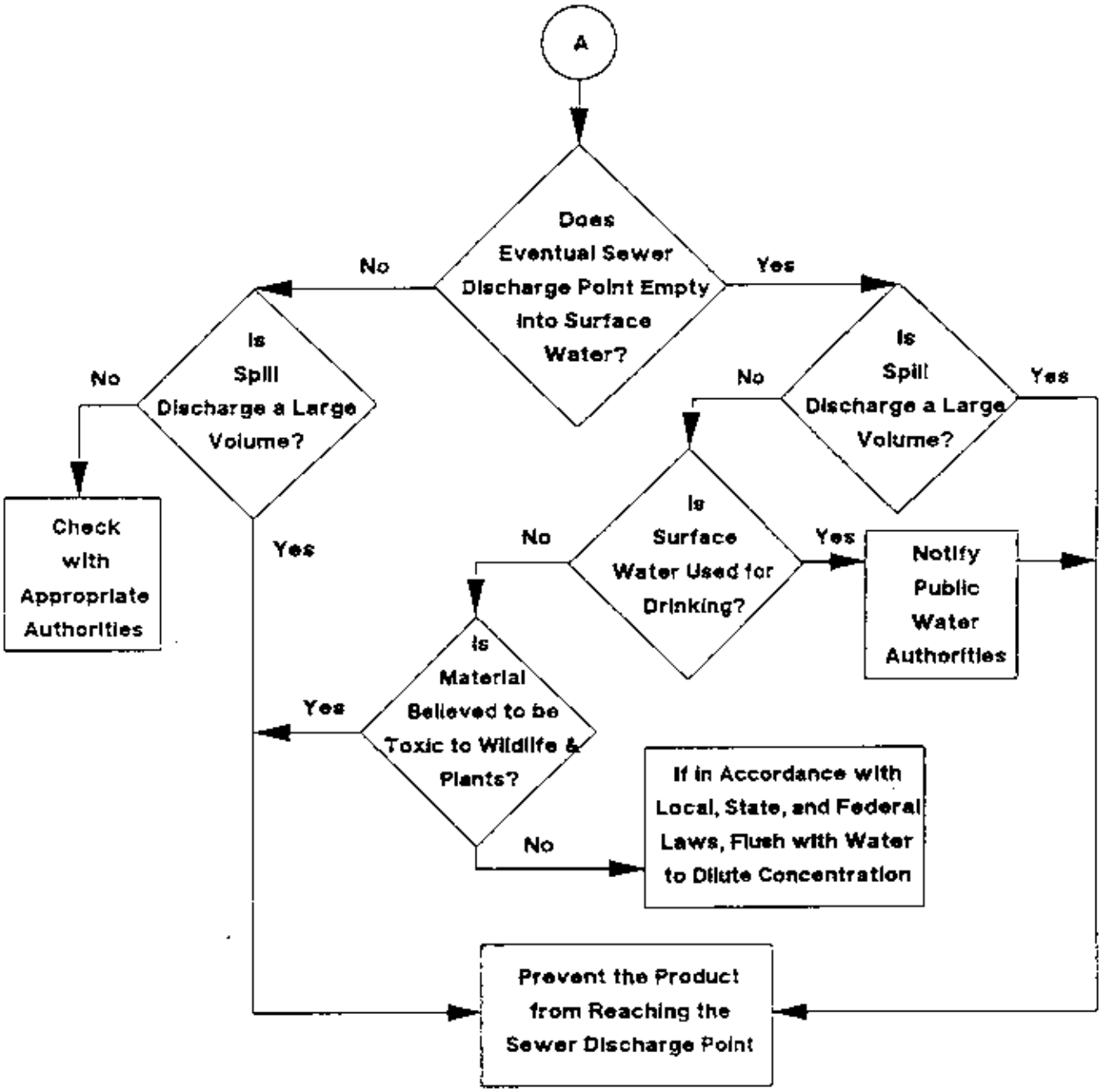
Guidance Summary-At-A-Glance



PRODUCT IN STRUCTURES, SEWERS, AND UNDERGROUND UTILITY LINES

Guidance Summary-At-A-Glance

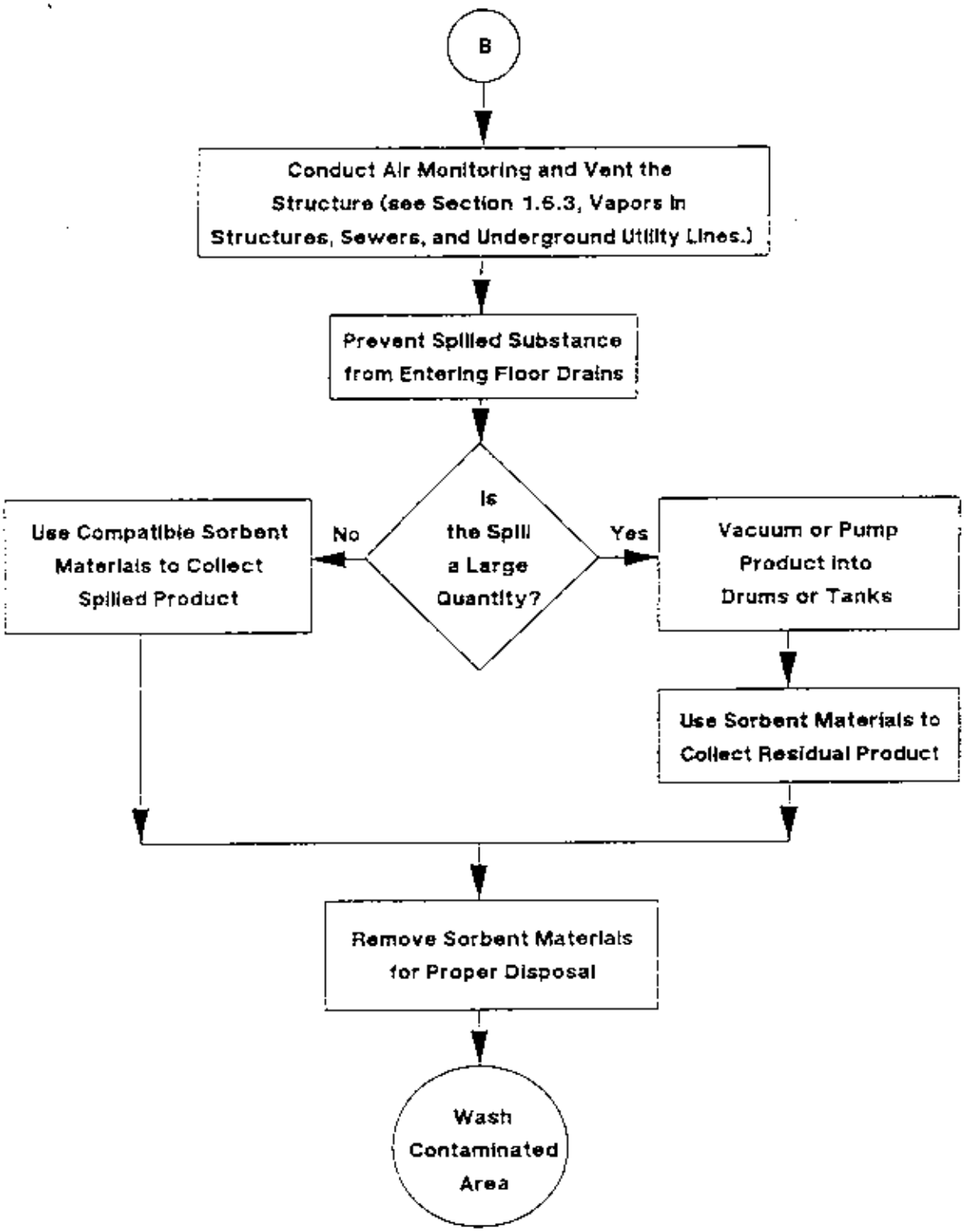
(continued)



PRODUCT IN STRUCTURES, SEWERS, AND UNDERGROUND UTILITY LINES

Guidance Summary-At-A-Glance

(continued)



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1.6.2 Corrective Action - Free Product in Structures, Sewers, and Underground Utility Lines

Finding free product in a normally inhabited structure or a sewer or underground utility line usually requires an immediate response.[5] Depending on the substance and the quantity spilled, such a situation may present a variety of concerns:

- A possible fire or explosion hazard, especially if an ignition source is present;
- A possible public health hazard because the vapors given off are toxic, because the spill may enter a drinking water supply, or because residents or the general public may come into direct contact with the substance;
- Possible environmental damage if the spill reaches a natural resource, and/or operational damage if the spill cannot be handled at the wastewater treatment plant; or
- Possible damage to underground utility equipment, resulting in interruption of phone or electrical service.

The types of situation that confront you when you arrive on the scene will vary; therefore, your initial response role will vary. In some cases, a fire department, public works department, or utility company will have already acted to confine or remove the product in the structure, sewer, or underground utility line. The fire department may have already acted to evacuate area residents and businesses, as well. In other cases, you will work with other response agencies or individuals to determine the degree of safety or health hazard and respond accordingly to confine and/or remove the product. Finally, if other response agencies cannot respond and take action in time, you may be faced with directing the initial response effort, including making any evacuation decisions (see also Subsection 3.1, Emergency Response to Fire and Safety Hazards, for additional guidance on your authority in this situation). In any of these situations, however, your ultimate response role is the same: to investigate the source of the free product, identify the spiller, and determine if additional clean-up measures are warranted.

In this subsection we discuss procedures and techniques for evaluating, confining, and cleaning up free product in structures, sewers, and underground utility lines. It is assumed that the spill has already made its way into the structure, sewer, or underground utility; that is responders do not have the opportunity to keep free product from entering the structure, sewer, or underground utility line. Other sections of this manual to refer to include:

- Part 1, Section 3.1, Emergency Response to Fire and Safety Hazards (explains BSPR policy on spill responder participation in emergency response activities and provides guidance on proper emergency response procedures);

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[5] *Throughout this section, the term "structure" means a normally inhabited above- or below-ground building, room, basement, crawl space, or other similar manmade structure. The term "sewer" is meant to include storm sewers and sanitary sewers. The term "underground utility line" is meant to cover the broad class of underground lines including utility vaults and telephone and electrical conduits. None of the three terms is meant to include trenches, pits, or excavations where free product may also be found.*

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- Part 1, Section 3.2, Confining and Containing Releases;
- Part 1, Section 4, Site Investigation Procedures;
- Part 1, Section 6.3, Vapors in Structures, Sewers, and Underground Utility Lines (contains guidance on the evaluation and removal of vapors from structures and sewers);
- Part 2, Section 1, Personal Health and Safety Protection; and
- Part 2, Section 2, Equipment Training, Calibration, and Maintenance (contains guidance on the use of air monitoring devices).

1. BSPR Policy

Bureau of Spill Prevention and Response (BSPR) personnel are not to conduct first response/emergency response activities or make evacuation decisions at spill sites when other response agencies with the requisite authority are present (e.g., the fire department). We expect you to consult and confer with these other response agencies, and to defer to their authority to make emergency response decisions, including how to respond to the presence of free product in structures, sewers, and underground utility lines. Our policy is based upon two factors: (1) BSPR personnel are not equipped, in terms of their personal protection and safety, to fulfill a first-response role, and (2) DEC has not been assigned the requisite authority. We recognize that there will be limited instances, in which there isn't enough time for others to respond and take action, you are on the scene, and you choose to respond to the immediate public health and/or safety threat. Your decision to act in this limited respect is reasonable and fully supported by DEC.

Even though your emergency response role is usually quite limited, it is important, for the following reasons, that you understand what constitutes an appropriate, safe, initial response to the discovery of free product in structures, sewers, and underground utility lines. First, it will enhance your ability both to communicate with other response agencies about the response activities and to ensure that adequate personal and environmental protection measures are taken by **all** response personnel, including yourself. Second, there will be instances, albeit rare, in which you are the first responder to reach the scene; in these cases, you will need to know what to do and what equipment is needed.

Once the emergency situation is under control, however, BSPR personnel are to take the lead in seeing that the spill is investigated and cleaned up. Either the spiller will be identified and will assume the responsibility for cleanup, or the state will assume this responsibility because the spiller could not be identified or refused to respond.[6] Therefore, the guidance contained in this subsection concerning free product cleanup in structures, sewers, and underground utility

[6] *Cleanup of petroleum spills is the responsibility of BSPR, whereas cleanup of hazardous materials spills is the responsibility of the Division of Hazardous Waste Remediation.*

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lines is important material for spill responders to review and become familiar with.

Not covered in this subsection are suggested procedures for investigating the source of a spill resulting in free product in a structure, sewer, or underground utility line. In some cases, the source of the spill will be obvious, for example, an overturned tanker truck. In other cases, such as spills from underground storage tanks, determining the source may be far more difficult, more involved, and more time consuming. Site investigation procedures are discussed in Part 1, Section 4.

2. General Guidelines and Procedures

A basic flow chart for responding to the presence of free product in structures, sewers, and underground utility lines has been provided in the Guidance Summary-At-A-Glance. The flow chart illustrates the typical actions taken and decisions made by the spill responder both when other response agencies are on the scene and when they are not. Exhibits 1.6-9 through 1.6-14 provide more detailed procedural guidelines than are shown in the flow chart and are organized as follows:

Exhibit 1.6-9	Initial Steps for Responding to Free Product in Structures, Sewers, and Underground Utility Lines
Exhibit 1.6-10	Collecting Small Amounts of Free Product from Inhabited Structures
Exhibit 1.6-12	Collecting Large Amounts of Free Product from Inhabited Structures
Exhibit 1.6-13	Collecting Small Amounts of Free Product from Sewers and Underground Utility Lines
Exhibit 1.6-14	Collecting Large Amounts of Free Product from Sewers and Underground Utility Lines

Notice that the tables consider only your responsibilities when other response agencies have responded to the report of free product in a structure or sewer. In other words, assume that fire department personnel have determined that it is safe to approach/enter the structure/sewer for the purposes of cleaning up the free product.

Exhibit 1.6-9

Initial Steps for Responding to Free Product in Structures, Sewers, and Underground Utility Lines

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Notify Appropriate Authorities - First, make sure that all other response agencies have been notified to ensure that all necessary actions are taken. Immediately call the local fire department and the Department of Health, if they haven't been notified. These agencies make the decisions regarding fire, explosive, or toxic hazards, and the need to evacuate the public. Contact the police department to help with crowd and traffic control. For spills to sewers, notify the sewer authority and wastewater treatment plant, as applicable. Contact the spiller, if known.

ACTION/SITUATION	PROCEDURES	COMMENTS
A. Notify the Fire Department.	1. Summon the local fire department (if they haven't already arrived).	# Seek assistance in the interest of safety, but avoid creating unnecessary alarm by an unwarranted disturbance of normal activities.
	2. Be familiar with all existing plans and agreements between your region and local fire departments.	
	3. Have the fire department judge the flammability of the product and test the atmosphere for toxic gases, flammable vapors, and/or insufficient oxygen levels. Local sewer authority personnel may also have this capability for evaluating hazardous conditions in sewers.	# The fire department may not have the appropriate monitoring instruments. BSPR or other state agencies may have to provide these instruments to the local fire department.
	4. The fire department will order an evacuation of an area if hazardous vapors or gases in the atmosphere measure close to or within the flammable range (i.e., between the lower and upper explosive limits).	
B. Notify the Police Department.	Summon the local police so that they are on hand in the event that crowd control, traffic control, or evacuation is necessary.	

Exhibit 1.6-9

Initial Steps for Responding to Free Product in Structures, Sewers, and Underground Utility Lines (continued)

Notify Appropriate Authorities (continued) - For spills into sewers, contact the sewer authority to determine where the spill could travel to "downstream." For example, if there is a wastewater treatment plant downstream, you'll need to alert the operator. If the sewer discharges to surface water, you may need to act quickly to block the end of the line to avoid contaminating a drinking water supply. Contact the owner of an affected public utility or industrial facility to implement their emergency response plans if such a plan exists.

	ACTION/SITUATION	PROCEDURES	COMMENTS
C.	Notify owner/Operator of the Affected Facility.		
i.	Free product in sewers or other utility conduits.	Notify the sewer authority or utility company.	# Consult with sewer or other utility operators on sewer/utility emergency response procedures. Normally, he/she will assist the spill responder in developing strategies to control the hazard.
ii.	Free product in normally inhabited structures.	Notify the owner/operator of the structure.	# The owner or operator may have an emergency response plan that can be implemented.

Take Safety Precautions - Take steps to protect human health and property consistent with your authority until the proper authorities arrive to investigate the situation. For free product in structures, such steps may include evacuating the affected structure (see next page), closing off the area to prevent unauthorized entry, and eliminating all possible ignition sources. For free product in sewers, such steps may include removing manhole covers to aid natural ventilation.

D.	Take Safety Precautions.		
#	Free product in normally inhabited structures.	1. Evacuate all persons from the structure and isolate the area to prevent unauthorized entry.	# See Part 1, Section 3.1 for evacuation guidance.
		2. If explosive vapor concentrations are suspected or known to be present, eliminate all possible sources of ignition.	
		# Enforce a "No Smoking" Policy.	# If available and practical to attempt, hang conspicuous "No Smoking" signs.
		# Eliminate all ignition sources. Remove equipment and tools that could create sparks or render them inoperable if they cannot be easily removed.	

Exhibit 1.6-9

Initial Steps for Responding to Free Product in Structures, Sewers, and Underground Utility Lines (continued)

Take Safety Precautions (continued) - Only the fire department and Department of Health have the authority to make an evacuation decision. Your spill response expertise may be called upon in a response situation, but avoid making the evacuation decision.

ACTION/SITUATION	PROCEDURES	COMMENTS
D. Take Safety Precautions. (continued)		
# Product in normally inhabited structures (continued).	# Use only explosion proof equipment and non-sparking tools in the enclosed area and near vapors.	
	# Disable lights and other electrical switches in the affected area.	# Use only electrical switches located well away from the contaminated area to cut off electrical power (a remote cut-off is handled by the electrical utility).
	# Ensure that the gas company or fire department cut off gas service (to extinguish pilot lights and burners).	

Determine Whether the Product is Volatile/Flammable - After taking safety measures, determine whether the liquid is flammable so further safety measures can be taken. The first step in identification is to test for oxygen-deficient or flammable atmospheres. **Never** trust your senses to determine if the air in a confined space is safe! You **cannot** see or smell many toxic gases and vapors, nor can you determine the level of oxygen present. The fire department will use self-contained breathing apparatus (SCBA) and will test the enclosed space with properly calibrated testing instruments. If testing reveals oxygen-deficiency or the presence of toxic gases or vapors, the space must be ventilated and re-tested before you may enter to clean up the free product.

E. Determine Whether the Product is Flammable.	1. Have the fire department and/or sewer authority (for spills in sewers) investigate product's flammability and test the atmosphere for explosive conditions, oxygen levels, and toxic gas concentrations.	# The fire department and/or sewer authorities will try to identify product and flammability from information provided by spiller and/or available Material Safety Data Sheets and other technical references.
	2. Ventilate as necessary to establish safe, non-hazardous condition. 3. Continue safety precautions listed above, and ventilate until the fire/health department determines that the structure is safe to enter.	# Fire or health department decides whether an evacuation is necessary.

Determine Whether the Product is Volatile/Flammable (continued) - Only the fire department and Department of Health have the authority to make an evacuation decision. Your spill response expertise may be called upon in a response situation, but avoid making the evacuation decision.

ACTION/SITUATION	PROCEDURES	COMMENTS
E. Determine Whether the Product is Flammable. (continued)	4. When the fire/health department has determined that the structure is safe for entry, search the structure to locate the pooled product for cleanup. 5. Proceed to collect free product from structure/sewer (see next page).	

Exhibit 1.6-10

Collection of Small Amounts of Free Product from Inhabited Structures

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Small pools of product may be allowed to evaporate or can be picked up with commercial sorbents. A sorbent material can absorb from 13 to 21 times its weight depending on the specific sorbent and spilled substance. When removing sorbent materials, be sure that response personnel wear appropriate protective clothing and respiratory protection, as necessary (see Part 2, Section 1, Personal Health and Safety Protection).

ACTION/SITUATION	PROCEDURES	COMMENTS
A. Consider Allowing Very Small Amounts of Non-Toxic Volatile Product to Evaporate.	1. Continue to naturally ventilate the structure by opening doors and windows. 2. If natural ventilation is insufficient, use mechanical exhaust ventilating equipment. **#** Fans driven by explosion-proof motors (see Exhibit 1.6-11); **#** Exhaust venting with an air eductor (see Exhibit 1.6-11); **#** From inside the structure, operate water hose nozzle in a fog pattern (i.e., wide-angled spray) to discharge vapors outwardly through a window.	**#** See also Vapors in Structures and Sewers (Subsection 6.3). **#** Eliminate all sources of ignition near exhaust outlets. **#** Provide openings for air to enter, but never force air into the structure. **#** The fire department can attempt this means of ventilation if they deem it appropriate. Firefighters often use water spray in this manner to force hot gases and smoke from burning structures immediately following suppression of flames.
B. Take Action to Prevent the Spilled Substance from Entering Floor Drains.	1. Surround floor drains with sorbent material; or 2. Cover floor drains with spill mats that seal off the drain.	

ACTION/SITUATION	PROCEDURES	COMMENTS
C. Use Sorbent Materials to Absorb/Adsorb the Spilled Substance.	1. If compatible with spilled substance, apply Universal Sorbent Materials (USM), consisting of free-flowing granules with a loose bulk density of about 2 lb/per cubic foot; or	# Most sorbents are safe to handle; very low toxicity. # Lose absorbent qualities in water.
	2. If compatible with spilled substance, apply commercial sorbents, including (a) activated carbon (which is versatile and readily available); (b) polyurethane (particulate or belt form); (c) natural or commercial sorbents (sawdust, straw, vermiculite, dolomite, cement powder, fly ash, wood waste, etc.); (d) polypropylene fibers; or	# Safe to handle. # Immobilize and localize spill. # May reduce vaporization.
	3. If compatible with spilled substance, place down sorbent pillows or sorbent sheets/pads.	
	4. If spilled material cannot be absorbed/ adsorded or there are not compatible sorbents available, proceed directly to Action/Situation D.	
D. Clean Up Spilled Substance, Spill Residues, and/or Sorbent Materials.	1. If spilled substance cannot be absorbed/ adsorbed, take up spill with a vacuum, pump, or similar mechanical means. If spilled material is solid or semi-solid, take up with shovel or broom.	
	2. Clean up sorbent materials: # Once sorbent material is saturated, use a broom or shovel to pick up and place it in covered metal containers. Covered metal containers prevent further spread of vapors. # Dispose of sorbent materials in accordance with federal, state, and local laws.	# Sorbent materials can be removed by personnel who are properly equipped and protected (see Part 2, Section 1). # Be sure container is compatible with spilled substance. # Local regulatory official should be consulted to ensure that the disposal method meets with their approval. # See Part 2, Section 3, Proper Management of Spill Residuals and Debris.

Exhibit 1.6-10

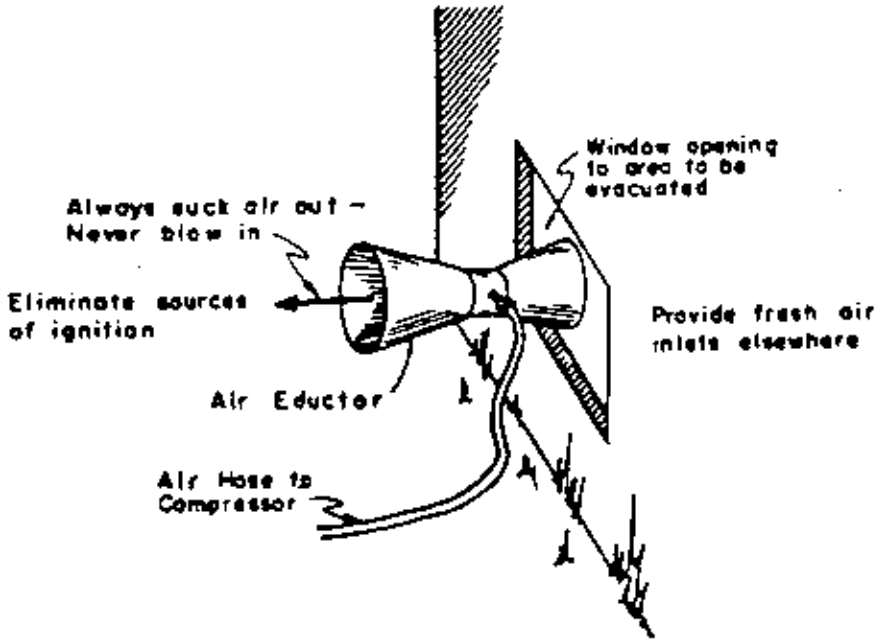
Collection of Small Amounts of Free Product from Inhabited Structures (continued)

As a final step, wash the contaminated area to remove any traces of the spilled substance. Check with health department and facility owner/operator to see how much cleaning is necessary.

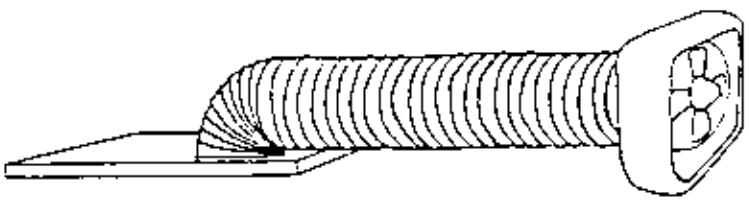
ACTION/SITUATION	PROCEDURES	COMMENTS
E. Wash Contaminated Area.	1. Flush basement or sumps and floor drains with water and/or appropriate agent.	**#** Uncontaminated water will dilute the effects of a hazardous spill.
	2. Dispose of wash water properly. Check with sanitation authorities before flushing such liquids into sewers.	**#** Local regulatory officials should be consulted to ensure that volume and contaminant loading can be handled.
	3. If not possible to flush contaminated water, pump product to recovery container. If necessary, soak up excess with disposable sorbent materials.	
	4. Dispose of any contaminated sorbent residues in accordance with federal, state, and local laws.	**#** See Part 2, Section 3, Proper Management of Spill Residuals and Debris.

Exhibit I.6-11

Ventilating with Fan and Trunk Hose



Exhaust Venting



Ventilating with Fan and Trunk Hose

Exhibit 1.6-12

Collection of Large Amounts of Free Product from Inhabited Structures

In cases involving large amounts of flammable free product in inhabited structures, ventilation may not sufficiently reduce the vapor concentration to a safe level due to the large size of the product pool. In such cases, and with large product pools of nonflammable liquids, vacuum or pump the liquid into drums or tanks for later treatment or disposal.

	ACTION/SITUATION	PROCEDURES	COMMENTS
A.	Locate Product Pool.	1. When fire department has determined that vapors are not flammable and that the structure is safe for entry, BSPR personnel can search the structure to locate the spilled material. 2. If vapors are too hazardous to allow BSPR entry into the structure, then properly equipped firefighters or hazmat team personnel will have to enter the structure and initiate response actions, assuming they feel it is safe to do so. 3. Maintain ventilation during cleanup. Work with the fire department to monitor for vapors throughout the clean-up period.	# Appropriate personal protection equipment must be worn during confinement, containment, and clean-up operations.
B.	Take Action to Prevent Spilled Substance from Entering Floor Drains.	1. Surround floor drains with loose sorbent material or sorbent booms; or 2. Cover floor drains with spill mats that seal off the drain.	
C.	Contain Product.	1. Pile up loose absorbents or place sorbent booms around the spill to contain it.	
D.	Clean up Spilled Substance and Spill Control Materials.	1. Pump or vacuum product into drums or tanks. # Use pumps with explosion-proof motors.	# Equipment is common and generally available. # Some pumping and vacuum equipment is vulnerable to damage by certain chemicals. # Ensure container is compatible with product.

Exhibit 1.6-12

Collection of Large Amounts of Free Product from Inhabited Structures

In cases involving large amounts of flammable free product in inhabited structures, ventilation may not sufficiently reduce the vapor concentration to a safe level due to the large size of the product pool. In such cases, and with large product pools of nonflammable liquids, vacuum or pump the liquid into drums or tanks for later treatment or disposal.

ACTION/SITUATION	PROCEDURES	COMMENTS
D. Clean up Spilled Substance and Spill Control Materials. (continued)	2. Soak up any remaining product after pumping operation. Use compatible sorbents and/or spill pads.	
	3. Clean up Sorbent Materials:	# Sorbent materials can be removed by personnel who are properly equipped and protected (see Part 2, Section 1).
	# Once sorbent material is saturated, use a broom or shovel to pick up and place it in covered metal containers. Covered metal containers prevent further spread of vapors.	# Be sure container is compatible with spilled substance.
	# Dispose of sorbent materials in accordance with federal, state, and local laws.	# Local regulatory official should be consulted to ensure that the disposal method meets with their approval.
		# See Part 2, Section 3, Proper Management of Spill Residuals and Debris.
E. Wash Contaminated Area.	1. Flush basement or sumps and floor drains with water and/or appropriate agent.	# Uncontaminated water will dilute the effects of a hazardous spill.
	2. Dispose of wash water properly. Check with sanitation authorities before flushing such liquids into sewers.	# Local regulatory officials should be consulted to ensure that volume and contaminant loading can be handled.
	3. If not possible to flush contaminated water, pump product to recovery container. If necessary, soak up excess with disposable sorbent materials.	# See Part 2, Section 3, Proper Management of Spill Residuals and Debris.
	4. Dispose of any contaminated sorbent residues in accordance with federal, state, and local laws.	

Exhibit 1.6-13

Collection of Small Amounts of Free Product from Sewers and Underground Utility Lines

Removal and disposal of product from sewers and other normally uninhabited substructures (e.g., utility vaults and conduits) may require different procedures than those for inhabited structures because (a) concentrations of spilled liquids may be much higher since early discovery is unlikely; (b) access to contaminated areas is not always possible; and (c) threat of public's exposure to contaminants is reduced. Consult with public works department or utility company on all details of the proposed purging procedures. If only small amounts of volatile or nonvolatile product are involved, ventilation and/or absorption methods may be adequate to allow continued use of the facility.

	ACTION/SITUATION	PROCEDURES	COMMENTS
A.	Monitor Sewers and Other Utility Conduits Continuously.	1. Throughout the clean-up process, the fire department should monitor the sewer/conduit periodically with an oxygen meter, CGI, and other instruments to detect a recurrence of vapor hazard. 2. Eliminate ignition sources.	
B.	Determine Destination of Sewer Discharge.	1. Call sewer authority or Department of Public Works to determine end point for sewer discharge (e.g., river, treatment plant, surface water used for drinking, etc.)	**#** Important consideration so that actions can be taken to minimize additional impact of spill.

Depending on the destination of the sewer discharge and the nature of the product spilled, it may be possible to suspend any further clean-up response. A "downstream" treatment plant may be able to easily handle the contaminant loading, especially since some dilution will occur. The volume of product may also be so small that even an eventual direct discharge to surface water is environmentally acceptable. If neither situation is true, however, the product must be contained and removed.

C.	Remove or Treat Contaminated Product in Sewer.	1. Check to determine whether flushing the sewer with water and/or adding an appropriate neutralizing agent is environmentally safe.	**#** Treatment plant may be able to handle volume and contaminant loading.
		2. Flush the sewer with water or introduce neutralizer, if environmentally safe.	**#** Determine whether flushing diluted contaminants into open waters is hazardous to wildlife, or if the receiving surface water is a potable water source.
		3. If Procedure #2 is not possible, use booms to divert sewer flow to an appropriate discharge point where contaminated runoff can be pumped to recovery drums or tank truck(s).	**#** Consult with sewer authorities regarding diversion of sewer runoff.

Exhibit 1.6-13

Collection of Small Amounts of Free Product from Sewers and Underground Utility Lines (continued)

ACTION/SITUATION	PROCEDURES	COMMENTS
C. Remove or Treat Contaminated Product in Sewer. (continued)	4. Pump off substance from the sewer discharge point to the tank truck or recovery drums. 5. Remove booms, if used, and decontaminate them or place them in waste drums.	**#** See Exhibit 1.6-11, Collection of Large Amounts of Free Product from Sewers.
D. Properly Dispose of Contaminated Product and Other Waste Materials Associated with Cleanup.	Transport the collected liquids to disposal facilities.	**#** Local regulatory officials and disposal facility should be consulted to ensure that the disposal method meets with their approval or residual can be accepted under conditions of permit.

Exhibit 1.6-14

Collection of Large Amounts of Free Product from Sewers and Underground Utility Lines

Larger quantities of free product in sewers and utility conduits normally must be contained and then removed. Keep product from reaching discharge point. Divert flow to oil-water separator, if possible, or set up skimming facility to contain product so that it can be pumped off.

ACTION/SITUATION	PROCEDURES	COMMENTS
A. Contain Large Product Spill.	1. Use booms to divert sewer flow to an appropriate discharge point where contaminated runoff can be pumped to tank trucks.	# Consult with sewer authorities concerning diversion of sewer runoff. # See Proper Management of Spill Residuals and Debris, Part 2, Section 3.
	2. Alternatively, set up a weir board to trap product and allow it to be pumped off.	# Localizes spill mass in a small area.
	# Place a floating polyurethane foam boom or an inflated fire hose across the sewer to trap floating product and allow removal using skimmer pumps and/or absorbents (see Exhibit 1.6-15).	# Requires non-turbulent surface flow. # Materials and equipment may not be readily available for quick response.
	3. Alternatively, use a weir board to trap product while water continues to flow underneath.	# Quite efficient method, especially when flow rates exceed 3 feet per second.
	4. Alternatively, plug sewer line to stop all flow until product can be removed. Can use a rubber bladder filled with air or wooden or other corking material to block end of sewer line.	# Consult with public works department. # Materials and equipment may not be readily available for quick response.
B. Remove Product from Sewer.	1. If booms were used to divert the spilled substance to a specific sewer discharge point:	# Sorbents are easily stored and commonly available. # Safe to handle by untrained personnel.
	# Pump the substance form the discharge point to a tank truck.	# Make sure container is compatible with product.
	# Remove booms and decontaminate them (if applicable) or place them in waste drums.	

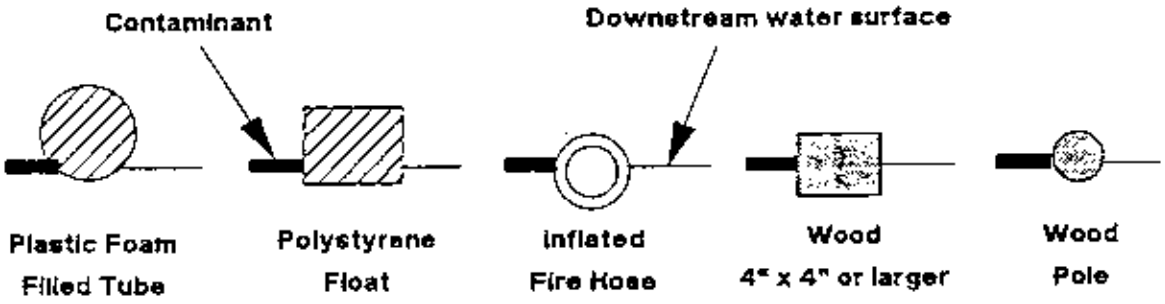
Exhibit 1.6-14

Collection of Large Amounts of Free Product from Sewers and Underground Utility Lines (continued)

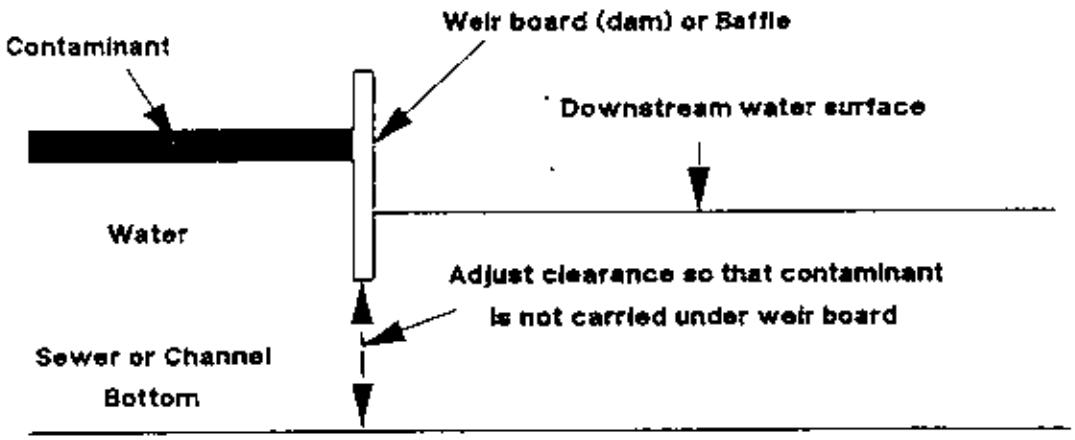
ACTION/SITUATION	PROCEDURES	COMMENTS
B. Remove Product from Sewer. (continued)	2. If efforts were made to confine the spill: **#** Apply sorbent pads or sheets over the area of the contained product. -- When saturated, use tool or protective gloves to pick up sorbent material and place in a drum or other container. -- Dispose of sorbent materials properly. **#** Alternatively, pump product into drums or other container. **#** Wash down contaminated area.	**#** Use explosion-proof pumps for flammable products. **#** Consult with local authorities on degree of cleanup necessary and whether contaminated wash water can be handled safely.

Exhibit 1.6-15

Containing Products in Sewers



EFFECTIVE IN CURRENTS UP TO 3 FT/SEC



When current flow exceeds 3 ft/sec, contaminants can be trapped by creating a difference in upstream and downstream surface with a baffle or weir board.

TECHNICAL

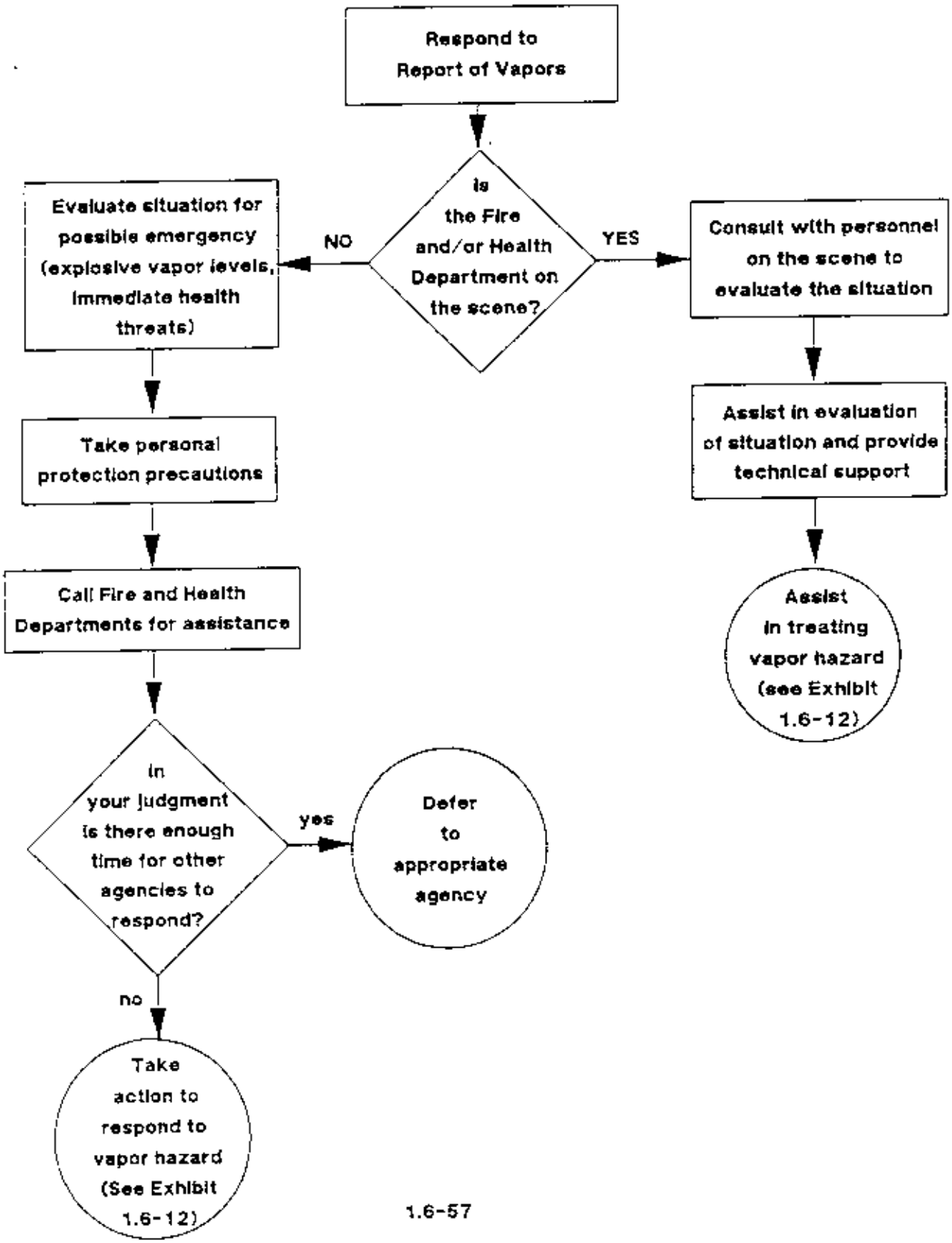
FIELD GUIDANCE

CORRECTIVE ACTION - VAPORS IN STRUCTURES, SEWERS, AND UNDERGROUND UTILITY LINES

Responding to Vapor Hazards
1. Take necessary personal protection measures 2. Use monitoring equipment to check atmosphere for explosive and/or oxygen-deficient conditions. 3. Do not enter structures when oxygen concentration is less than 21 percent. 4. *Do not* enter structures when explosive conditions are indicated. 5. *Do not* enter sewers. The practice is extremely dangerous, and the statistics show that many resucers are killed during rescue operations in sewers. 6. Ventilate structure/sewer to mitigate vapor hazard.

VAPORS IN STRUCTURES, SEWERS, AND UNDERGROUND UTILITY LINES

Guidance Summary--At-A-Glance



NOTES

1.6.3 Corrective Action - Vapors in Structures, Sewers, and Underground Utility Lines

Spills of volatile, flammable, or toxic substances such as gasoline can lead to an accumulation of vapors in structures, sewers, underground utility lines, and other confined, poorly ventilated spaces. These vapors can collect to reach concentrations that are:

- Potentially explosive if an ignition source and sufficient oxygen is present;
- Sufficient to lower the concentration of oxygen to levels insufficient to sustain life; or
- Potentially hazardous to human health if inhaled.

One of the first priorities in a spill response, therefore, is to check if any of the above conditions may be present, especially if the spilled substance (liquid or solid) is known to be flammable and/or volatile. Many of the lighter petroleum product fractions are particularly volatile and several also contain known carcinogens (e.g., benzene). Prompt action must then be taken to mitigate any detected vapor hazard.

Checking a structure, sewer, or underground utility line for any of these vapor hazards is a hazardous activity in itself, one that demands special training, specialized monitoring instruments, and other specialized protective equipment if it is to be done safely and effectively. As a general rule and policy, BSPR personnel are not equipped to investigate possible vapor hazards in structures, sewers and underground utility lines, nor should they take the lead in investigating such hazards. Other spill response agencies, such as the fire department and health department, have personnel that are both equipped and trained for this first-response function. There is only one, limited, exception to this policy. If (a) you are the first to arrive on the scene, (b) you determine, or there is sufficient reason to believe, that there is an imminent health and/or safety threat posed by a vapor hazard, **and** (c) other response agencies are unable to respond and take action in time (in your judgment), you may take steps to evaluate the situation and take appropriate action to minimize the hazard and/or recommend evacuation of individuals from the area of the hazard. Otherwise:

- BSPR personnel should allow other response agencies at the spill scene to evaluate and respond to possible vapor hazards. Fire or explosion concerns come under the purview of the fire department, and it is the responsibility of the health department to investigate and respond to imminent health hazards.
- Contact the appropriate authorities once you have reason to suspect a vapor hazard may exist.
- Take all necessary personal health and safety protection measures. Preferably, do not enter any enclosed structure until the fire department arrives and determines the extent of vapor hazards and whether the structure is safe to enter without self-contained breathing apparatus.

NOTES

- BSPR personnel are to limit their role to consulting with and providing technical assistance to these other response agencies in both evaluating and mitigating a vapor hazard.

If you are to assist other response agencies with an investigation of a possible vapor hazard, you need to know how an investigation is conducted safely and what kinds of options are available to remedy vapor hazards in structures, sewers, and underground utility lines. Exhibit 1.6-16 provides information on the proper procedures and techniques for addressing vapor hazards. Other sections containing guidance relevant to this topic include the following:

- Part 2, Section 1, Personal Health and Safety Protection, contains guidance on personal protective equipment and safety procedures.

- Part 2, Section 2, Equipment Training, Calibration, and Maintenance, contains guidance on the use and calibration of air monitoring equipment used in detecting vapor hazards.

- Part 1, Section 3.1, Emergency Response to Fire and Safety Hazards, explains BSPR policy on proper procedures for an emergency response to fire and safety hazards, including evacuation.

Situations involving vapors that have accumulated in confined areas, such as structures and sewers, are some of the most hazardous and dangerous situations facing emergency responders. The potential is great for explosions or flash fires to occur or for high levels of toxic vapors to accumulate. Response actions, which must be attempted only with the highest degree of safety precaution, should be performed by firefighters. The use of appropriate personal protection equipment is a must.

Whenever rescues are necessary, only trained fire/rescue personnel should make the decision on whether to attempt the rescue and only they should be involved in performing any rescues. Confined-area rescues, especially those involving sewers, are extremely dangerous because of the vapor hazards described earlier. Statistics show that many rescuers are killed while attempting to rescue others. Once again, **BSPR personnel should not be involved in rescue operations**; such operations are the responsibility of the fire department.

Exhibit 1.6-16

Vapors in Structures, Sewers, and Underground Utility Lines

Take specific personal health and safety precautions when responding to a report of vapors in a structure or sewer. **Never** enter an enclosed space if you are alone or do not have access to the necessary air monitoring equipment used in detecting possible vapor hazards. Do not enter the enclosed space, even to take measurements, unless you have self-contained breathing apparatus and are trained in the use of such equipment. Notify other response agencies of the possible problem and, if at all possible, wait until the fire department (or public works department in the case of sewers) arrives and can use their equipment to measure for vapor hazards. In instances where you perceive an imminent health or safety threat, and other first-response agencies will not be able to respond in a timely manner, you may consider initiating an evacuation (refer to Part 1, Section 3.1).

ACTION/SITUATION	PROCEDURES	COMMENTS
A. Notify Appropriate Authorities.	1. Summon the local fire or public works department (if they haven't already arrived).	# Seek assistance in the interest of safety, but avoid creating unnecessary alarm by an unwarranted disturbance of normal activities.
	# The fire department is equipped with self-contained breathing apparatus (SCBA) and other specialized equipment to safely test the atmosphere for the presence of toxic gases, flammable vapors at explosive concentrations, and/or insufficient oxygen levels.	# Familiarize yourself with all existing agreements between your region and local fire departments.
	# The fire department has the authority to order an evacuation of an area if flammable vapors are present in concentrations at or near the flammability range.	# See Part 1, Section 3.1, for an explanation of BSPR policy on initiating evacuations in response to imminent health and/or safety threats.

Exhibit 1.6-16

Vapors in Structures, Sewers, and Underground Utility Lines (continued)

In an emergency, different agencies have specific authority and responsibilities to test the hazardous atmosphere, order evacuations, control traffic/crowds, and the like, which BSPR personnel usually do not exercise. The owner or operator of the impacted structure or sewer may also have an emergency response capability and, therefore, should be contacted. Your role is to ensure that a proper response is taken and that threats to human health and the environment are mitigated, if not prevented. Once the safety hazard has been dealt with, you have the primary authority to investigate the spill and to see that any environmental impacts are remedied.

ACTION/SITUATION	PROCEDURES	COMMENTS
A. Notify Appropriate Authorities. (continued)	2. Call the local police (if they haven't already arrived), so that they are on hand in case crowd or traffic control is required. 3. Contact the owner/operator of the impacted structure or sewer.	**#** Have the owner/operator put into action any existing emergency response plan. **#** Consult sewer or other utility operators on matters regarding emergency response procedures involving sewers and utility lines; their special knowledge is essential for selecting appropriate response procedures and techniques.

Exhibit 1.6-16

Vapors in Structures, Sewers, and Underground Utility Lines (continued)

Health and safety precautions are taken to control the public's access to the site and to ensure that your own health and safety is protected. Never enter an enclosed space where hazardous vapors are present, or where you suspect there exists a potentially explosive condition or an oxygen-deficient atmosphere, unless you have respiratory protection and all ignition sources have been eliminated (in the case of potentially explosive conditions).

ACTION/SITUATION	PROCEDURES	COMMENTS
B. Take Health and Safety Precautions.	1. Restrict access to the contaminated area to prevent unauthorized entry, and to protect passers-by. **#** Cordon off the area with yellow caution/danger ribbon or other visible barriers and post signs, if available, that warn the public of danger. 2. Ensure that sources of ignition are eliminated. **#** Enforce a "No Smoking" policy. **#** Ensure that all flame or spark-producing equipment and tools are removed from the site, or have been rendered inoperable prior to the beginning of any vapor treatment. **#** Always use explosion-proof equipment.	**#**Make sure fire and/or health officials are on hand to make evacuation decisions. **#**Make sure police are on hand for traffic and crowd control. **#**Have fire department standing by with charged hoselines in case a flash fire develops.

Health or fire officials make decisions about whether to evacuate when combustible or toxic vapors are present in a normally inhabited structure (e.g., building, basement, subway). If the vapor concentration is within the explosive limits, the fire department has the authority to order an evacuation. The presence of vapors at concentrations that pose imminent health hazards, but not necessarily a safety hazard, is a concern of the health department, who can also order an evacuation. You may, if asked, provide authorities with your assessment of the degree of danger, but, in either case, avoid making the evacuation decision.

ACTION/SITUATION	PROCEDURES	COMMENTS
B. Take Health and Safety Precautions. (continued)	3. Eliminate sources of ignition (continued) # Disable lights and other electrical equipment in the affected area, **but do not use switches in the affected area**. # Cut off electrical power by switches and outlets **located well away from the area**. # Cut off gas service to extinguish pilot lights and burners.	

Exhibit 1.6-16

Vapors in Structures, Sewers, and Underground Utility Lines (continued)

The fire department is best equipped to take the lead in identifying vapor hazards in an enclosed structure or sewer. **Never** trust your senses to determine if the air in a confined, poorly ventilated space is safe! You **cannot** see or smell many toxic gases and vapors, nor can you determine the level of oxygen present without the use of an oxygen meter. The fire department will use self-contained breathing apparatus (SCBA) and will test the enclosed space with air monitoring instruments to determine whether toxic vapors are present, whether explosive conditions are indicated, or whether there is insufficient oxygen to sustain life. If any of these vapor hazards are indicated, the space must be ventilated and re-tested before anyone may enter to investigate the situation further.

ACTION/SITUATION	PROCEDURES	COMMENTS
C. Identify Vapor Hazards in the Atmosphere.	1. Fire department personnel, wearing SCBA, will approach or enter the enclosed space to measure the level of oxygen and test for flammable vapors reaching their explosive limits. The fire or health department will test for toxic vapors. 2. When responding to vapors in sewers or utility conduits, consult the sewer authority/utility company, which may have special instruments, equipment, and trained personnel for responding to situations in which vapors originate from overheated insulation, sewer-generated gases, or industrial gases.	**#** The fire department will use an oxygen meter to measure the level of oxygen in the atmosphere. Greater than 21% oxygen is an oxygen-enriched atmosphere and potentially explosive. Less than 19.5% oxygen is an oxygen-deficient atmosphere and will not sustain life unless SCBAs are worn. The oxygen level will also be a determining factor in whether a combustible gas indicator (CGI) can be utilized (refer to Part 2, Section 2). **#** The lower and upper explosive limits mark the range within which an air/gas mixture is combustible. **#** A CGI detects whether flammable gas and or vapor contaminants in the air are approaching explosive limits. **#** A photoionization detector can be used to detect toxic vapors. **#** Also see sections on Equipment Training, Calibration, and Maintenance (Part 2, Section 2) and Spill Management and Cleanup Technologies (Part 3, Section 1).

For low vapor concentrations, opening doors/windows/manholes to allow the structure/sewer to ventilate naturally may be adequate to mitigate a vapor hazard. Higher vapor concentrations in structures/sewers may require the use of grounded mechanical exhaust ventilating equipment to draw vapors out from the enclosed space. Provide as many openings for fresh air to enter, but **never** force air into the area. Use only explosion-proof equipment, and remove all sources of ignition from the vicinity of vapor exit. Under emergency conditions, only the fire department should perform ventilation.

ACTION/SITUATION	PROCEDURES	COMMENTS
D. Ventilate Enclosed Space to Mitigate Vapor Hazard.	1. Ventilate the area to remove or reduce the flammable and/or toxic vapors. **#** Employ natural ventilation to dissipate flammable/toxic vapors and normalize the oxygen level. Open windows and doors and allow natural air to dilute the vapors.	**#** Only effective if windows on two sides of the structure can be opened so that air is completely exchanged. **#** Release vapors into open areas. Be sure that vapors do not accumulate in another enclosed area. Keep ignition sources away from vapor exit.
	2. Alternatively, use hand-driven or mechanical fans to ventilate area. **#** Place fan in opening (i.e., up to window or over manhole or other subsurface opening). Make sure fan is drawing air **into** the structure/ sewer and forcing vapors **out**. **#** Can also set nozzle of a water hose in a fog pattern (i.e., wide-angled spray) to discharge vapors outwardly through a window. **#** Vent air and vapors into an open area that is free of people.	**#** Explosion-proof equipment must be used. **#** Local fire department or local vendor are the best sources of ventilation equipment. **#** Fans should never be used to force **into** air a structure. **#** Mechanical venting can create a negative air pressure within the structure so that vapors are drawn into the enclosed space. **#** Be sure that all ignition sources are removed from the vicinity of vapor exit.
	3. Alternatively, use an air eductor (i.e., grounded electrical ventilating equipment; see Exhibit 1.6-11).	

Exhibit 1.6-16

Vapors in Structures, Sewers, and Underground Utility Lines (continued)

Use water to flush flammable vapors out of sewers. This method may stop or significantly reduce the generation of sewer gas. Follow the advice of the public works department or sewer authority on consequences of flushing any free product (see section on Free Product in Structures and Sewers). The fire department should remain on the scene and continuously monitor the atmosphere for hazardous vapors and explosive conditions. Until the source of the vapors is found and controlled, there is always the possibility that vapors can again accumulate to hazardous levels.

ACTION/SITUATION	PROCEDURES	COMMENTS
D. Ventilate Enclosed Space to Mitigate Vapor Hazard (continued)	4. To assist in ventilating sewers, purge vapors in sewers by flushing with water.	**#** See Free Product in Structures, Sewers, and Underground Utility Lines (Part 1, Section 6.2). **#** Vapor control operations may help to prevent entry of vapors into structure or sewer.
E. Monitor Atmosphere Continuously Until Conditions Are Safe to Allow Investigation of Vapor Source.	1. Monitor conditions with oxygen meter, CGI, photoionization detector, and any other appropriate monitoring instruments to determine when the atmosphere is no longer flammable, explosive, or toxic.	**#** Flammable vapor must be reduced below 20% of the lower flammable limit to allow safe entry into the structure.

TECHNICAL

FIELD GUIDANCE

CORRECTIVE ACTION - FREE PRODUCT ON SOIL SURFACE

NOTES

Corrective Action - Free Product on Soil Surface

GUIDANCE SUMMARY-AT-A-GLANCE

- Unless a spill to surface soils results in an actual or imminent health or safety hazard that must be handled by the fire department and other emergency responders, BSPR personnel will direct the clean-up effort.

- Your first task is to identify the spiller and to inform them of their responsibility to clean up the spill. If the spiller accepts this responsibility and provides personnel to conduct the cleanup, your job is to monitor the effectiveness of the effort. If the spiller is unable to respond or refuses to initiate clean-up efforts, you are to inform the spiller that the state will coordinate the cleanup and bill them for all associated costs. If the spiller is not identified, the state should initiate the necessary cleanup. Initiate response efforts by calling in one or more standby spill response contractors.

- Liquid spills will soak into the soil; pool in depressions or in-place containment structures; flow along ground contours towards or into ditches, storm drains, waterways, etc.; and/or evaporate to some extent. BSPR personnel must ensure that properly trained and equipped responders take quick action to confine the spill and to prevent it from entering storm drains, waterways, and bodies of water.

- Spills of solid substances that are granular or particulate in composition are much easier to confine than liquid spills, however, solid materials are subject to blowing and are vulnerable to precipitation. For these reasons, spill responders must take quick action to cover spilled solid materials to protect them from both wind and moisture. If it is raining to any significant degree, dikes may need to be established to confine the hazardous substance/runoff mixture. Water mixing with the spilled substance may also cause an adverse reaction that could create additional health and safety hazards.

- Initial spill responders may need to use whatever resources are available at the site in order to confine the spill in a timely manner; however, no action should be taken unless it can be done safely and attain positive results.

- The exhibits in this section on initial response to free product (i.e., liquid or solid) on soil surfaces describe procedures for responding to spills of petroleum products and hazardous materials on land. Included are procedures for identifying the substance involved, determining hazards, taking safety and health precautions, coordinating response operations with other agencies, and confining, treating, and cleaning up the spilled substance. These exhibits should be reviewed during training sessions and consulted during incidents.

NOTES

Corrective Action -
Free Product on Soil Surface

GUIDANCE SUMMARY-AT-A-GLANCE
(continued)

- **#** The exhibits cannot provide guidance specific to every spill situation. Ultimately, you must rely on your own experience and judgment in choosing the best approach and remedial action.

- **#** If spilled materials on soil surfaces also enter sewers, waterways, or bodies of water, you must respond to these situations, as well. Sections 6.2, 6.3, and 6.5 should be consulted for guidance regarding these situations.

NOTES

1.6.4 Corrective Action - Free Product on Soil Surface

Aboveground spills of petroleum or hazardous materials can flow overland to enter sewers or waterways, can pool on impermeable surfaces such as asphalt or concrete, or can soak into the soil. A response to free product spill on the soil surface, therefore, can range from constructing berms and containment pits to simply allowing a small spill of a volatile material to evaporate.

A response to a spill on the soil surface can also involve numerous agencies with whom BSPR personnel must coordinate to ensure an effective response. For example, a local fire department may be on hand to evaluate potential fire or explosive conditions and/or to help you contain the spill. Spill responders should work with local fire departments to help them recognize the possible environmental damage that may result by flushing a surface spill into a sewer as a means of avoiding a possible fire/explosion hazard. If the spill can be cleaned up quickly by other means, with sorbent materials, for example, use of this method may be preferable to flushing the free product into the sewer.

Wildlife and natural resource protection agencies might also become involved in spill response if natural resources and/or wildlife are threatened or damaged/injured by the effects of the spill. Your Regional Contingency Plan should describe these relationships. Familiarize yourself with this plan and contact the representatives of these other agencies to introduce yourself since you may be working with them during spill response.

Unless a spill to surface soils results in some imminent health or safety hazard that must be addressed immediately (e.g., a vapor hazard), BSPR personnel direct the response effort. As with any other spill, your first task is to identify the spiller. Since most spills to surface soils are detected quickly and, therefore, are usually small in volume, the spill is unlikely to have traveled very far from its source. Most spills to surface soils also leave a clear trail, especially spills of petroleum product.

Once the spiller is identified, request that he or she assume responsibility for spill cleanup. If the spiller accepts the responsibility, your job is to monitor the progress and effectiveness of the clean-up effort. If the spiller refuses or is otherwise unable to respond, then you are to inform the spiller that the state will clean up the spill and bill them for these costs.[7] If the spiller cannot be located, the state should initiate the necessary cleanup. As with any other spill, you will then call out standby spill contractors. For more information on this initial exchange with the potentially responsible party, see Part 1, Section 1.2, on Enforcement of Spiller Responsibility. For more information on calling out spill contractors, see Part 1, Section 2, on Contractor Selection and Call-Out.

The following exhibits on initial response to free product on soil surface (Exhibit 1.6-17 through 1.6-20) provide guidance to BSPR spill responders on appropriate procedures for responding to spills of petroleum or hazardous materials that result in free product on surface soils. Included are methods for confining, treating, and cleaning up liquid and solid product spills of varying size that are either

[7] *Cleanup of petroleum spills is the responsibility of BSPR, whereas cleanup of hazardous materials spills is the responsibility of the Division of Hazardous Waste Remediation.*

Exhibit 1.6-17

Initial Response to Free Product on Soil Surface

GENERAL PROCEDURAL GUIDELINES

	Guideline		Comment
#	Notify other response agencies, if they are not already on the scene.	#	Familiarize yourself with all existing agreements between your region and other response agencies.
		#	Seek assistance in the interest of safety.
#	Ask the police (if they are not already on site) for assistance, as necessary, to control traffic and to keep public from area.		
#	Identify the material(s) spilled and determine the associated hazards.	#	The spiller may be able to provide information on the spilled substance (i.e., type, quantity, health hazards, flammability, reactivity).
		#	This information can also be obtained from the following sources:
		--	Material Safety Data Sheets kept on file at the State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC), and/or at the local fire department;
		--	The shipping manifest document that is required to be kept in transport vehicles;
		--	CHEMTREC, a technical assistance center operated by the Chemical Manufacturers Association (CMA) that provides guidance related to chemical transportation emergencies as well as other chemical emergencies. CHEMTREC provides information on emergency response to different chemical releases. Additionally, CHEMTREC serves as a liaison between the on-site personnel and the chemical manufacturer and/or shipper, who can provide further guidance on the product and its properties. CHEMTREC can be contacted by dialing 1-800-424-9300.
#	Determine the extent of the hazard and the level of health & safety protection needed by spill responders.	#	If an initial reading can be obtained without entering the contaminated area, monitor the air around the spill with an oxygen meter and combustible gas indicator (CGI) to determine if a fire or explosion potential exists and to determine if there is an oxygen-deficient atmosphere that will necessitate use of self-contained breathing apparatus (SCBA). Use a Photoinization Detector (PID) to detect the presence of unsafe concentrations of certain organic or inorganic compounds.
		#	If an initial reading cannot be obtained without entering the contaminated area, let other emergency response personnel on the scene (e.g., fire department, spill contractor) with requisite body and respiratory protection (SCBA, chemical-resistant clothing, boots and gloves) enter the area for this purpose.

Exhibit 1.6-17

Initial Response to Free Product on Soil Surface

GENERAL PROCEDURAL GUIDELINES

	Guideline		Comment
#	Eliminate all ignition sources, if flammable or combustible materials are spilled and the danger of explosion exists.	#	Establish a "No Smoking" policy at the incident scene.
		#	Eliminate all flame sources and remove equipment and tools that could create sparks or render them inoperable if they cannot be easily removed from the site.
		#	Look around to see if there are any other possible ignition sources (e.g., friction, static electricity). These may not be too obvious (e.g., any place where two pieces of metal may come in contact). Make sure that all persons on site are aware of these potential sources.
		#	Use only explosion-proof equipment and non-sparking tools.
		#	Notify the electric and/or gas companies to cut off service from a location remote from the hazardous area. Supply the site with a portable power source, if needed.
#	Ensure that public protection actions, including evacuations and temporary relocations, are carried out by the appropriate authorities.	#	Fire and health departments have authority to make evacuation decisions. (See Part 1, Section 3.1, for explanation of BSPR policy on evacuations.)

Exhibit 1.6-17

Initial Response to Free Product on Soil Surface

GENERAL PROCEDURAL GUIDELINES

Guideline	Comment
# Dike the area around sewer drains. Use sand or soil from the area. Cover the drains with spill mats, if available. If the spill drains into the sewer system, refer to Sections 6.2 and 6.3, Free Product in Structures and Sewers and Vapors in Structures and Sewers, respectively, for guidance on responding to these situations.	# If the spill has impacted or may impact fish or wildlife, call the Regional Fish and Wildlife Office. # If the waterway is navigable, contact the Coast Guard. They will divert all traffic from the contaminated area. # If the contamination impacts or potentially impacts a recreational area, contact the health department.
# Stop the flow from the original leaking container (if possible). For more detailed information on this topic, see Part 1, Section 6.2, Confining and Containing Releases.	
# Monitor and evaluate clean-up operation to determine effectiveness.	
# Collect spilled substance from water surface (before or after treatment in place) and dispose of properly.	# Use containers compatible with product.
# Arrange for licensed hauler to remove and dispose of containerized waste materials at permitted facility (see Part 2, Section 3, Proper Management of Spill Residuals and Debris).	
# Biological treatment and other soil remediation techniques are discussed in Section 6.6, Soil Remediation.	

Exhibit 1.6-18

Initial Response to Free Product on Soil Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON SOIL SURFACE

Situation	Strategy/Technique	Advantages	Disadvantages
A. The Material Spilled is a Solid.	1. Isolate the material to prevent the material from being carried off site on shoes, clothing, and vehicle tires. Solids are easy to contain because of their immobility.		
	2. Do not increase the mobility of the material by the indiscriminate application of water or another liquid.		
	3. Consider covering powders and granular material with tarps or plastic sheets to prevent contaminants from becoming airborne.		Tarps/plastic sheets must be anchored down commensurate to the wind conditions.
B. The Material Spilled is a Liquid that is Spreading Overland.	1. Allow the spilled substance to collect in a natural depression or an in-place containment structure.		
	2. Alternatively, create a flow channel by hand shovelling or by machine trenching, if necessary, to a natural depression or in-place containment structure.		

Exhibit 1.6-18

Initial Response to Free Product on Soil Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON SOIL SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
B. The Material Spilled is a Liquid that is Spreading Overland. (continued)	3. Alternatively, confine the material with a dike, berm, excavation, or a gelling agent.		
	# Use hand shovels or earth-moving equipment to compact the earth into an embankment to enclose spill (see Exhibit 1.6-19).	On-site material is used. Can be constructed with commonly used equipment.	Without using an impervious bottom layer, seepage through ground is possible because of the natural permeability of soil.
	# The height of the dike depends on the amount of liquid to be confined.	Applicable to a wide variety of spills and soil surfaces (e.g., flat, sloping).	The surface composition of soil is not suitable for dike-forming in all cases.
	# Dikes made with clay are superior to those made of soil.		Removal of the material confined by an earthen dike generally requires that a sizeable quantity of contaminated earth be removed as well.
	# If practicable, install an impervious bottom layer (i.e., plastic sheeting or shielding, soil sealant) in order to minimize seepage into the earth.		Suitable dike-forming equipment may not be available. For large spills, the construction of a large enough dike can be time-consuming. Disposal and reclamation present potentially serious problems.

Exhibit 1.6-18

Initial Response to Free Product on Soil Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON SOIL SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
B. The Material Spilled is a Liquid that is Spreading Overland. (continued)	4. Create a pit, pond, lagoon, or holding area with earth-moving equipment (see Exhibit 1.6-20). # Line excavation with an impermeable liner (e.g., plastic sheeting, soil sealant), if possible. # Can be combined effectively with a dike, especially on sloped surfaces (see Exhibit 1.6-21).	On-site material is used. Can be constructed with commonly used equipment. Applicable to a wide variety of spills. Especially well suited for use on soft ground.	Large amounts of contaminated soil might have to be removed during cleanup and reclamation. Without using an impervious bottom layer, seepage to ground is probable because of natural permeability of soil. In certain cases, soil or subgrade composition may render excavation impossible or ineffective. Construction equipment must be available to create the excavation. Not effective in areas where water table is shallow.
	5. Alternatively, build a dike using commercial diking products such as foam polyurethane or foam concrete. Apply these products from an upwind location, especially on windy days.	Barrier can effectively confine liquids, without seepage, in most cases. Set-up is quick and easy. Applicable to a wide variety of spills. Foam polyurethane is especially well-suited for use on hard and dry surfaces. Foam concrete is especially well suited for spills that are slow moving.	Diking products may react or be incompatible with some substances. It is difficult to obtain an application device; may not be available for quick response. Only trained personnel can apply these products. May not eliminate percolation and will not eliminate volatilization. A foamed polyurethane is ineffective on wet surfaces. Adhesion of a foamed polyurethane may be suspect on dry earthen or prepared surface, and seepage may occur at the bottom of the dike.

Exhibit 1.6-18

Initial Response to Free Product on Soil Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON SOIL SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
B. The Material Spilled is a Liquid that is Spreading Overland. (continued)	5. Build a dike using commercial diking products such as foam polyurethane or foam concrete (continued)		Foamed concrete may have to cure for a significant amount of time for it to be effective. Foamed concrete may not hold high hydraulic heads.
	6. Alternatively, apply a gelling agent onto the spill with shovels, hand pumps, dry chemical fire extinguishers, or sandblasters. - Consider combining with a fire or vapor suppression foam to reduce any fire hazard. - Apply these products from an upwind location. - Combine with other containment methods in some cases for effective containment of contaminated liquids.	Compatible with a variety of substances. Easily removed for disposal by mechanical means. Innocuous thickening; no exothermic reaction. May prevent percolation into ground water. May prevent vaporization. Rapid reaction rate.	Equipment and material may not be readily available for quick response. Trained personnel required for application. May be ineffective in adverse wind conditions. Use of gelling agent may affect recoverability of the spilled product.

C. The Material Spilled is a Liquid that has Pooled on the Soil Surface.

Depending on the size and type of the spill, the material can be left to evaporate or can be collected by using sorbents or pumping methods (see Exhibit 1.6-23).

D. The Material Spilled has Completely or Partially Soaked into the Ground.

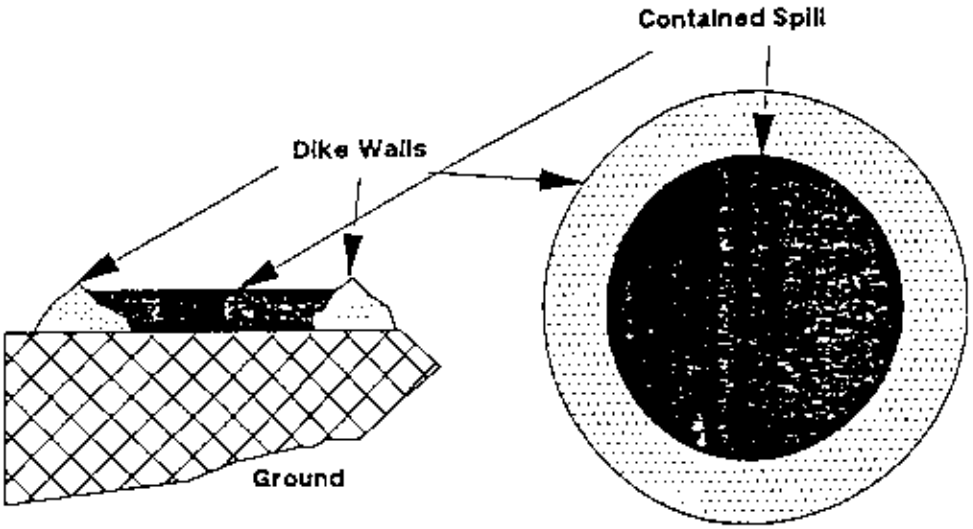
1. Confine the spill, if necessary, using one method or a combination of the methods described above.

2. Remove the contaminated soil with shovels, backhoes, or bulldozers (see Exhibit 1.6-23).

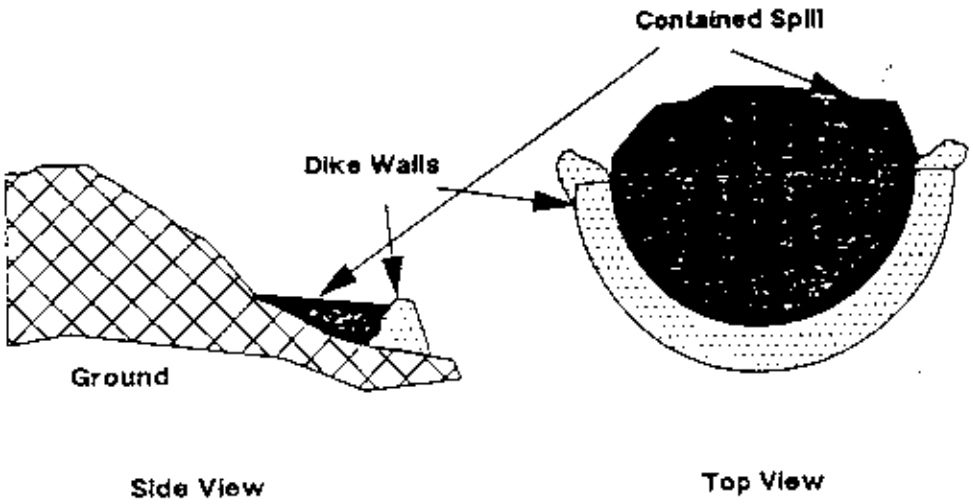
Allowing the substance to evaporate could result in a vapor cloud and air pollution.

Exhibit 1.6-19

TYPES OF DIKES



CIRCLE DIKE



V-SHAPED DIKE

Exhibit 1.6-20

AN EXCAVATION

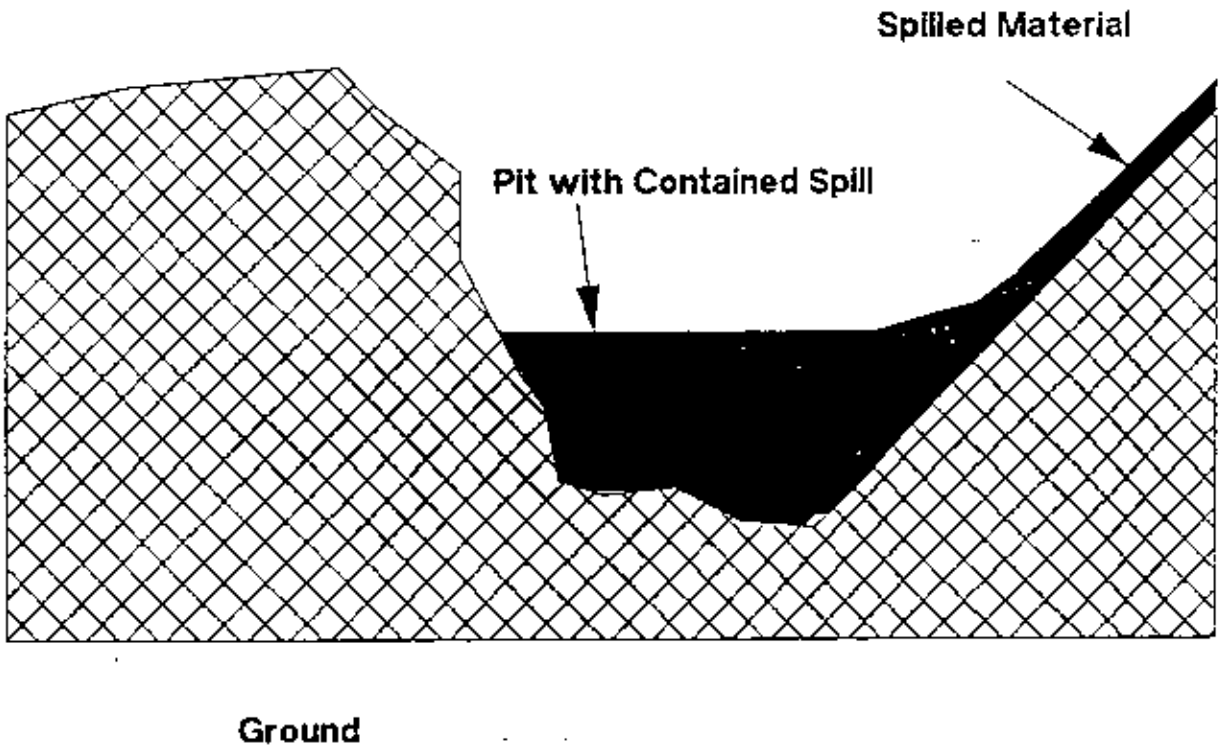


Exhibit 1.6-21

EXCAVATION AND DIKE

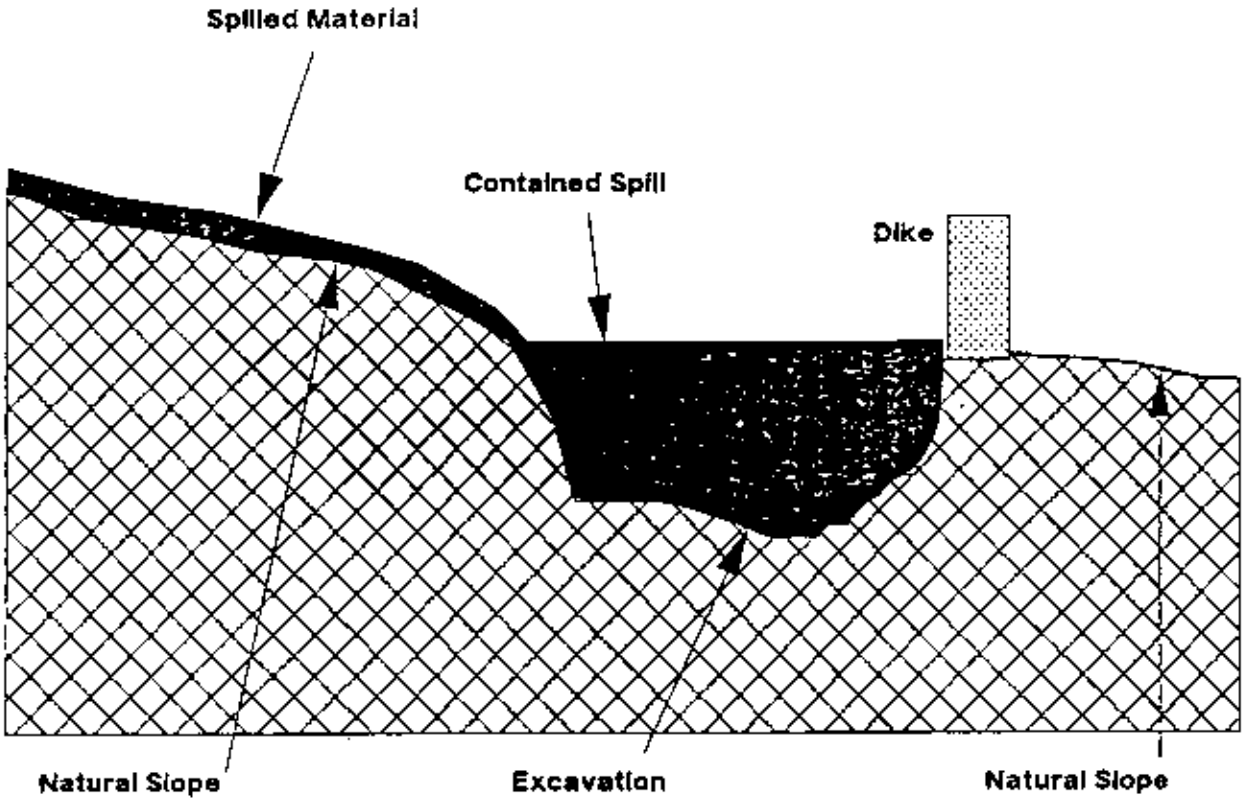


Exhibit 1.6-22

Initial Response to Free Product on Soil Surface

TREATMENT METHODS FOR CONFINED SPILLS ON SOIL SURFACE

Treatment/Method	Description/Comment	Advantages	Disadvantages
A. Neutralization	# Neutralization involves the reaction between a spilled substance and another chemical added to the spilled substance which serves to counteract the hazards that were present. # Due to the extreme importance of using the appropriate neutralizing chemical for a particular spill, your best course of action is to consult one or more of the following references for selecting the proper neutralizer: - CHEMTREC (1-800-424-9300) - Manufacturer (if known) of the spilled substance - Dangerous Properties of Industrial Materials, 7th Edition, Sax, 1989. - Manual of Hazardous Chemical Reactions (NFPA 491M), National Fire Protection Association, 1986. - EPA Chemical Profiles for Extremely Hazardous Substances, Environmental Protection Agency, June 1988. # Apply recommended neutralizing chemicals to a spill to eliminate or significantly reduce the hazards. # Neutralization chemicals can be combined with fly ash (in certain cases) in order to reduce bubbling and frothing. Consult with a chemist before taking action.	# Reduces the initial high concentration. # Minimal auxiliary equipment required for small spills.	# Neutralization is normally applicable to only small spills and should only be attempted under controlled circumstances. # May not be readily available for quick response. # Trained personnel and appropriate protective gear are necessary. # Possible secondary environmental hazard created if application is overshot and/or used in excess. # Effectiveness is reduced in water where proper mixing cannot occur. # Possible exothermic reaction causing bubbling, frothing, or spattering; may present hazards and/or difficulties with cleanup. # Specialized application equipment may be necessary for large spills (e.g., helicopters).

Exhibit 1.6-22

Initial Response to Free Product on Soil Surface

TREATMENT METHODS FOR CONFINED SPILLS ON SOIL SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
B. Dispersion	# Apply uncontaminated water to the contained spill (if water is compatible) in order to dilute the effects of the spill. # Dispersion of a flammable liquid will reduce the generation of flammable vapors.	# Water supplies are readily available. # Immediate reduction of initial high concentration. # Equipment is common and generally available. # May reduce fire hazard. # In rare instances, contamination may be reduced to such a degree that collection is rendered unnecessary.	# May not eliminate volatil- ization. # Application is limited to only certain chemicals and situations. # Potential contamination of water used for drinking, recreation, industry, agriculture, or navigation.
C. Encapsulation	# Cover the spilled substance with a plastic sheet, tarp, or close-packed sorbents. Best used in combination with dikes.	# Safe to handle by untrained personnel. # No secondary effects to the environment. # Materials are common and generally available. # Reduces vapor hazards. # Good as a short-term solution.	# Some materials are vulnerable to damage from certain chemicals. # Plastic sheet must be cleaned promptly after use (if it is to be reused); may present problems in cleanup and disposal. # May be difficult to set up. # Tarps/plastic sheets must be anchored down commensurate with the wind conditions. # Encapsulation will not eliminate vapor hazards completely.

Exhibit 1.6-22

Initial Response to Free Product on Soil Surface

TREATMENT METHODS FOR CONFINED SPILLS ON SOIL SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
D. Foams	# Apply a compatible foam (e.g., a hazmat foam, protein, fluoroprotein, alcohol, AFFF) to the surface of the spill. # Apply foam from an upwind location. # May be combined with a gelling agent in some cases, if compatible. # Replenish the foam blanket periodically to ensure a continuous blanket.	# Reduces vapor generation and, therefore, prevents downwind contamination. # May act as a barrier to ignition from external sources. # May reduce fire hazard, if spilled substance is flammable or combustible.	# Protection time is limited and finite, because foam eventually degrades, unless foam blanket is replenished. # May be ineffective in adverse wind conditions as collapse rate of the foam bubbles is increased. # Low-expansion foams are somewhat permeable to vapors. # May be incompatible with certain chemicals. # Possible exothermic reaction may be produced. # Equipment and materials may not be available for quick response. # Trained personnel are necessary for application. # Possible secondary effects on the environment. # Presence of foam may complicate clean-up efforts.

Exhibit 1.6-22

Initial Response to Free Product on Soil Surface

TREATMENT METHODS FOR CONFINED SPILLS ON SOIL SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
E. Soil Surface Sealant	1. Prepare site by removing large pieces of debris, sticks, stones, etc. 2. Apply the sealant to soil surface in the path of the spill to prevent spill mass from penetrating into the ground. - Sealants are usually sprayed on with a hand pump, propellant pressurized system, or powered sprayer. - Sealants are classified according to how they are formed chemically and the nature of the interaction between the sealant and the soil surface: (a) Nonreactive. Examples include rubber, acrylic, fluoroplastic, polyester, and PVC.	Immobilizes the material. Prevents penetration into ground and ground water.	Requires specialized equipment and trained personnel. Materials may not be readily available for quick response.

Exhibit 1.6-22

Initial Response to Free Product on Soil Surface

TREATMENT METHODS FOR CONFINED SPILLS ON SOIL SURFACE
(continued)

Treatment/Method	Description/Comment		Advantages	Disadvantages
E. Soil Surface Sealant. (continued)	(a)	Nonreactive (continued)		Slow under wet and cold conditions. Subject to pinhole formation, especially when applied over gravel or stones. Repeated applications required in porous substrates in order to attain adequate film formation. When coating rough surfaces, it is difficult to cover or seal cracks and to cover all sides of any large particle.
	(b)	Reactive. Examples include epoxy, urethane, urea/ formaldehyde, unsaturated polyester.	More likely to form films in wet and cold conditions. Some reactive sealants have the ability to foam in place, reducing pinhole formation and increasing resiliency. Immobilizes the material. Prevents penetration into the ground and ground water.	Requires specialized equipment and trained personnel. Materials may not be readily available for quick response. Reactants must be kept at 55EF or above to be sprayable.
	(c)	Repellant Chemicals. Examples include silicones and fluorocarbons.	Localizes the material. Prevents penetration into the ground and ground water.	Requires specialized equipment and trained personnel. Materials may not be readily available for quick response.

Exhibit 1.6-22

Initial Response to Free Product on Soil Surface

TREATMENT METHODS FOR CONFINED SPILLS ON SOIL SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
F. Cryogens	# Apply a **non-reactive** cryogenic agent to the spilled substance to reduce vaporization and/or lower flammability. **Prior to application, ensure that it is compatible with the spilled substance.** # In many cases, it is advised that persons applying these materials should be upwind of the location of application. # Possible cryogens include:		# Cryogenic substances are dangerous due to their inherent physical properties (i.e., extreme cold). Cryogens will instantly freeze living tissue upon contact.
	(a) Liquid carbon dioxide (CO_2)	# Rapid cooling effect of reaction. # Small quantity needed relative to other cryogens. # Reduces generation of toxic vapors and/or heat and flames.	# High CO_2 losses occur upon application to the spill. # Secondary effect to the environment. CO_2 cloud reduces visibility and oxygen levels in the vicinity. # Trained personnel wearing appropriate protective gear are required. # Materials may not be readily available for quick response.
	(b) Dry ice (solid CO_2)	# Has better cooling and projection capabilities than liquid CO_2. # More available than liquid CO_2. # Reduces generation of toxic vapors and/or heat and flames.	# Grinding is necessary before application; may be time-consuming. # Application requires the use of appropriate protective gear. # Reduction in temperature is often insufficient.

Exhibit 1.6-22

Initial Response to Free Product on Soil Surface

TREATMENT METHODS FOR CONFINED SPILLS ON SOIL SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
F. Cryogens (continued)	(c) Ice	# Safe for use by untrained personnel. # Generally available. # Reduces generation of toxic vapors and/or heat.	# Reduction in temperature is often insufficient. # If water is reactive with the spilled substance, so too will ice be.
	(d) Liquid nitrogen (N_2)	# Extremely low temperature reduction is possible. # Reduces dispersion of toxic vapors and/or heat and flames.	# Large quantities necessary. # Secondary effects to environment: N_2 cloud reduces visibility and oxygen levels in vicinity. # Materials may not be available for quick response. # Trained personnel are necessary; contact with liquid N_2 is extremely dangerous.
G. Biodegradation	# Apply the microbes specific for the involved hazardous chemical(s) on the spill. # Microbes' food source is the contaminant; they persist until food source is consumed.	# Hazardous substance is removed from the environment. # Subsequent disposal is not always necessary. # In some cases, cleanup can be completed at a much quicker rate than with other remedial options.	# Many hazardous materials are resistant to biological degradation. # Method can be slow if significant research is necessary to find the correct microbes and to transport them to the spill site.

Exhibit 1.6-22

Initial Response to Free Product on Soil Surface

TREATMENT METHODS FOR CONFINED SPILLS ON SOIL SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
G. Biodegradation (continued)		# Process is natural and ecological and is nonpathogenic to humans and animals.	# In order to achieve a faster reaction rate, it is necessary to add large quantities of acclimated cultures; however, the technique is generally slow. # This technique is not recommended for emergency response. # The biodegradation treatment method is labor intensive.

Exhibit 1.6-23

Initial Response to Free Product on Soil Surface

COLLECTION OF CONFINED SPILL ON SOIL SURFACE FOR DISPOSAL

Situation	Collection Method	Advantages	Disadvantages
A. The Amount of Liquid Spilled is Small	1. Soak up the spill with a commercial sorbent material (see Section 6.5, Free Product on Water Surface, for additional information on sorbents). # Spread sorbent material (e.g., pillows, pads, particulate, etc.) on and around the spill. Apply manually or with a pitchfork. # Once sorbent is saturated, remove and place it into drums or plastic bags for later disposal.	Sorbents are generally inert materials; safe to handle. May reduce vaporization. Removal is relatively simple and can be accomplished quickly. Immobilizes the spill. Some sorbents resist flammability. Some sorbents repel water while ab/adsorbing contaminants.	Materials and equipment may not be readily available for quick response. Organic sorbents must not be used on oxidizer spills.
	2. Alternatively, use amorphous silicate glass as an absorbent.	Very safe to handle; very low toxicity. Because of its inert nature and low density, it can be readily stored at chemical facilities or carried on emergency response vehicles. Once the material becomes dry, it is easily handled. Very light weight gives the material its ability to ab/adsorb large quantities of liquid.	Because of its light weight, it is difficult to apply and keep in place in windy conditions. Some materials lose their absorbent properties for petroleum when they come in contact with water. Material is expensive and may not be readily available.
	3. Alternatively, use activated carbon as a sorbent material.	Applicable to a wide variety of substances (i.e., organics that will adsorb to carbon) and spill situations. Very versatile and available. Resistant to chemical attack.	Because of its light weight, it is difficult to apply and keep in place in windy conditions. Negative impacts on the environment. Disposal may be costly. Material is expensive and may not be readily available.

Exhibit 1.6-23

Initial Response to Free Product on Soil Surface

COLLECTION OF CONFINED SPILL ON SOIL SURFACE FOR DISPOSAL
(continued)

Situation	Collection Method	Advantages	Disadvantages
A. The Amount of Liquid Spilled is Small (continued)	3. Alternatively, use activated carbon as a sorbent (continued)	Equipment for application is generally available.	
	4. Alternatively, use polyurethane foam (in particulate or roll form) as a sorbent.	Recovery and regeneration of the foam is generally possible. No secondary effects on the environment.	May be incompatible with certain chemicals.
	5. Alternatively, use other sorbents such as fly ash, wool waste, sawdust, straw, cat litter, vermiculite, dolomite, cement powder, or imbiber beads.	Can be very effective in certain cases.	May not be as effective as previously mentioned manufactured sorbent materials. Combustible material (e.g., sawdust, straw, etc.) cannot be applied to flammable liquids or oxidizers.
B. The Amount of Liquid Spilled is Large	1. Remove as much of the spilled substance as possible, using a pump, vacuum truck, or suction hose, and place all collected product in a suitable container for disposal. 2. Soak up remaining product with sorbent material.	Equipment is common and generally available. Equipment is adaptable to a wide range of spill situations and topographic settings.	Effectiveness decreases in shallow spill situations. Flammable liquids will necessitate the use of spark-resistant tools, explosion-proof equipment, and grounding cables. Vulnerable to damage by certain chemicals. Vacuum trucks have difficulty positioning near the spill in rough terrain.

Exhibit 1.6-23

Initial Response to Free Product on Soil Surface

COLLECTION OF CONFINED SPILL ON SOIL SURFACE FOR DISPOSAL
(continued)

	Situation	Collection Method	Advantages	Disadvantages
C.	The Spilled Substance has Hardened or is a Solid Material.	1. Break it into pieces with a pick, shovel, or hammer, unless it is flammable, combustible, explosive, or shock sensitive. 2. Pick up pieces with a shovel or vacuum and place into container.	Removal is usually quick and easy. Equipment is common and generally available. Equipment, with the exception of machinery (e.g., vacuum device), is safe to handle by untrained personnel. Equipment is adaptable to a wide range of chemicals and topographic settings.	Removal may require excavation of a large quantity of earth under the spill.

NOTES

flowing overland, have pooled on the soil surface, or have soaked into the top layer of soil.

Obviously, these exhibits cannot provide guidance specific to every surface soil spill situation. Ultimately, you must rely on your own experience and judgment in choosing the best approach for remedial action. The most generally applicable rule is: Confine the spill as quickly as possible. This may mean that you, your contractor, and other response agencies may have to use the tools, equipment, and materials that are readily on hand until there is time to bring additional, perhaps more effective, resources to the site.[8] There is nothing wrong with the "let's make do with what we've got" strategy, unless such action is likely to cause injury or more severe damage.

[8] *See Part 2, Section 2, Equipment Training, Calibration, and Maintenance, for additional information on the spill containment materials each state spill response vehicle should have as part of its standard equipment inventory.*

TECHNICAL

FIELD GUIDANCE

CORRECTIVE ACTION - FREE PRODUCT ON WATER SURFACE

NOTES

Corrective Action - Free Product on Water Surface

GUIDANCE SUMMARY-AT-A-GLANCE

- Depending upon the location of a waterway spill, BSPR personnel may or may not have the lead role in spill response.

- A spill in coastal waterways is under the jurisdiction of the U.S. Coast Guard (USCG); therefore, the Federal Government will have the lead role.

- Response to an inland waterway spill will more likely be a BSPR responsibility.

- A response to a waterway spill can involve numerous agencies with whom BSPR personnel must coordinate to ensure an effective response. Your Regional Contingency Plan should describe these relationships.

- Your first task is to identify the spiller. A spill discovered on a waterway may have flowed overland or may have been discharged from shore-based sources, near-shore sources, or from marine craft. Once the spiller is identified, request that they assume responsibility for spill cleanup. If the spiller accepts this responsibility, your job is to monitor the progress and effectiveness of the clean-up effort. If the spiller refuses or is otherwise unable to respond, then you are to inform the spiller that the state will clean up the spill and bill the responsible party for these costs. If the spiller cannot be located, the state should initiate the necessary cleanup. As with any other spill, you will then call out standby spill contractors.

- The accompanying exhibits on procedures for initial response to free product on water surface provide guidance on appropriate procedures for responding to spills of petroleum or hazardous materials that result in free product floating on the water surface. Included are methods for containing and cleaning up a floating product spill under varying conditions such as high winds, fast currents, turbulent waters, and freezing temperatures.

- You must rely on your own experience and judgment in choosing the best approach and remedial actions. The most generally applicable rule is: Confine the spill as quickly as possible. This may mean using the tools, equipment, and materials that are readily on hand until there is time to bring additional, and perhaps more effective, materials to the site.

NOTES

1.6.5 Corrective Action - Free Product on Water Surface

A petroleum or hazardous material spill to a waterway can result in free product floating on the water surface. Depending upon the location of the waterway spill, BSPR personnel may or may not have the lead for spill response. For example, spills in coastal waterways (i.e., Great Lakes, Atlantic Ocean, and Hudson River as far north as Troy) comes under the jurisdiction of the U.S. Coast Guard (USCG). The USCG will direct spill cleanup in these cases, although state spill response personnel may be involved.

Alternatively, an inland waterway spill will more likely be a BSPR responsibility. Local fire departments may get involved in helping to confine and contain the spill. If the waterway is a source of drinking water, local and state health departments and water supply authorities will be involved in evaluating the threat to public health in the event that drinking water intakes must be blocked or shut down. These agencies will also be involved in evaluating the health threat when recreational waters are impacted by a spill. Fish and wildlife protection agencies will also be involved if natural resources and/or wildlife are damaged by the effects of the spill.

A response to a waterway spill, therefore, can involve numerous agencies with whom BSPR personnel must coordinate to ensure an effective response. Your Regional Contingency Plan should describe these relationships. Familiarize yourself with this plan and contact the representatives of these other agencies to introduce yourself since you may be working with them during spill response.

Unless a waterway spill results in some imminent health or safety hazard that must be addressed immediately (e.g., fires can occur with spills to waterways), BSPR personnel (or the USCG for a coastal waterway spill) will direct the spill response effort from the outset. As with any other spill, your first task is to identify the spiller. A spill discovered on a waterway may have flowed overland or may have been discharged from shore-based sources (e.g., petroleum tank farms, sewers), near-shore sources (e.g., drilling platforms), or from marine craft. Once the spiller is identified, request that they assume responsibility for spill cleanup. If the spiller accepts this responsibility, your job is to monitor the progress and effectiveness of the cleanup effort. If the spiller refuses or is otherwise unable to respond, then you are to inform the spiller that the state will clean up the spill and bill them for these costs.[1] If the spiller cannot be located, the state should initiate the necessary cleanup. As with any other spill, you will then call out standby spill contractors. For more information on this initial exchange with the potentially responsible party, see Part 1, Section 1.2, on Enforcement of Spiller Responsibility. For more information on calling out spill contractors, see Part 1, Section 2, on Contractor Selection and Call-Out.

The following exhibits on initial response to free product on water surface (Exhibits 1.6-24 through 1.6-25) provide guidance to BSPR spill responders on appropriate procedures for responding to spills of petroleum or hazardous materials that result in free product floating on the water surface. Included are methods for confining, treating, and cleaning up a floating product spill under varying

Exhibit 1.6-24

Initial Response to Free Product on Water Surface

GENERAL PROCEDURAL GUIDELINES

	Guideline		Comment
#	Notify other response agencies, if they are not already on the scene.	#	Familiarize yourself with all existing agreements between your region and other response agencies.
		#	Seek assistance in the interest of safety.
#	Ask the police (if they are not already on site) for assistance, as necessary, to control traffic and to keep public from area.		
#	Identify the material(s) spilled and determine the associated hazards.	#	The spiller may be able to provide information on the spilled substance (i.e., type, quantity, health hazards, flammability, reactivity).
		#	This information can also be obtained from the following sources:
		--	Material Safety Data Sheets kept on file at the State Emergency Response Commission (SERC), Local Emergency Planning Committee (LEPC), and/or at the local fire department;
		--	the shipping manifest document that is required to be kept in transport vehicles;
		--	CHEMTREC, a technical assistance center operated by the Chemical Manufacturers Association (CMA) that provides guidance related to chemical transportation emergencies as well as other chemical emergencies. CHEMTREC provides information on emergency response to different chemical releases. Additionally, CHEMTREC serves as a liaison between the on-site personnel and the chemical manufacturer and/or shipper, who can provide further guidance on the product and its properties. CHEMTREC can be contacted by dialing 1-800-424-9300.

Exhibit 1.6-24

Initial Response to Free Product on Water Surface

GENERAL PROCEDURAL GUIDELINES
(continued)

	Guideline		Comment
#	Determine the extent of the hazard and the level of health & safety protection needed by spill responders.	#	If an initial reading can be obtained without entering the contaminated area, monitor the air around the spill with an oxygen meter and combustible gas indicator (CGI) to determine if a fire or explosion potential exists and to determine if there is an oxygen-deficient atmosphere that will necessitate use of self-contained breathing apparatus (SCBA). Use a Photoionization Detector (PID) to detect the presence of unsafe concentrations of certain organic or inorganic compounds.
		#	If an initial reading cannot be obtained without entering the contaminated area, let other emergency response person on the scene (e.g., fire department, spill contractor) with requisite body and respiratory protection (SCBA, chemical-resistant clothing, boots and gloves) enter the area for this purpose.
		#	If water samples can be taken safely, take water samples to determine the contaminant concentrations.
#	Eliminate all ignition sources, if flammable or combustible materials are spilled and the danger of explosion exists.	#	Establish a "No Smoking" policy at the incident scene.
		#	Eliminate all flame sources and remove equipment and tools that could create sparks, or render them inoperable if they cannot be easily removed from the site.
		#	Look around to see if there are any other possible ignition sources (e.g., friction, static electricity). These may not be too obvious (e.g., any place where two pieces of metal may come in contact). Make sure that all persons on site are aware of these potential sources.
		#	Use only explosion-proof equipment and non-sparking tools.
		#	Notify the electric and/or gas companies to cut off service from a location remote from the hazardous area. Supply the site with a portable power source, if needed.
#	Ensure that public protection actions, including evacuations and temporary relocations, are carried out by the appropriate authorities.	#	Fire and health departments have authority to make evacuation decisions. (See Part 1, Section 3.1, for explanation of BSPR policy on evacuations.)
#	Coordinate activities among all response agencies to ensure maximum safety of response personnel and local population.		

Exhibit 1.6-24

Initial Response to Free Product on Water Surface

GENERAL PROCEDURAL GUIDELINES
(continued)

Guideline	Comment
# Protect environmentally sensitive areas (drinking water intakes, fishing areas, beaches, and wildlife sanctuaries).	# Place booms in these areas and/or divert the flow of spill away from these areas. # If the spill has impacted or may impact fish or wildlife, call the Regional Fish and Wildlife Office. # If the waterway is navigable, contact the Coast Guard. They will divert all traffic from the contaminated area. # If the contamination impacts or potentially impacts a recreational area, contact the health department.
# Stop the flow from the original leaking container (if possible). For more detailed information on this topic, see Part 1, Section 3.2, Confining and Containing Releases. # Monitor and evaluate clean-up operation to determine effectiveness.	
# Collect spilled substance from water surface (before or after treatment in place) and dispose of properly.	# Use containers compatible with product. # Arrange for licensed hauler to remove and dispose of containerized waste materials at permitted facility (see Part 2, Section 3, Proper Management of Spill Residuals and Debris).

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE

Confine the spill as close as possible to the source of the release. Evaluate these factors to determine the best alternative for spill confinement:

(1) **Type of spill**: (a) floating vs. sinking materials; (b) hazardous vs. non-hazardous materials; **(2) Location of the spill**: (a) type of waterway affected; (b) accessibility for clean-up activities; **(3**) **Weather conditions** (i.e., high winds); **(4) Type of current**: (a) fast versus slow; (b) turbulent versus nonturbulent; **(5) Amount of the spill**.

Once all relevant factors are identified, work with (not against) the specific conditions of the spill. For example, in a high wind and swift current situation, identify the direction in which the spill is moving, then try to contain the spill at the location where you expect it to hit the shore.

	Situation	Strategy/Technique	Advantages	Disadvantages
A.	The Spill Floats on Water.	1. Basic tools for confinement of a spill that floats on water include: # Containment booms # Spill herding equipment (i.e., fire hose sprays or motor boat propwash used for directing spilled substances into a confined area). # Sorbent materials # Deployment boats. 2. Select the best site for boom/ sorbent deployment (if there is time). # Analyze wind and current conditions to determine where the spill is heading.		

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
A. The Spill Floats on Water. (continued)	# Based on this information, use a U.S. Geological Survey Map or other map of the area to select possible locations for deployment. Choose backwater areas (if possible), since it is relatively easy to confine a spill in these areas. If this is not possible, choose an area with a very low current. # Select a location that is easily accessible by road; there should be no obstruc-tion of fences, drainage ditches, etc. # Select a location that would involve a minimum of traffic interruption both on land and water. # Check prospective sites before making a final decision.		

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
A. The Spill Floats on Water. (continued)	# Water depth may be a factor in selection if: (a) the stream is too shallow for effective booming; (b) the contaminated area is in a tidal area; or (c) recovery equipment to be used draws several feet of water.		
	3. Deploy the boom as near as possible to the source.		
	# Depending upon the situation, booms can be deployed manually (i.e., by workers wearing life jackets, wading boots, and appropriate protective gear when the spill is small and located close to the shoreline) or with the use of boats. Wear life jackets.		If the spilled substance is toxic or presents other significant health hazards, it may be too dangerous to place people into the water to deploy the boom.
	# If boats are used, booms can be towed in place or placed across the channel by hauling a line.		

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
A. The Spill Floats on Water. (continued)	**#** When towing at higher speeds, use an extra length of line since a boom may have a tendency to twist. **#** Maneuver slowly to ensure that the boom will not slide across the surface instead of following in place. **#** Exercise caution to avoid snags and obstructions that may damage the boom. 4. Attach the boom in its proper place with guide stakes on the shore(s), and in the water, if possible. **#** Check these stakes frequently to ensure that the boom is moored properly and kept in proper position. **#** Booms should always be lighted with flood lights at night, (especially in navigable areas) so that water traffic can steer clear of the booms. 5. Place sorbent materials on the upstream side of the boom. These sorbents will assist in confining the spilled substance as well as cleaning up (i.e., absorbing) the substance. Cleanup of the confined substance is discussed in Exhibit 1.6-36.		Booms require constant attention for the following reasons: **#** Changes in wind and current conditions can adversely affect the boom and its moorings. Seepage from underneath the boom may occur. **#** Floating debris can damage the boom. Boats may have to go out and pick up pieces of floating debris. **#** In high-traffic areas, it is possible that some traffic will not notice the presence of the boom.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
B. Spills in Slow Moving, Narrow Streams.	1. Use Underflow Method (see Exhibit 1.6-26). Install a pipe through an earthen-berm built on the stream bed to contain insoluble floating substances and to allow uncontaminated water to flow by.	Localizes spill and prevents spreading and dispersion of substance. Quick and easy to deploy. Material and equipment are common and generally available. Safe to handle by untrained personnel when appropriate safeguards are employed to protect them from hazards.	May be ineffective in adverse weather conditions (e.g., rain). Ineffective in turbulent conditions behind the berm. May not eliminate percolation. Pipe must be correct diameter for stream flow. Deployment is possible in faster- moving streams, but may be difficult.
	2. Use U-Shaped Boom (see Exhibit 1.6-27). Stretch the boom across the channel, allowing enough slack so that the boom will bow out into a widened "U" shape once moored on both sides of the shore. # Attached submersible skirts to the boom in order to prevent seepage of the product underneath the boom, if necessary. # Place loose sorbent materials on the upstream side of the boom in order to help contain the spill, if necessary.	Effectiveness is increased with use of a submersible skirt and/or sorbent material. No secondary effects to the environment. Safe to handle. Prevents spreading of the spilled substance.	Effectiveness is limited to streams with very slow currents (2 to 3 mph). Will not eliminate volatilization. Trained personnel and special equipment necessary. Vulnerable to damage by certain high-solvency hazardous substances. Prone to hydroplane in high wind conditions. May be difficult and time-consuming to obtain and deploy. More troublesome to use in navigable waters.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
B. Spills in Slow Moving, Narrow Streams. (continued)	3. Install a fine-meshed net around an insoluble floating substance.	May be used effectively for spill removal by towing. Localizes the spill. Safe to handle by untrained personnel. No secondary effects to the environment.	Materials with proper mesh size may not be readily available. Ineffective in strong wind and current. Does not reduce volatilization.
	4. Stretch a flexible fiber-reinforced plastic curtain barrier with inflatable flotation collars across the channel. Place sorbent materials in the upstream side of the barrier, if necessary.	Localizes spill. Safe to handle by untrained personnel. No secondary effects to the environment.	Limited to non-navigable waters. Vulnerable to damage by certain chemicals. Ineffective in strong winds and currents. Installation difficult and time-consuming in water deeper than 25 feet. (Deployment requires approximately five persons.) Materials are generally not available for quick response.
	5. Construct a Straw Skimming Installation (see Exhibit 1.6-28). Stretch a wire fence across a stream and secure it on both shore lines and to stakes distributed at intervals across the stream bed. Trim the bottom of the fence before deployment so that it fits snugly to the contour of the stream bed. Place bales of straw on the upstream side of the fence.	Localizes spill. Safe to handle by untrained personnel. No secondary effects to the environment. Materials are easy to obtain.	Use is limited to small streams or drainage ditches. Stream banks must be of sufficient height. Current must be relatively slow. Limited to non-navigable waters. Loose straw will allow leakage.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
B. Spills in Slow Moving, Narrow Streams. (continued)	6. Anchor baled or loose straw boom with a 2 x 4 piece of wood and rope to a road bridge (see Exhibit 1.6-29).	Very effective in certain situations. Makes use of a pre-existing barrier.	Loose straw will allow leakage. Must be monitored closely and pumped out regularly.
	7. Anchor baled or loose straw boom with a 2 x 4 piece of wood (or steel stakes driven through the bales) to circular culverts (see Exhibit 1.6-30).	Very effective in certain situations. Makes use of a pre-existing barrier.	Loose straw will allow leakage. Must be monitored closely and pumped out regularly.
	8. Apply air with diffusers or air compressors to the water surface to act as a barrier to insoluble floating substances.	Necessary equipment is common and generally available. Navigation is not impeded. Prevents spreading of spill. Safe to handle. No secondary effects to environment.	May be ineffective in adverse wind conditions or strong currents. Ineffective in deep water. Ineffective for large, thick-layered spills. Usually needs to be pre-installed at the spill site. Is rarely used in emergency response. Obtaining proper diffusers and compressors may be difficult.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
C. Moderate to Large Spills in Fast-Moving, Narrow Streams.	1. Use a deflection boom (see Exhibit 1.6-31).	Considered to be one of the most effective means of confinement. No secondary effects to the environment. Safe to handle. Prevents spreading of spilled substance.	Must have access to a significant amount of boom sections. Extent of use for one boom is limited to only a couple of thousand yards. May not eliminate volatilization. Trained personnel and specialized equipment are needed. May be difficult and time-consuming to obtain and deploy. Vulnerable to damage by certain high-solvency hazardous substances. Prone to hydroplane under high conditions.
	# If the water is navigable or the boom cannot stretch across the channel: (a) Determine in what part of the stream the spilled substance is flowing (i.e., side, middle, or some combination); (b) Deploy the boom at the best location such that the most amount of spilled material can be confined;	Should not impede navigation since it does not stretch across the entire width of the river.	

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
C. Moderate to Large Spills in Fast-Moving, Narrow Streams. (continued)	(c) Tie boom to the shoreline at one end and tow it upstream at approximately a 30E angle until the leading edge of the boom is about 1/4 of the way across the width of the area to confine; (d) Attach the end of the boom to a mooring line to maintain the proper configuration to herd the spilled substance; (e) Place a second boom downstream and parallel to the first boom such that its leading edge is far enough out to catch spilled material that was not captured by the first boom; (f) Place subsequent booms in the same fashion (approximately three or four booms should be enough; (g) If the booms cannot capture all of the spill (i.e., the boom's leading edge is not far enough out in the stream to catch all of the flow), consider placing booms in the same manner on the opposite shoreline.		

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
C. Moderate to Large Spills in Fast-Moving, Narrow Streams. (continued)	# If the water is not navigable and the boom can stretch across the channel: (a) Tie the boom to the shoreline at the intended collection point and tow the boom upstream at approximately a 30E angle; (b) Moor the boom on the other side of the shore. The boom should not have enough slack to bow out into a "U" shape; (c) In small streams, additional booms might be used to catch any entrained material. One of these should be deployed just downstream of the first boom and others at intervals of 1/4 to 1/2 mile downstream.		Navigation is impeded.
	2. Use a Gelling Agent. # Disperse the gelling agent onto the spill with shovels, hand pumps, dry chemical fire extinguishers, or sandblasters from shoreline or boats. # Persons applying this product should be upwind of the location of application.	Compatible with a variety of substances. Innocuous thickening; no exothermic reaction. May prevent vaporization. Rapid reaction rate.	Equipment and material may not be readily available for quick response. Trained personnel required for application. May be ineffective in adverse wind conditions. Use of gelling agents is regulated under federal, state, and, possibly, local laws; check these laws before using gelling agents.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
C. Moderate to Large Spills in Fast-Moving, Narrow Streams. (continued)	# Consider combining with a fire or vapor suppression foam to reduce any fire hazard, unless current is too swift for foam build-up. # Combine with other confinement methods, in some cases.		
D. Spill in a Large, Fast-Moving River.	Prospects for confining the spill are not good, unless it flows into a natural confinement area at a location along the shoreline. Use combination of the confinement techniques discussed for other situations, as appropriate.		
E. Spill Trapped Under Ice.	1. Allow the product to float to a downstream area free from the ice, if the water body has a current and ice area is limited. 2. If the above situation is not applicable. (a) Determine the extent of the spill mass with ice borings;		May require that people walk onto the surface of the ice. Rescue contingencies must be established.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
E. Spill Trapped Under Ice. (continued)	(b) Construct a ditch of approximately 1 inch width around the periphery of the spill. The depth of the ditch should be down to water level. (c) Construct a wooden boom by placing 4 x 8 sheets of marine plywood into the ditch around the periphery of the spill. (d) Prop the plywood in place, and allow it to freeze into position. (e) Heat the spilled substance (except for flammables) if it freezes or becomes too viscous for skimming. A Salamander heating unit, which can be found at most petroleum transfer facilities, can be used for this purpose. (f) Skim the product from the water once the ice in the boomed area has melted. (g) Periodically drill borings in nearby ice and sample water to determine if any pollutants are escaping from the boomed area.		

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
F. Spill Covers a Large Area Where the Current Is Very Slow.	1. If spill is near shoreline, use a boom in order to contain the spill. (a) Moor one end of the boom to the shore. (b) Tow the loose end around the periphery of the slick. (c) Slowly, tow into shore as much as possible.		
	2. If the spill is near center of waterway, determine direction of the wind and current. If the situation permits, wait for the spill to reach shore, then use containment boom to surround and contain it for collection.		
	3. If you have very little current or wind, use an encircling boom (see Exhibit 1.6-33). (a) Deploy the boom such that it completely encircles the spill. (b) Shorten the boom in order to effectively contain the spill to a smaller size.	Can be very effective in certain cases. No secondary effects to the environment. Safe to handle. Prevents spreading of spill. Should not impede navigation.	Extent of use is limited to only a couple of thousand yards. May not eliminate volatilization. Trained personnel and specialized equipment are needed. May be difficult and time-consuming to obtain and deploy.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

	Situation		Strategy/Technique	Advantages	Disadvantages
F.	Spill Covers a Large Area Where the Current Is Very Slow. (continued)	(c)	If commercial booms are not available, make shallow barrier made from rope, an air-inflated fire hose, logs, etc.	Can be very effective in certain cases. Logs can be more effective than hawsers and hoses since they ride deeper in the water.	Prone to hydroplane under high wind conditions. Heavy currents and wind or current shifts may render this method ineffective. Wind, current action, or additional spill volume entering the area inside the barrier may cause the depth of the material to increase and pass under the containment device. Logs can be difficult to handle Logs can be ineffective in rough water because they may pitch when perpendicular to the crest of a wave. Logs cannot be easily fastened to one another to form a continuous boom.
G.	Spill in a Smaller Water Body that is Connected to Stream or River.	Construct a dike or berm at the location where the smaller water body begins flowing into the stream.		Materials and equipment are generally available. Safe to handle by untrained personnel. Localizes the hazard by preventing diffusion and spreading of the spilled substance.	Subject to unstable overflow conditions. May not eliminate percolation or volatilization. Limited to specific topographical situations. May require heavy earth-moving equipment.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
H. Off-Shore Oil Spill.	U.S. Coast Guard takes the lead role. Coast Guard will determine if and where the spill will come ashore. They may choose to let the spill disperse at sea. To confine spill, they will use an encircling boom.		Whereas the USCG may wish to allow the spill to disperse, NYS law requires that spills in state waters be confined.
I. Spill Sinks in Water.	1. Not all spills that sink in water will require confinement. Some substances sink close to the source of the release and are not light enough to be carried by the current. 2. For spills that sink and will require confinement in slow- moving streams: (a) Use Containment Curtains. These are flexible mesh skirts of varying grades that are supported by foam jacket floats. The permeable mesh allows the water to flow through but retains the spilled substance. # Bring curtain in its container by boat to location where it will be deployed.	Can be highly effective. Costs are moderate relative to other confinement measures.	Limited to spills that are relatively confined. Cannot be used effectively in swift currents and high wave action. Curtain needs periodic repositioning. Trained personnel are required. Deployment may be time-consuming.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
I. Spill Sinks in Water. (continued)	# Deploy curtain directly into the water from its shipping container by pulling one end away by a second boat. # Move the curtain into position. # Increase the weight of the curtain ballast (with weights, chains) to sink it in-place. # Anchor the curtain to the bottom.		
	(b) Alternatively, construct a trench (by dredging, usually) in a stream bed to trap immiscible substances by gravity. # Do not use natural depressions for containment purposes because the currents that created the depression would also tend to remove the spill mass.	Costs are low relative to other confinement techniques. Spilled materials may be recovered in a nearly unadulterated, easily recoverable form. Prevents spreading along the bottom of the stream. Adequate construction time, especially given advance notice of an upstream spill for a downstream excavation.	Impractical in spill situations when the bed is extremely hard or soft, or granular. Limited to areas with a gentle current so that equipment can be maneuvered effectively. Impractical in areas with high sediment transport (trenches could be filled with non-contaminated materials).

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
I. Spill Sinks in Water. (continued)	# Use underwater ploughs to excavate trenches up to 10 feet deep and to excavate trenches in silty clays. # Use submersible trenchers when excavating in very deep waters (up to 650 feet). # Excavate downstream of a spill and perpendicular to the direction of the flow. # Dig trenches completely around a spill in harbors and shallow open water. # Dig wide trenches to contain substances with low specific gravity and of small particle size; dig narrow ones to contain heavy substances and those of large particle size.		Impractical for extensive areas of contamination. May not eliminate percolation. Limited to specific topographic situations. May need divers (who may be difficult to find). Use of mechanical equipment may stir up contaminants back into the water column causing further downstream contamination.

Exhibit 1.6-25

Initial Response to Free Product on Water Surface

STRATEGIES & TECHNIQUES FOR SPILL CONFINEMENT ON WATER SURFACE
(continued)

Situation	Strategy/Technique	Advantages	Disadvantages
I. Spill Sinks in Water. (continued)	3. For spills that sink in slow-moving, small ditches, creeks, and streams:		
	(a) Construct an underwater dike or berm to contain insoluble sinking materials and allow clean, lighter water to flow over (see Exhibit 1.6-34).	Localizes spill and prevents spreading of the substance along the stream bed. Relatively quick and easy to deploy. Materials and equipment are common and generally available. Costs associated with containment dikes are low to moderate relative to other confinement techniques.	Ineffective in fast-moving streams with strong current and high flow. Ineffective in adverse weather conditions. Turbulence behind the berm may render the method ineffective. May not eliminate percolation. Effective placement is hampered by deep water depths. Compaction equipment and monitoring of placement may be needed to ensure that a continuous dike of adequate structural stability is created. Any construction activities in water require notification to the NYSDEC Regional Permit Administrator.
	# Use earth material, sand bags, etc. that are sufficiently coarse to resist erosion and downstream transport. Use conventional excavation and earth-moving equipment for installation. Manual placement is possible in small-scale, shallow applications.		
	# Extend dike or berm across a stream channel, perpendicular to the direction of flow.		
	(b) Alternatively, construct cofferdam to cut off a section of the stream and to divert partial or full water flow through a pipe of an excavated channel so that it re-enters the stream channel at a point farther downstream (see Exhibit 1.6-35).	Localizes spill and prevents spreading of the substance. Materials and equipment are common and generally available.Ineffective in fast-moving streams with strong current and high flow. Any addition of permanent fill or bulkheading to water may require a Stream Protection Permit.	

I. Spill Sinks in Water. (continued)		# Construct dam of soil, sheet piling, earth-filled sheet pile cells, or sand bags. # Various configurations are useful and depend on the specific situation and desired effect.		
	4. For spills that sink in slow-moving, but deep waters:	# Create a curtain of rising air bubbles that spreads laterally in the water body. Artificially induced water currents are generated by the air curtain that counter the normal currents, thus confining the spilled substances. # Lay a weighted perforated header pipe on the bottom in a configuration similar to that employed for containment curtains. # Compressed air is transmitted from blowers or air compressors through a flexible feed line to the header pipe. # Air forced through the header pipe is released to the water column through the perforation.	Can be deployed quickly; particularly well-suited for emergency response. Well-suited for use in waters with boat traffic because their presence does not impede navigation. Costs are moderate relative to other containment techniques.	Not effective in water bodies with substantial turbulence or current. Not as efficient in shallow water because greater volumes of air are necessary to maintain an effective curtain.

Exhibit 1.6-26

The Underflow Method

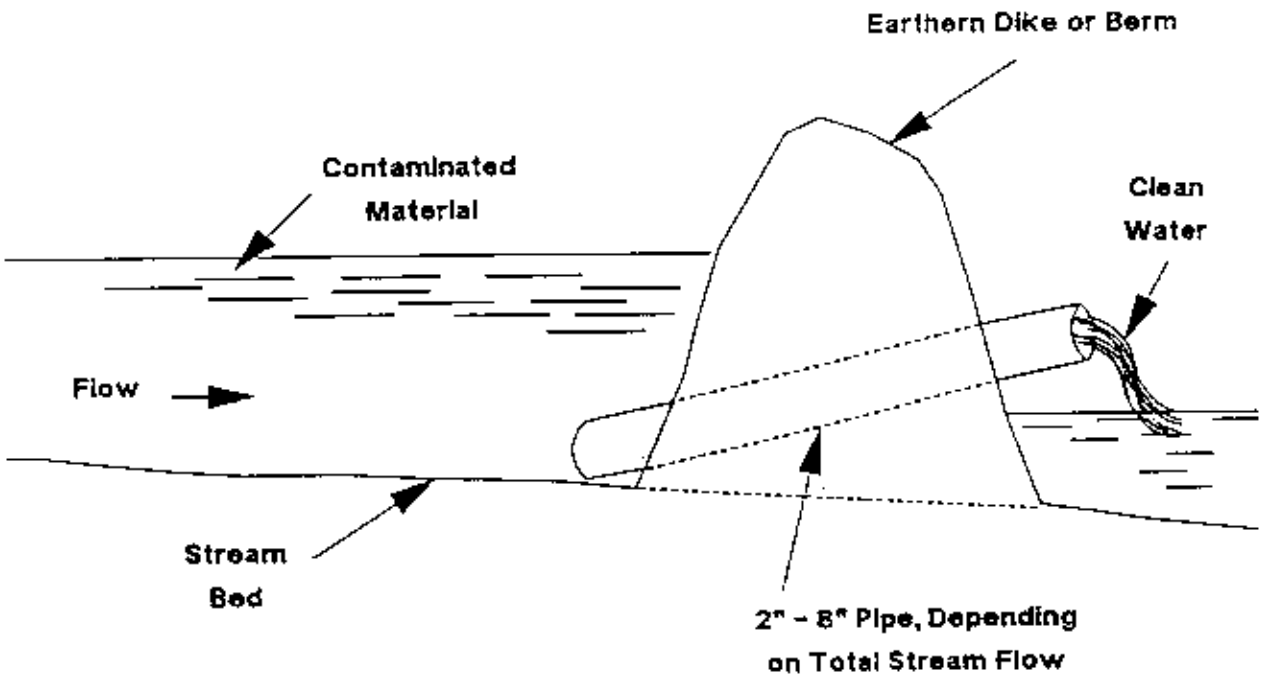


Exhibit 1.6-27

U-Shaped Boom

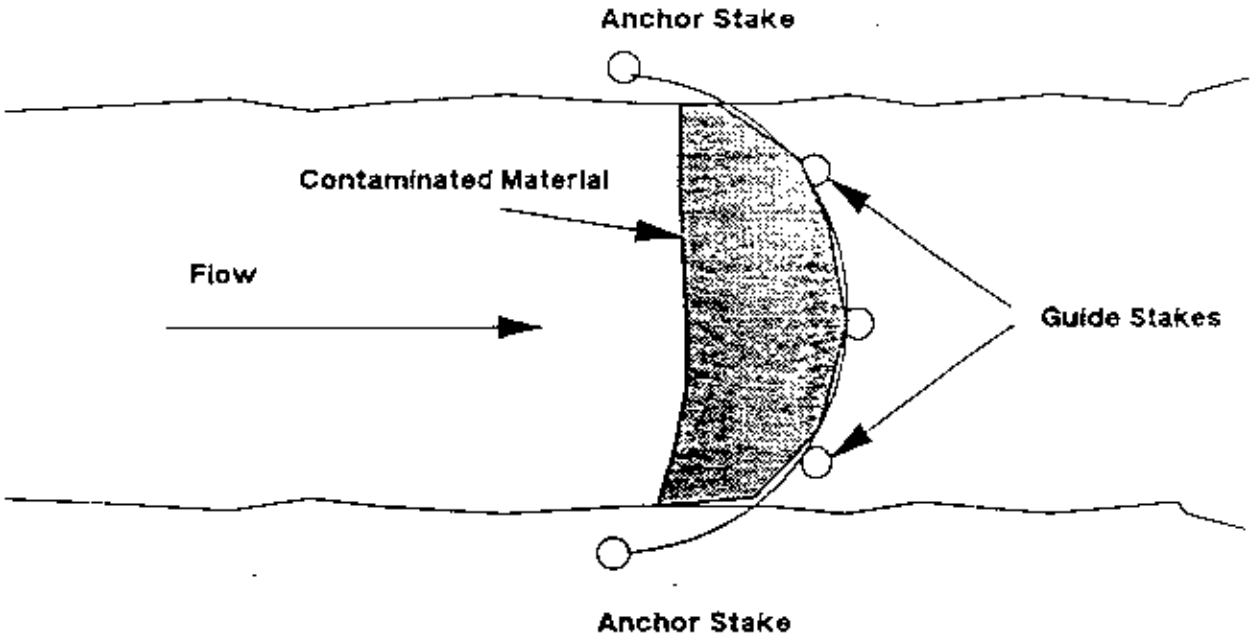


Exhibit 1.6-28

Straw Skimming Installation

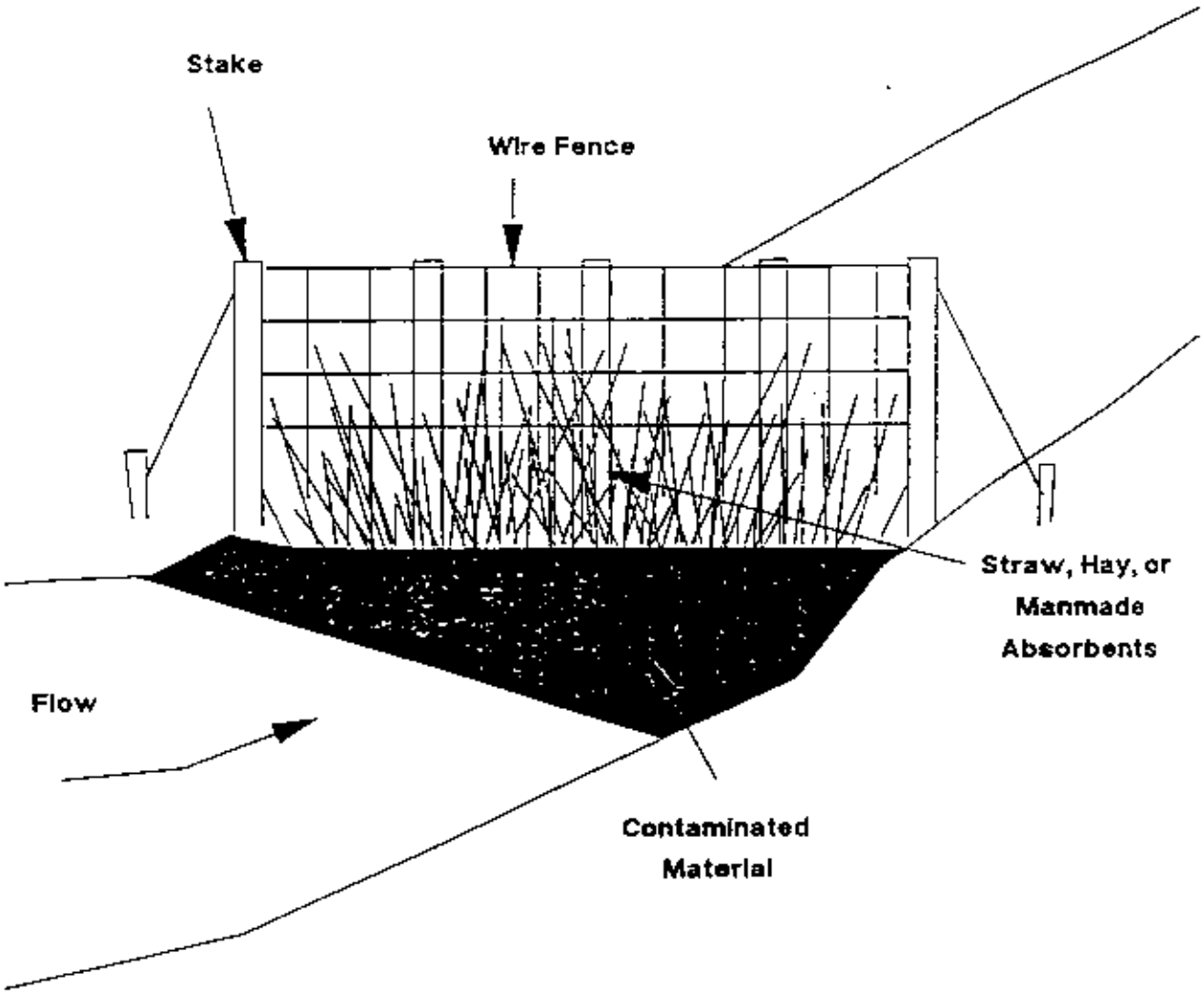
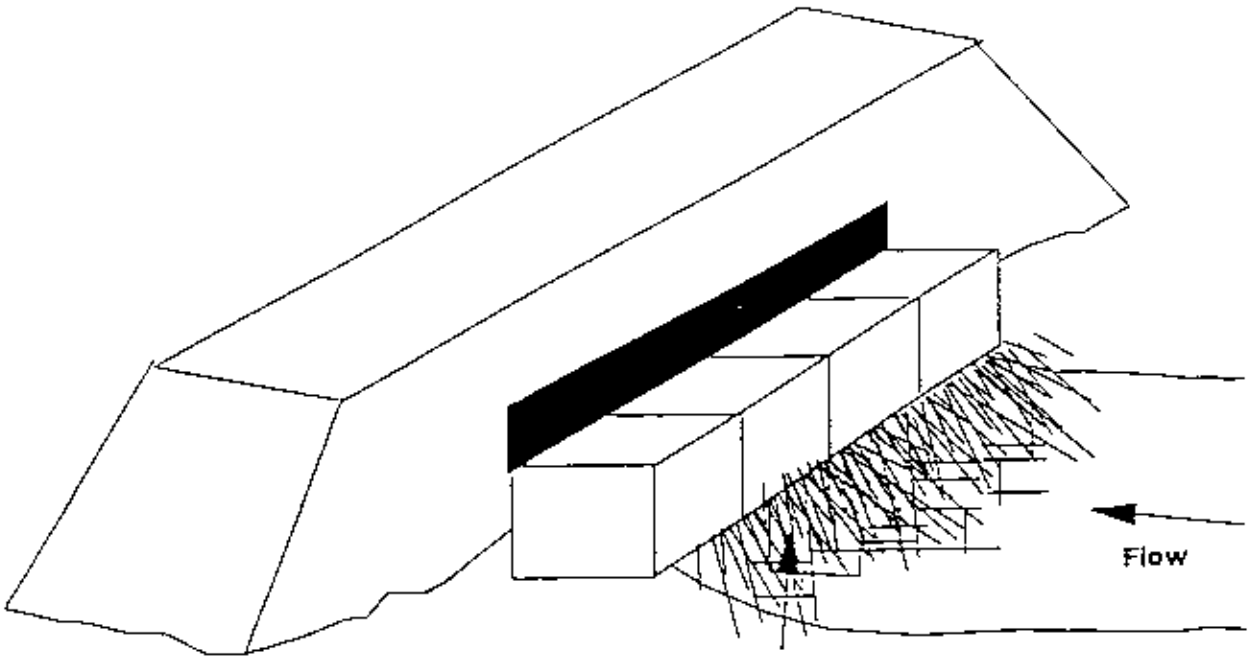


Exhibit 1.6-29

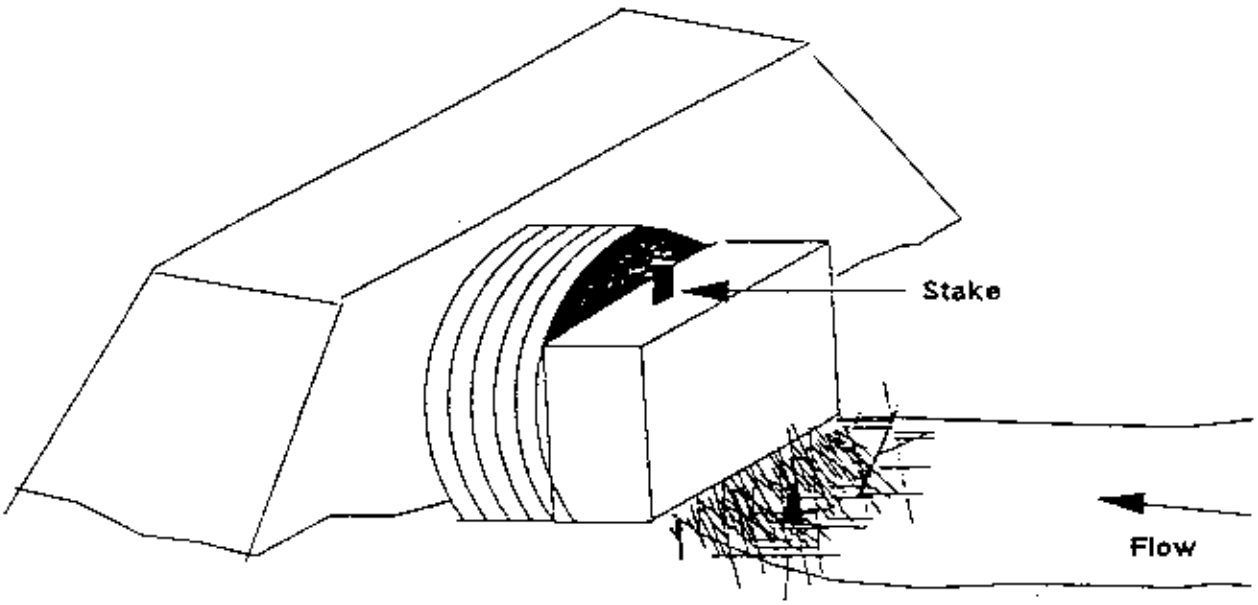
Straw Boom Attached to Road Bridge



Loose Straw or Manmade Absorbent and Contaminated Materials

Exhibit 1.6-30

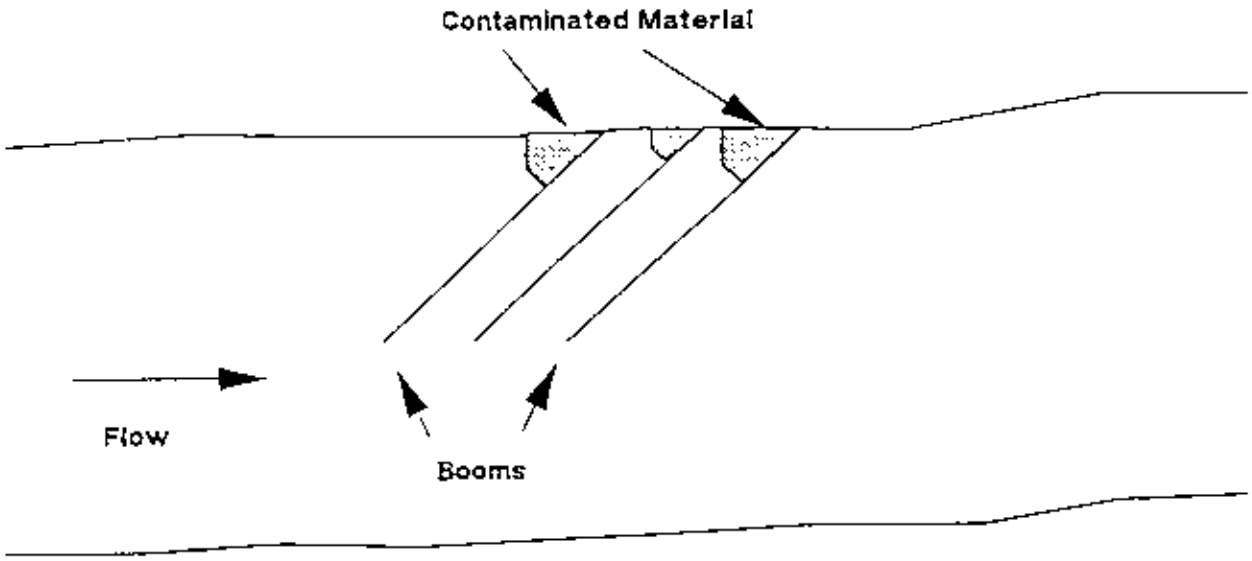
Straw Boom Attached to Circular Culvert



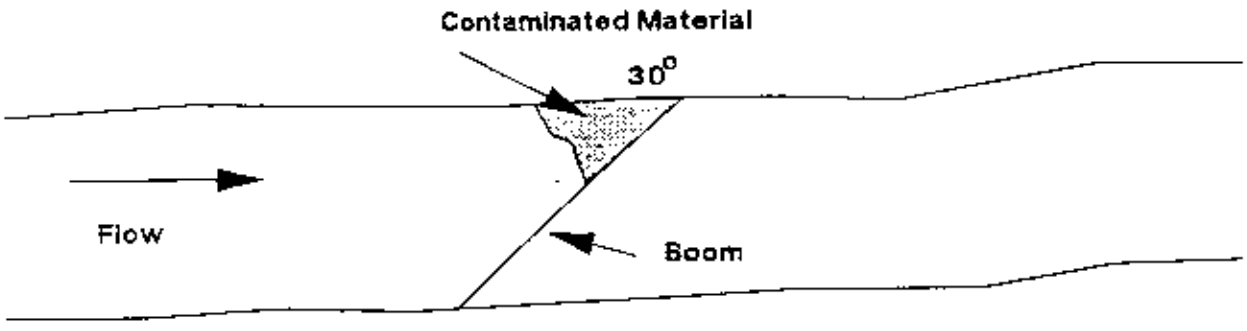
Loose Straw or Manmade Absorbent and Contaminated Materials

Exhibit 1.6-31

Deflector Booms



Boom That Cannot Reach Across Width of Stream



Boom That Can Reach Across Width of Stream

Exhibit 1.6-32

Weir

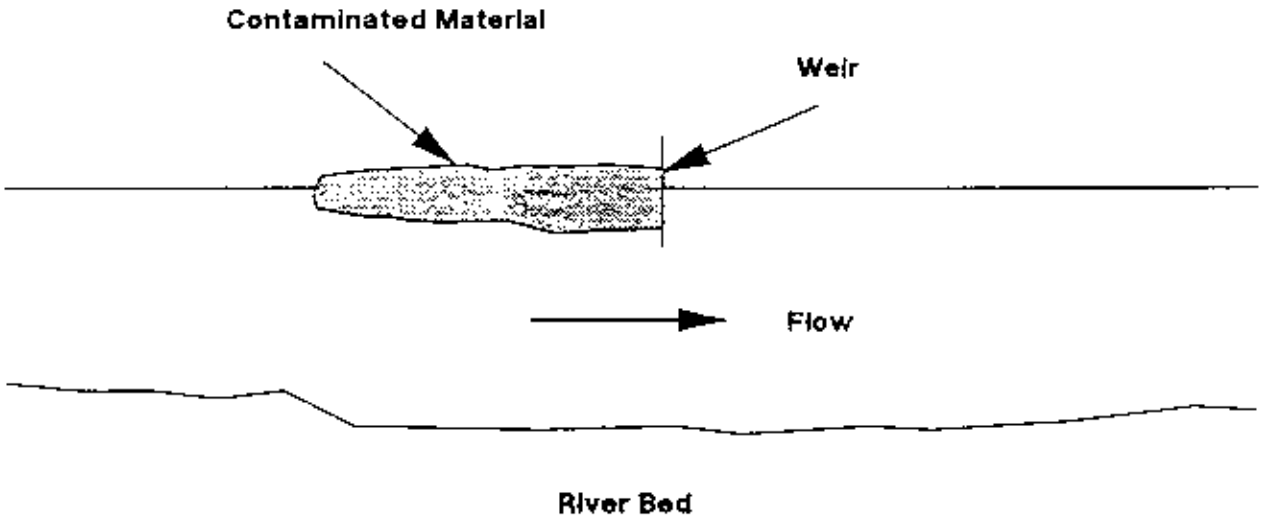
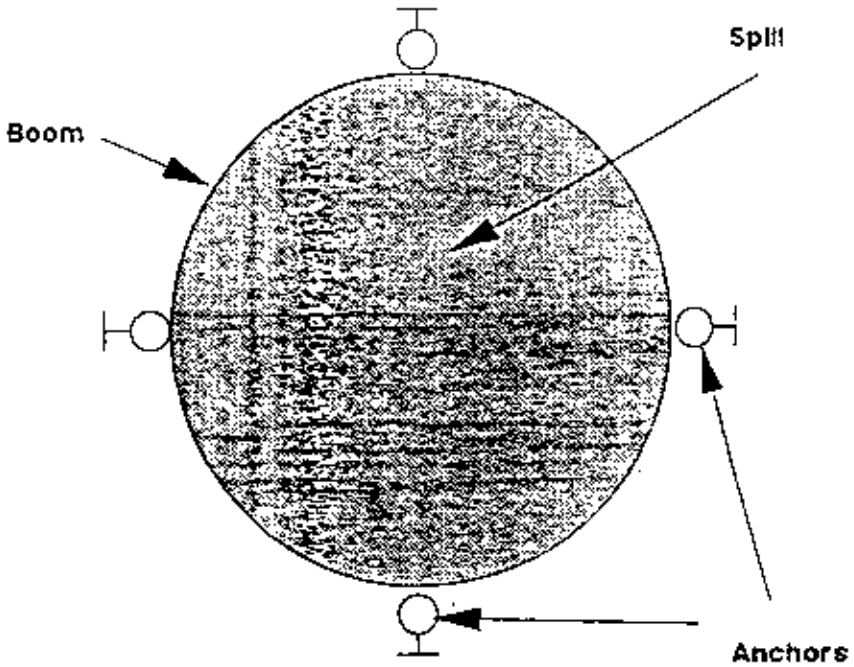


Exhibit 1.6-33

Encircling Boom



Top View

Exhibit 1.6-34

Overflow

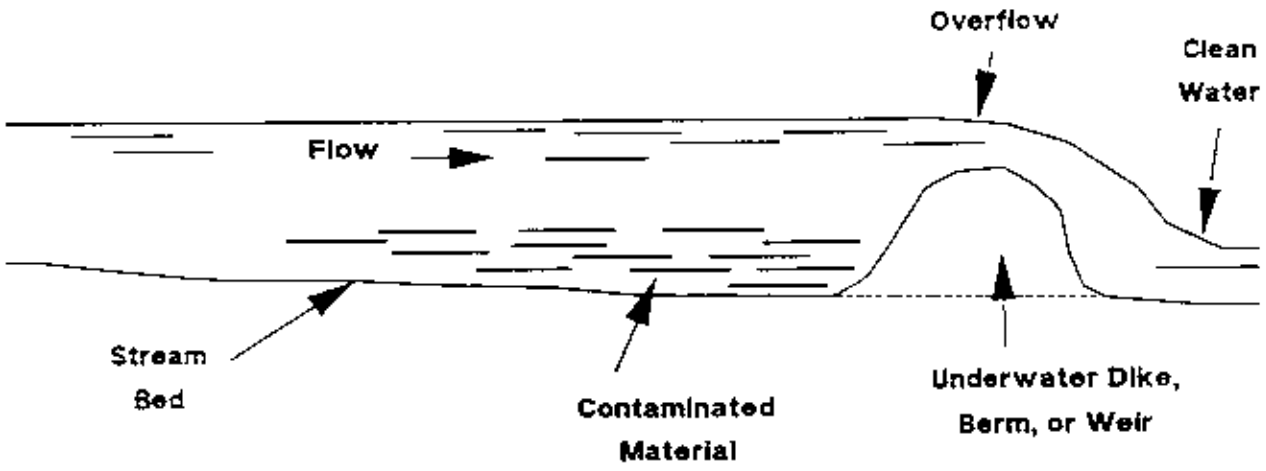


Exhibit 1.6-35

Streamflow Diversion Using Single Cofferdam

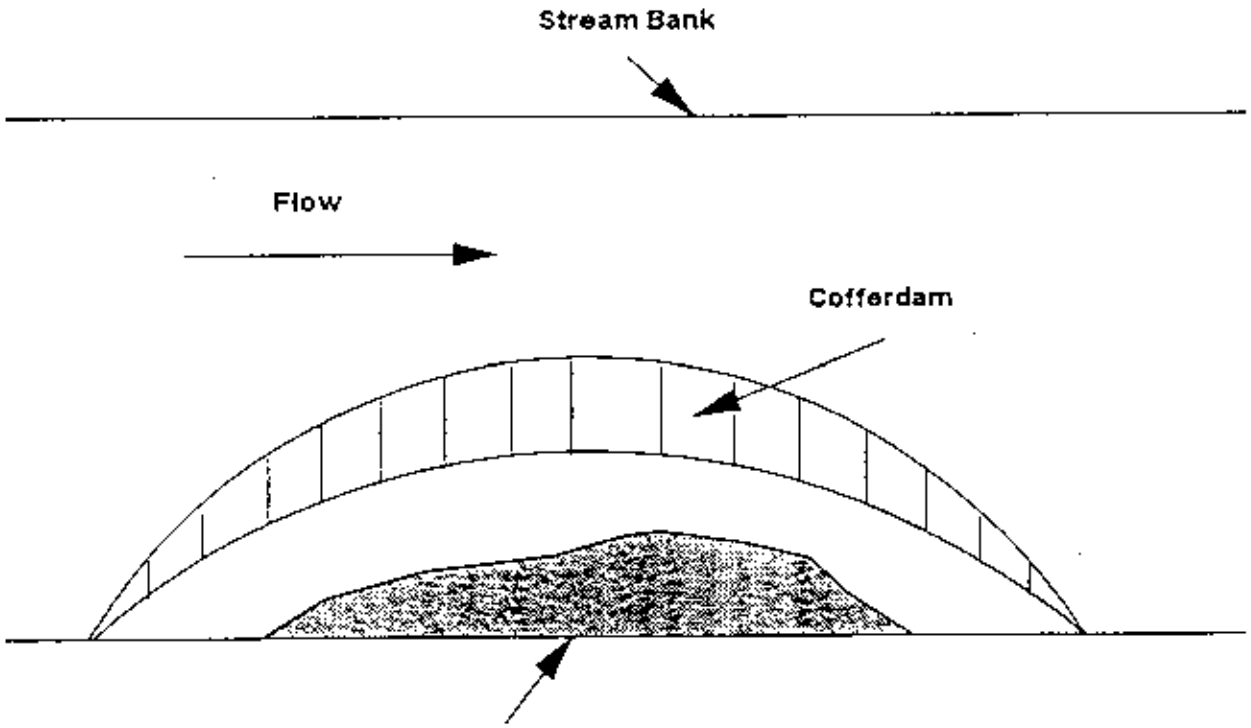


Exhibit 1.6-36

Initial Response to Free Product on Water Surface

ADVANTAGES & DISADVANTAGES OF ALTERNATIVE SPILL CONFINEMENT AND CLEAN-UP EQUIPMENT

Spill Confinement Equipment/Material	Description/Comment	Advantages	Disadvantages
A. Containment Booms	# Buoyant, sausage-like apparatus used to confine a spill of a liquid material that is floating on a water surface. Boom may be constructed of a sorbent material, in which case it will also absorb a portion of the spilled substance.	# Very effective in slow-moving waterways where relative velocity of the current is less than 1.3 knots and the waves are less than 2.54 feet. # No secondary effects to the environment. # Applicable for a wide range of water body types. # Prevents spreading of spill.	# Extent of use is limited to only a couple thousand yards. # Effective only in slow or stagnant water. Otherwise material will be entrained by the current passing under the boom. # More expensive than makeshift booms. # Will not eliminate volatilization. # Trained personnel and special equipment needed to deploy boom. # Boom may be difficult and time-consuming to obtain and deploy. # Vulnerable to damage by certain high-solvency hazardous substances. # Prone to hydroplane even under high wind conditions. # May impede navigation. # Dangerous (i.e., flammable and/or toxic) concentrations of vapors may build up when a large spill is confined within or behind booms.

Exhibit 1.6-36

Initial Response to Free Product on Water Surface

ADVANTAGES & DISADVANTAGES OF ALTERNATIVE SPILL CONFINEMENT AND CLEAN-UP EQUIPMENT
(continued)

Spill Confinement Equipment/Material		Description/Comment	Advantages	Disadvantages
B. "Sausage" Boom	#	A buoyant boom covered with sorbent material that is composed of sections of 5 to 10 feet that are clipped together to attain the desired length for effective spill confinement.	# Flexible usage for many different spill types and sizes. # Can be effective in both containing and collecting the spill simultaneously. # Designed for long-term deployment; will not deteriorate or disintegrate when left in water for long periods.	# Relatively expensive. # Cannot be reused. # Requires connection of each link; can be time-consuming. # Must be disposed of as a hazardous waste.
	#	Must be disposed of after use.		
C. Harbor Boom	#	Boom is composed of polyurethane and comes in sections of varying lengths (i.e., 5 to 20 ft.), which can be connected to form one large continuous boom.	# Connection of sections is not involved. # Reusable. # Stronger than a "sausage" boom.	# Use is not as flexible as a sausage boom. # Must be cleaned after use.
	#	Often combined with a submersible skirt in order to prevent entrainment. Submersible skirt is a flat, plastic device that is approximately 1 to 2 feet in width and runs the length of the boom.		
	#	Often combined with sorbent materials (placed on the upstream side of the boom) in order to enhance confinement and also collect material.		
D. Makeshift Boom	#	Manufactured booms may not be available. In these cases, use readily available materials to construct booms.	# Construction items are readily available. # Items are usually inexpensive.	# Effectiveness is limited. # Secondary effects to the environment (i.e., straw floating downstream).
	#	Makeshift booms can be made from a variety of materials including the following:		

Exhibit 1.6-36

Initial Response to Free Product on Water Surface

ADVANTAGES & DISADVANTAGES OF ALTERNATIVE SPILL CONFINEMENT AND CLEAN-UP EQUIPMENT
(continued)

Spill Confinement Equipment/Material	Description/Comment	Advantages	Disadvantages
	-- air-inflated fire hoses (especially suited for containing a thin layer of a substance on the water surface) -- logs -- straw -- inflated tires -- rope hawsers.		
E. Spill Herding	# Fire hose sprays or propwash are used to direct spilled, insoluble materials into a confined area (i.e., boomed area).	# Necessary equipment is common and generally available. # Localizes the spill. # Safe to handle. # Quick and easy.	# May be ineffective in adverse wind conditions or strong currents. # Suitable confinement area must be available. # Turbulent flow may produce some chemical distribution.

Exhibit 1.6-36

Initial Response to Free Product on Water Surface

ADVANTAGES & DISADVANTAGES OF ALTERNATIVE SPILL CONFINEMENT AND CLEAN-UP EQUIPMENT
(continued)

Spill Confinement Equipment/Material	Description/Comment	Advantages	Disadvantages
F. Sorbent Materials	# Use to ad/absorb the spilled material once it is confined. # Is often used in conjunction with a boom, and with other collection techniques (e.g., pumping) in order to ensure complete cleanup. # Apply by hand or with a pitchfork. May be able to blow particulate in-place with a mulcher, if practicable.	# Materials are generally inert; safe to handle. # May reduce vaporization. # Removal is relatively simple and can be accomplished quickly. # Immobilizes and collects the spill.	# Materials and equipment may not be readily available for quick response.
G. Manufactured Sorbent Materials	# Can be composed of a variety of materials, including the following: -- amorphous silicate glass foam -- polypropylene -- activated carbon -- polyurethane.	# Many sorbents absorb several (13 to 28) times their own weight. # Many sorbents repel water while ab/adsorbing contaminants and remaining afloat. # Many sorbents will not deteriorate, disintegrate, nor sink when left in water for months. # Some sorbents resist flammability. # Much more effective than clay sorbents. # Very useful when combined with a wire fence as a barrier to filter out the contaminant.	# More expensive than clay sorbents. # May not be as readily available as clay sorbents.

Exhibit 1.6-36

Initial Response to Free Product on Water Surface

ADVANTAGES & DISADVANTAGES OF ALTERNATIVE SPILL CONFINEMENT AND CLEAN-UP EQUIPMENT
(continued)

Spill Confinement Equipment/Material		Description/Comment	Advantages	Disadvantages
G. Manufactured Sorbent Materials (continued)	#	Particulate sorbents can be spread manually or mechanically through a mulcher (if practicable) on open area of large spills.		
	#	Sorbent booms are recommended for confinement and absorption of large spills of light oil and long-term control of discharges in ditches, streams, rivers, lakes, and terminal docks and piers.		
	#	Sorbent pillows are recommended for handling of smaller quantities of light oil in confined spaces (e.g., sumps, catch basins, bilges, or settlement ponds).		
	#	Sorbent sheets/pads are useful in open areas, but particularly useful for congested areas (e.g., under docks, in shallow waters, rocky shorelines, marshes, and beaches where skimmers cannot be deployed).	Can also be used to wipe up contaminated docks, boats, and equipment.	
	#	Sorbent sweeps are recommended for sweeping rainbow sheens and other thin slicks on water where mechanical skimmers fail. The rope enclosed in the sorbent material facilitates sweeping action over large surface areas.	Can also be traced downstream from booms to remove escaping oil traces.	
	#	Sorbent rolls can be used on all sizes of spills and discharges. Can be cut to cover small areas.		

Exhibit 1.6-36

Initial Response to Free Product on Water Surface

ADVANTAGES & DISADVANTAGES OF ALTERNATIVE SPILL CONFINEMENT AND CLEAN-UP EQUIPMENT
(continued)

Spill Confinement Equipment/Material		Description/Comment	Advantages	Disadvantages
G.	Manufactured Sorbent Materials (continued)	# Sorbent pom-pons/snares are recommended for sorbing heavy crudes and fuel oils, and chemicals in freezing or subfreezing temperatures. Activated carbon is most often used with 2 x 4 pieces of wood and some type of netting (mesh or fence) to create a "filter box" that is placed across the entire width of a small stream.		
H.	Deployment Boats	# Booms can be deployed with a variety of types of boats. The most commonly used boats are small motor boats. If the spilled substance is flammable or combustible, use a boat with an explosion-proof engine. # Some companies manufacture pollution barges that both deploy the boom and pump up the spilled material for disposal.	# Some boats are specially manufactured and equipped for deploying booms.	

Exhibit 1.6-37

Initial Response to Free Product on Water Surface

TREATMENT METHODS FOR CONFINED SPILLS ON WATER SURFACE

Treatment/Method	Description/Comment	Advantages	Disadvantages
A. Neutralization	# Neutralization involves the reaction between a spilled substance and another chemical added to the spilled substance which serves to counteract the hazards that were present. # Due to the extreme importance of using the appropriate neutralizing chemical for a particular spill, your best course of action is to consult one or more of the following references for selecting the proper neutralizer: - CHEMTREC (1-800-424-9300) - Manufacturer (if known) of the spilled substance - Dangerous Properties of Industrial Materials 7th Edition, Sax, 1989. - Manual of Hazardous Chemical Reactions (NFPA 491M), National Fire Protection Association, 1986. - EPA Chemical Profiles for Extremely Hazardous Substances, Environmental Protection Agency, June 1988. # Apply recommended neutralizing chemicals to a spill to eliminate or significantly reduce the hazards. # Neutralization chemicals can be combined with fly ash (in certain cases) in order to reduce bubbling and frothing. Consult with a chemist before taking action. # Apply these chemicals from an upwind position.	# Reduces the initial high concentration. # Minimal auxiliary equipment required for small spills.	# May not be readily available for quick response. # Trained personnel and appropriate protective gear are necessary. # Possible secondary environmental hazard created if application is overshot and/or used in excess. # Effectiveness is reduced in water where proper mixing cannot occur. # Possible exothermic reaction causing bubbling, frothing, or spattering; may present hazards and/or difficulties with cleanup. # Specialized application equipment may be necessary for large spills (e.g., helicopters). # May have an adverse aquatic impact. # Possible synergistic effects between neutralizing agent and other natural materials present in the water.

Exhibit 1.6-37

Initial Response to Free Product on Water Surface

TREATMENT METHODS FOR CONFINED SPILLS ON WATER SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
B. Dispersion	# Apply uncontaminated water to the contained spill (if water is compatible) in order to dilute the effects of the spill. # Dispersion of a flammable liquid will reduce the generation of flammable vapors.	# Water supplies are readily available. # Immediate reduction of initial high concentration. # Equipment is common and generally available. # May reduce fire hazard. # Hazard may be reduced to such a degree that collection is rendered unnecessary.	# May not eliminate volatilization. # Application is limited to only certain chemicals and situations. # Potential contamination of water used for drinking, recreation, industry, agriculture, or navigation.
C. Encapsulation	# Cover the floating substance with a plastic sheet, tarp, or close-packed sorbents. Best used in combination with booms.	# Safe to handle by untrained personnel. # No secondary effects to the environment. # Materials are common and generally available. # Reduces vapor hazards. # Good as a short-term solution.	# Some materials are vulnerable to damage from certain chemicals. # Plastic sheet must be cleaned promptly after use (if it is to be reused); may present problems in cleanup and disposal. # May be difficult to set up. # Encapsulation will not eliminate vapor hazards completely.
D. Foams	# Apply a compatible foam (e.g., a hazmat foam, protein, fluoroprotein, alcohol, AFFF) to the surface of the spill. # Apply foam from an upwind location. # May be combined with a gelling agent in some cases, if compatible. # Replenish the foam blanket periodically to ensure a continuous blanket.	# Reduces vapor generation and, therefore, prevents downwind contamination. # May act as a barrier to ignition from external sources. # May reduce fire hazard, if spilled substance is flammable or combustible.	# Protection time is limited and finite, because foam eventually degrades, unless foam is replenished. # May be ineffective in adverse wind or wave conditions as collapse rate of the foam bubbles is increased. # Will be ineffective in fast- moving current. # Low-expansion foams are permeable to vapors. # May be incompatible with certain chemicals.

Exhibit 1.6-37

Initial Response to Free Product on Water Surface

TREATMENT METHODS FOR CONFINED SPILLS ON WATER SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
D. Foams (continued)			# Possible exothermic reaction may be produced. # Equipment and materials may not be available for quick response. # Trained personnel are necessary for application. # Possible secondary effects on the environment. # Presence of foam may complicate clean-up efforts.
E. Chelation	# Apply compounds (generally organic) that bind metal ions resulting in their deactivation either in solution (sequestrants) or as precipitates. # Apply these products from an upwind location.	May reduce concentration in solution to below toxic levels.	# Finite lifetime. Eventual release of metal ions into environment. # Increase in oxygen demand. # Secondary effects on environment. # Trained personnel required. # Materials and equipment may not be readily available for quick response. # Has limited effectiveness in emergency hazardous spill response.

Exhibit 1.6-37

Initial Response to Free Product on Water Surface

TREATMENT METHODS FOR CONFINED SPILLS ON WATER SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
F. Solvent extraction	# Apply chemicals that transfer soluble organic compounds to an immiscible phase. # Apply these products from an upwind location.	# May reduce concentration in solution to below toxic levels. # Creates an inert material that may be more easily removed. # Low toxicity. # Safe to handle.	# Ineffective in large spills. # Specialized equipment necessary for dispersion, vigorous mixing, extraction, and condensing, etc. # Trained personnel necessary. # Secondary effects to the envir- onment (i.e., formation of a surface film, which may interfere with aeration or photosynthesis; cause fouling of shorelines; and interfere with waterfowl). # Use for emergency hazardous spill response very limited. # Presence of chemicals may complicate clean-up efforts.
G. Precipitation (using sinking agents) NOTE: Use of sinking agents in New York State waters is not allowed.	# Apply chemicals (i.e., sinking agents) to convert hazardous substances into settleable particles. # Apply these products from an upwind location.	# Creates an inert material that may be easily removed from the body of water. # May reduce concentration in solution to below toxic levels.	# Subsequent removal of deposits could result in resuspension. # Negative impacts on environment due to increase in ionic strength of water. # Increased turbidity. # Potential increase in nutrient concentration, which may promote algae growth or increase oxygen demand. # Use for emergency hazardous spill response very limited.

Exhibit 1.6-37

Initial Response to Free Product on Water Surface

TREATMENT METHODS FOR CONFINED SPILLS ON WATER SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
H. Biodegradation	# Apply the microbes specific for the involved hazardous chemical(s) on the spill. # Microbes' food source is the contaminant; they persist until food source is consumed.	# Hazardous substance is removed from the environment. # Subsequent disposal is not always necessary. # In some cases, cleanup can be completed at a much quicker rate than with other remedial options. # Process is natural and ecological and is nonpathogenic to humans and animals.#Many hazardous materials are resistant to biological degradation. # Method can be slow if significant research is necessary to find the correct microbes and to transport them to the spill site. # In order to achieve a faster reaction rate, it is necessary to add large quantities of acclimated cultures; however, the technique is generally slow. # This technique is not recommended for emergency response. # The biodegradation treatment method is labor intensive.	

Exhibit 1.6-37

Initial Response to Free Product on Water Surface

TREATMENT METHODS FOR CONFINED SPILLS ON WATER SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
I. Cryogens	# Apply a **non-reactive** cryogenic agent to the spilled substance to reduce vaporization and/or lower flammability. Prior to application, ensure that it is compatible with the spilled substance.		# Handling cryogenic substances is dangerous because of their inherent physical properties (i.e., extreme cold). Cryogens will instantly freeze living tissue upon contact.
	# In many cases, it is advised that persons applying these materials be upwind of the location of application.		
	# Possible cryogens include:		
	(a) Liquid carbon dioxide (CO_2)	# Rapid cooling effect of reaction.	# High CO_2 losses occur upon application to the spill.
		# Small quantity needed relative to other cryogens.	# Secondary effect to the environment. CO_2 cloud reduces visibility and oxygen levels in the vicinity.
		# Reduces generation of toxic vapors and/or heat and flames.	# Trained personnel wearing appropriate protective gear are required.
			# Materials may not be readily available for quick response.
	(b) Dry ice (solid CO_2)	# Has better protection and cooling capabilities than liquid CO_2.	# Grinding is necessary before application; may be time-consuming.
		# More available than liquid CO_2.	# May change pH of water.
		# Reduces generation of toxic vapors and/or heat and flames.	# Application requires the use of appropriate protective gear.
			# Reduction in temperature is often insufficient.

Exhibit 1.6-37

Initial Response to Free Product on Water Surface

TREATMENT METHODS FOR CONFINED SPILLS ON WATER SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
I. Cryogens (continued)	(c) Ice	# Safe for use by untrained personnel. # Generally available. # Reduces generation of toxic vapors and/or heat.	# Reduction in temperature is often insufficient.
	(d) Liquid nitrogen (N_2)	# Extremely low temperature reduction is possible. # Reduces dispersion of toxic vapors and/or heat and flames.	# Large quantities necessary. # Secondary effects to environment: N_2 cloud reduces visibility and oxygen levels in vicinity. # Materials may not be available for quick response. # Trained personnel are necessary; contact with liquid N_2 is extremely dangerous. # Possible water pollution problem created by entrainment of hazardous liquid by N_2 vapors.

Exhibit 1.6-37

Initial Response to Free Product on Water Surface

TREATMENT METHODS FOR CONFINED SPILLS ON WATER SURFACE
(continued)

Treatment/Method	Description/Comment	Advantages	Disadvantages
J. Dispersion by Chemical Application	# Chemical dispersants are surfactants that function at the spilled substance/water interface by reducing surface tension and promoting droplet formation of the spilled substance. Dispersants only work on substances that: -- are lighter than water, -- are non-soluble in water, and -- have petroleum-like properties. # The purpose of applying dispersants is to spread out the spilled substance to allow rapid dilution to occur, which lowers the concentration level to acceptable levels. # Dispersants can be applied to a waterborne spill by spraying from an aircraft, boat, or from shore. # Any dispersant that is being considered for use, must have been approved by EPA. # Utilization of dispersants should be made on a case-by-case basis. The decision should be based upon on-scene environmental conditions, toxicity of the spilled substance, the amount of substance to be dispersed, and present water current conditions.	# Large spills are broken up into droplets that can be naturally diluted and degraded by the water. # Can be faster and less expensive than other treatment/clean-up methods, provided that dispersing agents and equipment are readily available. # Dispersants are most effective on petroleum spills, a commonly spilled product.	# Chemical dispersants may have an adverse effect on the surrounding ecology, particularly when large dosages are applied. # Dispersants will not be effective in calm water or excessively choppy water. # Sufficient quantities of EPA-approved chemical dispersants are not normally readily available. # For large spills, effective application of dispersants will normally require the use of aircraft. # Few substances can be effectively dispersed using chemical agents. # The dispersion process is usually slow, which increases the chances of failure due to changing environmental conditions. # Once the spilled substance and water have formed an emulsion, the less likely it is that the dispersant will be effective. # Attempts should not be made to disperse highly toxic substances. # Dispersants should only be used as a last resort due to the negative connotations associated with their use.

Exhibit 1.6-38

Initial Response to Free Product on Water Surface

COLLECTION OF CONFINED WATER SURFACE SPILL FOR DISPOSAL

If after spill confinement and/or treatment the contaminant is rendered environmentally safe, leave it in place for natural degradation. If after spill confinement and/or treatment the contaminant is still hazardous, recover the spilled product for safe disposal.

Choice of clean-up strategies should be based upon the following: (a) immediate and ultimate danger posed to local populations and local biological communities by the spill; (b) degree of difficulty and danger encountered with removal; (c) cost; and (d) available resources.

Situation	Collection Method	Advantages	Disadvantages
A. The Confined Spill is Large in Size.	Use skimmers to remove as much of the spill as possible and use sorbent materials (see Exhibit 1.6-20, Parts 6 and 7) to soak up the remaining substance. # Types of skimmers include the following: (a) Floating suction head. An enlarged end of a suction hose that allows material to be recovered over a wider area than the open end of a suction pipe. (b) Round floating weir. Circular weirs supported in the water by a round float or series of floats. A suction line runs from the bottom of the pan and continually draws off the pollutant and water that is skimmed into the pan.	# Prevents spreading of spill. # No secondary effects to environment. # Applicable to a wide range of water body types.	# Vulnerable to damage from certain high-solvency chemicals. # Large quantity of water removed. # Equipment may not be readily available for response. # Requires trained personnel.

Exhibit 1.6-38

Initial Response to Free Product on Water Surface

COLLECTION OF CONFINED WATER SURFACE SPILL FOR DISPOSAL
(continued)

	Situation	Collection Method	Advantages	Disadvantages
A.	Confined Spill is Large in Size. (continued)	(c) Rotating arm or disc. Rotates in and out of a spill. Material is wiped from the drum or disc to a collecting tank. (d) Oleophyllic belt. Works like a rotating drum or disc-type skimmer except it uses an oleophyllic material (i.e., poly-propylene).		
B.	Confined Spill is Relatively Small in Size, or Skimming is Not Feasible for a Large Spill.	1. Use a hand-held pump, vacuum, or suction hose to remove as much of the spill as possible. 2. Use sorbent materials (see Exhibit 1.6-20, Parts 6 and 7) to soak-up the remaining quantities of the product.	# Necessary equipment is common and generally available. # Can be used in various types of spill situations and topographical settings.	# Effectiveness decreases as spill size increases. # Large quantity of water and/or sediment can potentially be removed. # Vulnerable to damage by certain chemicals. # Needs collection device. # Requires trained personnel.
C.	Spilled Material Sinks in Water.	Choice of clean-up strategy should be based upon the following: (a) immediate and ultimate danger to local populations and local biological communities from the spill; (b) degree of difficulty and danger encountered with removal or burial; (c) cost; and (d) available resources.		

Exhibit 1.6-38

Initial Response to Free Product on Water Surface

COLLECTION OF CONFINED WATER SURFACE SPILL FOR DISPOSAL
(continued)

	Situation	Collection Method	Advantages	Disadvantages
C.	Spilled Material Sinks in Water. (continued)	Options include: (a) Leaving the treated contaminant in-place if it is environmentally safe or if removal or burial is impossible. (b) Burying the treated material in-place (if legal) using a suitable, inert covering material such as sand or crushed stone.	# Equipment and materials are common and readily available. # Prevents immediate spreading and dispersion.	# Potential natural re-excavation by scouring and biological action. # Ineffective in navigable waters that are routinely dredged (i.e., shipping channels). # May require underwater operations by divers (in chemical-resistant suits) and/or manned or unmanned equipment. # Possible secondary effects on environment. # May not eliminate percolation.

Exhibit 1.6-38

Initial Response to Free Product on Water Surface

COLLECTION OF CONFINED WATER SURFACE SPILL FOR DISPOSAL
(continued)

Situation	Collection Method	Advantages	Disadvantages
C. Spilled Material Sinks in Water. (continued)	(c) Recovering the product using diver-held dredges, mechanical dredges, hydraulic dredges, barge-mounted centrifugal pumps, pneumatic dredges, barge-mounted suction hoses.	# Necessary equipment is common and generally available. # Application in wide variety of bodies of water. # Prevents spreading along the bottom of the body of water. # May be used immediately as an emergency response technique or for subsequent chemical treatments (e.g., precipitation).	# Increased turbidity due to force of bottom impact, ascent to surface, and reapplications of dredge. # Effectiveness decreases with large spills. # Large quantity of natural sediment and benthos removed. # Adverse effects on environment. # Spreads contamination by mixing with water. # May be difficult to find divers willing to enter contaminated waters. # Divers must wear chemical-resistant suits.

NOTES

conditions such as high winds, fast currents, turbulent waters, and freezing temperatures. These exhibits do not discuss releases of gases, but do discuss different treatment methods to reduce the volatilization of a spilled material (see also Part 1, Section 3.2, Confining and Containing Releases). Confining a spill on land to prevent its spread to a waterway is also not covered in this exhibit, but is covered in the subsections on Confining and Containing Releases (Part 1, Section 3.2), Free Product in Structures, Sewers, and Underground Utility Lines (Part 1, Section 6.2), and Free Product on Soil Surface (Part 1, Section 6.4).

Obviously, these exhibits cannot provide guidance specific to every waterway spill situation. Ultimately, you must rely on your own experience and judgment in choosing the best approach and remedial actions. The most generally applicable rule is: Confine the spill as quickly as possible. This may mean you, your contractor, and other response agencies have to use the tools, equipment, and materials that are readily on hand at the time that a response is necessary until there is time to bring additional, perhaps more effective, materials to the site.[10] There is nothing wrong with the "let's make do with what we've got" strategy (e.g., spreading available straw on a floating spill until more sophisticated spill control equipment becomes available), unless such action is likely to cause injury or more severe damage.

An exhibit has been included near the end of this subsection to assist BSPR personnel in estimating spill volumes on water. Based on your observations of the appearance of oil on the surface of water, Exhibit 1.6-39 provides corresponding spill volumes and volume-to-area ratios. The exhibit also provides volume-to-area ratios based upon thickness of oil on water surface.

In addition, a worksheet (Attachment 1.6-1) has been provided at the end of this subsection to assist BSPR personnel in recording pertinent information regarding spills to waterways. BSPR personnel should begin filling in the worksheet upon arrival at the incident scene and continue completing it during the incident as the information becomes available. The worksheet provides space for recording not only information regarding the spill site, weather and current conditions, and remedial efforts, but also for recording information about the vessel from which the spill occurred (if applicable). The information you record on this worksheet will be helpful to you later on when are you completing your required reports regarding the incident.

[10] *See Part 2, Section 2, on Equipment Training, Calibration, and Maintenance for additional information on the spill containment materials that each BSPR response vehicle should have as part of its standard equipment inventory.*

Exhibit 1.6-39
Estimates of Spill Volumes on Water

The color that is reflected by oil on water is related to the thickness of the oil slick. By observing the color of the slick (and, thus, the thickness) and estimating the number of square miles covered by the oil, we can get a fairly accurate estimate of the volume of oil that has been spilled. For example, oil with a thickness of $3x10^{-6}$ inches appears as a silvery sheen. If this silvery sheen is visible over an area of 1 square mile, then the volume of oil is $1.2x10^{4}$ cubic inches, or 6.97 cubic feet of oil. Since we know that there are 7.481 gallons per cubic feet, we can use the following equation to calculate the volume of the spill:

$$1 \text{ sq. mile} \times \frac{6.97 \text{ cubic feet}}{1 \text{ sq. mile}} \times \frac{7.481 \text{ gallons}}{1 \text{ cubic foot}} = 52 \text{ gallons of oil on that 1 sq. mile surface}$$

Appearance of Oil on Water	Thickness (inches)	Vol. (gal)	(Gal/sq. ft.)	(Sq.ft./gal)
1. Barely visible under most favorable light conditions. (Need to compare with clear water to observe.)	$1.5x10^{-6}$	25	.000000896	1,120,000
2. Visible as silvery sheen	$3x10^{-6}$	50	.00000179	558,000
3. First trace of color may be observed (yellow, bronze, deep violet or purple)	$6x10^{-6}$	100	.00000358	279,000
4. Bright bands of color are visible (purple, blue to green)	$12x10^{-6}$	200	.00000717	139,000
5. Colors begin to turn (brick red, turquoise, trace of white, or pale yellow)	$40x10^{-6}$	670	.0000240	41,600
6. Colors are much darker	$80x10^{-6}$	1300+	.00004	21,500

Thickness	Gal/sq. mile	Gal/sq. ft	Sq. ft/Gal
1/16"	1,081,000	0.0388	25.77
1/8"	2,172,300	0.0779	12.836
1/4"	4,344,500	0.1558	6.418
1/2"	8,689,000	0.1246	3.21
1"	10,737,800	0.62335	1.604

Exhibit 1.6-39

Estimates of Spill Volumes on Water
(continued)

Conversions

#	To convert inches of product per square mile to gallons of product per sq. mile multiply number of inches x 17,378,000.	# inches of product/mile^2 x 17,378,000 # gals. of product/mile^2
#	To convert inches of product per sq. ft. to gallons of product per sq. foot multiply by 0.62335.	# inches of product/ft^2 x 0.62335 # gals. of product/ft^2

Source: Field Reference Manual, NYSDEC, Region 2 Office.

Attachment 1.6-1
Worksheet for Spill to Waterway

Investigator: _____

Date: _____ Time: _____

Location Description (e.g., latitude-longitude; area-block; river mile):

_____

_____

_____

_____

State: _____ Water body: _____

Describe Source or Suspected Source(s): _____

_____

_____

_____

If Spill was from a Vessel, record following:

Name of vessel _____

Gross tonnage _____ Net tonnage _____

Call Sign(s) or Official Number(s) _____

Type of vessel _____

Nationality(ies) _____

Course _____ Speed _____

Homeport(s) _____

Destination(s) _____

Fuel & Cargo Capacity _____

Where and How Moored or Anchored _____

_____

Owner(s)/Operator(s) _____

Agent(s) _____ Phone # _____

Insurance Underwriter _____

Certificate of Financial Responsibility: Date Issued _____

Number _____

Expiration Date _____

Worksheet for Spill to Waterway
(continued)

If Spill was from a Vessel (continued)

Oil Record Book:

Available? Yes ____ No ____

Properly maintained? Yes ____ No ____

Transfer operation procedure posted? Yes ____ No ____

Declaration of Inspection properly maintained? Yes ____ No ____

Person-In-Charge of Transfer Operation _____

_____

Master _____

Chief Engineer _____

Violation of 33 CFR, Subchapter O indicated? _____

Describe Cause of Spill to Extent Known: _____

_____

_____

_____

Describe Material Spilled, if Known: _____

_____

_____

Quantity Spilled: _____

Sheen, Slick, or Emulsion on Water Surface? Yes ____ No ____

Size, Shape, and Extent of Slick/Sheen _____

_____

_____

How Did Material Spilled Enter Waterway (include map or sketch if appropriate) _____

_____

_____

_____

Weather Conditions: Wind Speed _____ Wind Direction _____

Sea Height _____ Swell Direction _____

Current Speed _____ Current Direction _____

Ceiling _____ Visibility _____

Spill Detected By: _____

_____

Worksheet for Spill to Waterway
(continued)

Spill Reported By: _____

_____

Spill Reported To: _____

_____

Time Elapsed Between Spill Incident and Report: _____

Considering All Circumstances, Was Spill Reported Immediately by "Person in Charge?"

Yes ___ No ___

Removal Initiated By:

_____ Coast Guard

_____ EPA

_____ Other Federal/State/Local Agency

_____ Other (specify) _____

_____

Time Elapsed from Spill Report to Removal _____

Removal _____ is/was _____ is not/was not sufficient.

List name, address, phone number of all parties involved:

A. Suspected violator _____

_____

B. Witnesses _____

_____

C. Coast Guard Personnel _____

_____

_____

D. EPA Personnel _____

_____

_____

e. Other Personnel _____

_____

_____

Worksheet for Spill to Waterway
(continued)

Samples Taken (number, location, identification): _____

_____

_____

Date & Time Samples Taken: _____

Samples Taken By: _____

Photographs Taken (number, type, camera used, type of film, shutter speed, lens opening): _____

_____

_____

_____

_____

Date & Time of Photographs: _____

Photographs Taken By: _____

_____

Source: The information contained within this worksheet was drawn and adapted from the Water Pollution Incident Report Workbook (CG-3639A) developed by the U.S. Coast Guard.