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Response to Oil Spills

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Course Content

Preventing oil spills is the best strategy for avoiding potential damage to human health and the environment. However, once a spill occurs, the best approach for containing and controlling the spill is to respond quickly and in a well-organized manner. There is a defined hierarchy for spill response, beginning at the facility level and including government responders and decision-makers. A response will be quick and organized if response measures have been planned ahead of time. A number of advanced response mechanisms are available for controlling oil spills and minimizing their impacts on human health and the environment. The key to effectively combating spills is careful selection and proper use of the equipment and materials best suited to the type of oil and the conditions at the spill site. Mechanical approaches to contain and/or recover the oil are the primary line of defense against oil spills in the United States. Additives can be used in conjunction with mechanical means for containing and cleaning up oil spills provided they are approved by the Federal On Scene Coordinator.

1. Oil Spill Response Planning (Reference 1, 5)

There are defined planning requirements for potential sources of oil spills and for designated response agencies. The overall program for this planning effort is summarized in this section, including:

- Contingency plans – what they include and who is responsible for these
- The National Response System – including roles and responsibilities for government agencies and private parties
- Clean up approaches – including factors to be considered in planning for shore line cleanup

1.1 Planning for Oil Spills – Contingency Plans (Reference 5)

Preventing oil spills is the best strategy for avoiding potential damage to human health and the environment. However, once a spill occurs, the best approach for containing and controlling the spill is to respond quickly and in a well-organized manner. A response will be quick and organized if response measures have been planned ahead of time. A contingency plan looks at all the possibilities of what could go wrong and, "contingent" upon actual events, has the contacts, resource lists, and strategies to assist in the response to the spill.

Although they are different in many respects, contingency plans usually have four major elements in common:

- Hazard identification – including information such as:

  - Types of oils frequently stored in or transported through that area
  - Locations where oil is stored in large quantities and the mode of transportation used to move the oil, such as pipelines, trucks, railroads, or tankers
  - Extreme weather conditions that might occur in the area during different times of the year
  - The location of response equipment and personnel trained to use the equipment and respond to the spill

- Vulnerability analysis – including information such as:
  - Lists of public safety officials in the community
  - Lists of facilities such as schools, nursing homes, hospitals, and prisons
  - Lists of recreational areas, such as campgrounds
  - Lists of special events and when they take place
  - Identification of parts of the environment that are particularly susceptible to oil or water pollution

- Risk assessment – comparing the hazard and vulnerability in a particular location to see the kind of risk that is posed

- Response actions – developed to address the risks that are identified including typical steps such as:
  - Notifying all private companies or government agencies that are responsible for the cleanup effort
  - Getting trained personnel and equipment to the site quickly
  - Defining the size, position, and content of the spill; its direction and speed of movement; and its likelihood of affecting sensitive habitats
  - Ensuring the safety of all response personnel and the public
  - Stopping the flow of oil from the ship, truck, or storage facility, if possible, and preventing ignition
  - Containing the spill to a limited area
  - Removing the oil
  - Disposing of the oil once it has been removed from the water or land

The requirement for a contingency plan is included in several environmental regulatory plans, including Facility Response Plans and Spill Prevention, Control, and Countermeasures (SPCC) Plans required under the Clean Water Act (40 CFR 112). Response to oil releases also is included in other programs such as Storm Water Pollution Prevention (SWPP) Plans and Best Management Practices for storm water discharges.

1.2 National Response System (Reference 5)

Overview

The federal government has designed a spill response plan, called the National Oil and Hazardous Substances Pollution Contingency Plan, also called the *National Contingency*

Plan or NCP. The NCP ensures that the resources and expertise of the federal government would be available for those relatively rare, but very serious, oil spills that require a national response. The NCP was designed primarily to assist with coordinating the various federal agencies that are responsible for dealing with oil spill emergencies. The following chapter discusses the roles of the different federal agencies and how the NCP fits in with the *National Response System*.

Because a single plan cannot address the unique conditions of all areas, EPA and other organizations have developed many plans for smaller areas. These plans, known as Area Contingency Plans, may cover only a few counties. These plans describe the area covered by the plan; describe the responsibilities of an owner or operator and of government agencies in removing, mitigating, or preventing a discharge; and list all equipment, dispersants, or other mitigating substances and devices available to an owner or operator and government agencies to ensure effective and immediate removal, mitigation, or prevention of a discharge.

Every facility in the United States that stores or refines oil products, whether owned by a private company or operated by a government agency, is required to develop a plan for dealing with an accidental release of oil on its property. Certain facilities that store and use oil are required to prepare and submit a Facility Response Plan (FRP) to respond to a **worst case discharge** of oil and to a substantial threat of such a discharge. US EPA has established regulations that define who must prepare and submit an FRP and what must be included in the Plan [40 CFR 112.20 (f)(1)]:

> Does the facility transfer oil over water to or from vessels, and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons? If yes, the FRP must be prepared and submitted to US EPA.
>
> Does the facility have a total storage capacity greater than or equal to 1,000,000 gallons of oil? If yes to this criterion, evaluate the following:
>
>> Lack of secondary containment?
>> Proximity to fish and wildlife and sensitive environments?
>> Proximity to public drinking water intakes?
>> Reportable discharge greater than or equal to 10,000 gallons in the past 5 years?
>>
>> If yes to any of these criteria, then the FRP must be prepared and submitted to US EPA>

The US EPA can request preparation of an FRP at any time.

Other facilities that store oil in quantities greater than 1,320 gallons total (in bulk oil containers greater than or equal to 55 gallons) are required to prepare SPCC Plans. These facilities also must describe their response measures to an oil spill under the Control and Countermeasures section of the Plan. These Plans are not required to be submitted to US

EPA. The Plans do require reporting of oil spills to the *National Response Center* if any one spill exceeds 1,000 gallons or if there are two spills each exceeding 42 gallons in any one 12 month period.

National Response System

The NCP, which was signed into law on November 13, 1968, established the National Response System, a network of individuals and teams from local, state, and federal agencies who combine their expertise and resources to ensure that oil spill control and cleanup activities are timely, efficient, and minimize threats to human health and the environment.

The three major components of the National Response System are the (1) *On-Scene Coordinators,* (2) *National Response Team,* and (3) *Regional Response Teams.* A fourth component, *Special Forces*, are organizations with special skills and knowledge that can be called upon to support a response.

The National Response System is activated when the *National Response Center* receives notification of an oil spill.

On-Scene Coordinators (OSC)

The OSCs have the most prominent role in the National Response System. They are federal officials responsible for directing response actions and coordinating all other efforts at the scene of a discharge or spill. In addition, OSCs work in partnership with other federal, state, local, and private response agencies. OSCs' duties also include providing support and information to regional response committees.

There are 48 OSCs in the Coast Guard and 215 OSCs in EPA. OSCs are stationed in locations across the country to allow for quick and efficient response to spills. When a spill occurs in coastal waters, the local Coast Guard Port Commander is the OSC. When a spill occurs in an inland area, such as a spill from a pipeline or rail tank car, a regional EPA official is assigned as the OSC. The OSC is responsible for four main tasks during an oil spill response:

(1) Assessment – An OSC must evaluate the size and nature of a spill and its potential hazards. The OSC who is in charge also estimates the resources needed to contain the oil and clean it up and assesses the ability of the responsible party or local authorities to handle the incident. Collectively these activities are called assessment. OSCs typically conduct assessment activities at the beginning of a response. The assessment determines the need for personnel, equipment, and other resources to promptly and effectively combat the spill.

(2) Monitoring -- Throughout an oil spill response, OSCs monitor the actions being taken to control and clean up a spill to make sure they are appropriate. All spills of a legally defined minimum size must be monitored by an OSC, even though most spills are small and are cleaned up by the responsible party or local fire or

police departments. Monitoring can be conducted from the site when necessary or from an agency office if the situation appears to be under control.

(3) Response assistance – Once a spill has been assessed, an OSC determines whether federal assistance will be necessary to help control and contain the spill. If an OSC decides that federal assistance is required, he or she will obtain needed resources such as personnel and equipment. If sufficient resources are not available at or near the spill site, an OSC can secure them using a special fund—the Oil Spill Liability Trust Fund—that the federal government established for this purpose. The fund is intended to ensure that oil spill cleanups will not be hindered by a lack of personnel or equipment.

(4) Reporting – OSCs report all activities that take place during and after a spill. For example, following a spill, the OSC is required to file a summary report that outlines the actions taken to remedy the spill and the level of assistance provided by local, state, and federal agencies. These reports can be used to identify problem areas and improve spill response plans. They can also be shared with other agencies that may make recommendations about how to respond more effectively in future incidents or how to prevent more spills.

Regional Response Teams (RRTs)

RRTs are another major component of the National Response System. There are 13 RRTs in the United States, each representing a particular geographic region of the United States (including Alaska, the Caribbean, and the Pacific Basin). RRTs are composed of representatives from states and field offices of the federal agencies that make up the National Response Team (discussed later). The RRTs provide assistance when it is requested by OSCs and may respond on-scene. The four major responsibilities of RRTs are:

(1) Response – Regional Response Team members do not respond directly to spills as do OSCs, but they may be called upon to provide technical advice, equipment, or manpower to assist with a response. RRTs provide a forum for federal agency field offices and state agencies to exchange information about their abilities to respond to OSCs' requests for assistance.

(2) Planning -- Each RRT develops a Regional Contingency Plan to ensure that during an actual oil spill the roles of federal and state agencies are clear. Following an oil spill, the RRT reviews the reports from the OSC to identify problems with the Region's response to the incident and improves the plan as necessary.

(3) Training -- Regional Response Teams provide simulation exercises of regional plans to test the abilities of federal, state, and local agencies to coordinate their responses to oil spills.

(4) Coordination -- The RRTs are responsible for identifying the resources available from each federal agency and state in their regions. Such resources include equipment, guidance, training, and technical expertise for dealing with oil spills.

National Response Team (NRT)

The NRT is an organization composed of 16 federal agencies, each of which has responsibilities in environmental areas and expertise in various aspects of emergency response to pollution incidents. EPA serves as the NRT's chair and the Coast Guard serves as the vice chair. Although the NRT does not respond directly to incidents, it is responsible for three major activities relating to managing oil spill response:

(1) distributing information,

(2) planning for emergencies, and

(3) training for emergencies.

1.3 Cleanup Methods for Shoreline Areas (Reference 1)

In developing contingency plans, the response actions that may be needed should recognize that it is almost impossible to fully prevent shoreline oiling during a spill. The factors that influence the selection of cleanup techniques should be considered.

Influence of oil volume and type

The type and quantity of the oil that may be spilled must be determined. Oil types vary greatly and have a major influence on the degree of shoreline impact, oil persistence, and ease of cleanup. For example, lighter fuels (diesel, home heating fuel and light crude oils) will evaporate quickly, but tend to be more toxic and penetrate the shoreline sediments to a greater degree. Heavy oils (bunker C, #6 fuel and heavy crude oils) are less toxic to shoreline ecosystems and do not penetrate finer sediments, but they are very persistent, difficult to clean and may smother shoreline organisms.

Influence of Shoreline Type

Shoreline types greatly influence the impacts of oil and cleanup methods, and should be considered in evaluating risk from spills. State and federal mapping projects have categorized U.S. coastlines in terms of habitat sensitivity to oil. The National Oceanic and Atmospheric Administrative (NOAA) Environmental Sensitivity Index (ESI) is a widely used characterization scheme, ranking shorelines by sensitivity to oil spill impacts, predicted rates of removal of stranded oil by natural processes, and ease of cleanup. The ESI shoreline ranks, from least to most sensitive:

1. Exposed rocky cliffs & seawalls
2. Wave cut rocky platforms
3. Fine to medium-grained sand beaches
4. Coarse-grained sand beaches
5. Mixed sand and gravel beaches
6. Gravel beaches/Riprap
7. Exposed tidal flats
8. Sheltered rocky shores/man-made structures
9. Sheltered tidal flats
10. Marshes

Defining Cleanup Options

Types of shorelines impacted and degree of impact allow responders to develop a list of preferred response options by shoreline type. Many Area Contingency Plans have predefined matrices with appropriate response methods by oil and shoreline type. Major categories of techniques include:

1) Natural Recovery
2) Manual Removal
3) Mechanical Removal
4) Passive Collection with Sorbents
5) Vacuum
6) Debris Removal
7) Sediment Reworking/Tilling
8) Vegetation Cutting/Removal
9) Flooding (deluge)
10) Ambient Water Washing (low to high pressure)
11) Warm Water Washing (< 90 °F)
12) Hot Water Washing (> 90 °F)
13) Slurry Sand Blasting

14) Solidifiers (special approval required)
15) Shoreline Cleaning Agents (special approval required)
16) Nutrient Enrichment (special approval required)
17) Burning (special approval required)

Preferred techniques for the spill are established based on shoreline type. For example, the method for treating exposed seawalls might be high-pressure, ambient-temperature seawater flushing at mid-tide stages.

Natural recovery is often misunderstood. In sensitive environments active cleanup activity may cause more harm than allowing the oil to slowly degrade naturally, as disturbance by human cleanup activity can drive oil below the surface causing significant damage.

Cleanup teams are mobilized to conduct shoreline surveys and develop recommendations for specific shorelines, based on the general options for each shoreline type. The survey teams include scientific and oil response expertise. Survey results include type, degree of oiling, location of specific sensitive resources to be avoided or protected, other logistical information, and the team's recommended cleanup method, selected from the agreed upon cleanup options for that shoreline type. Areas of specific concern are identified and planned based on unique factors. Cleanup is monitored to ensure that continued response measures do not cause more harm than the remaining oil.

Shoreline cleanup plans try to minimize the harm caused by spilled oil, not to clean up all oil. Responders must weigh the response priorities in determining the end point for shoreline cleanup actions.

2.0 Response Techniques

There are a number of response mechanisms available for controlling oil spills and minimizing their impacts on human health and the environment. A brief description of major response techniques is summarized in this section, including:

- Overview of Approaches – what they include and when are they effective
- Specific Approaches – information on when and how to use several techniques, including specific requirements for approval from government agencies for use of certain chemical additives

2.1 Overview of Approaches

The key to effectively combating spills is careful selection and proper use of the equipment and materials best suited to the type of oil and the conditions at the spill site. Most spill response equipment and materials are greatly affected by such factors as conditions at sea, water currents, and wind. Damage to spill-contaminated shorelines and dangers to other threatened areas can be reduced by timely and proper use of containment and recovery equipment.

Mechanical Containment or Recovery

Mechanical approaches to contain and/or recover the oil are the primary line of defense against oil spills in the United States. Containment and recovery equipment includes a variety of booms, barriers, and skimmers, as well as natural and synthetic sorbent materials. Mechanical containment is used to capture and store the spilled oil until it can be disposed of properly. Where feasible and effective, this technique is preferable to other methods, since spilled oil is removed from the environment to be recycled or disposed of properly. Mechanical removal of oil utilizes two types of equipment: booms and skimmers. The benefits of mechanical removal techniques include: physically removes oil from the environment; allows recycling or proper disposal of recovered oil; and little direct environmental impacts in open water.

Chemical and Biological Additives

Additives can be used in conjunction with mechanical means for containing and cleaning up oil spills. Dispersants and gelling agents are most useful in helping to keep oil from reaching shorelines and other sensitive habitats. Biological agents have the potential to assist recovery in sensitive areas such as shorelines, marshes, and wetlands. Research into these technologies continues to improve oil spill cleanup. Subpart J of the NCP establishes the process for authorizing the use of dispersants and other chemical response agents, which includes the NCP Product Schedule, the federal government's listing of chemical countermeasures that are available for use during or after an oil spill response.

Additional Physical Methods

Additional physical methods can be used to clean up affected resources such as stream channels or water body shorelines. Natural processes such as evaporation, oxidation, and biodegradation can start the cleanup process, but are generally too slow to provide adequate environmental recovery. Physical methods, such as wiping with sorbent materials, pressure washing, and raking and bulldozing can be used to assist these natural processes.

Wildlife Protection using Scare Tactics

Scare tactics can be used to protect birds and animals by keeping them away from oil spill areas. Devices such as propane scare-cans, floating dummies, and helium-filled balloons are often used, particularly to keep birds away.

2.2 Booms

Containment booms are used to control the spread of oil to reduce the possibility of polluting shorelines and other resources, as well as to concentrate oil in thicker surface layers, making recovery easier. In addition, booms may be used to divert and channel oil slicks along desired paths, making them easier to remove from the surface of the water. Although there is a great deal of variation in the design and construction of booms, all generally share the following four basic elements:

- An above-water "freeboard" to contain the oil and to help prevent waves from splashing oil over the top of the boom
- A flotation device
- A below-water "skirt" to contain the oil and help reduce the amount of oil lost under the boom
- A "longitudinal support," usually a chain or cable running along the bottom of the skirt, that strengthens the boom against wind and wave action; the support may also serve as a weight or ballast to add stability and help keep the boom upright

Booms can be divided into several basic types:

Fence booms have a high freeboard and a flat flotation device, making them least effective in rough water, where wave and wind action can cause the boom to twist.

Round or curtain booms have a more circular flotation device and a continuous skirt. They perform well in rough water, but are more difficult to clean and store than fence booms.

Non-rigid or inflatable booms come in many shapes. They are easy to clean and store, and they perform well in rough seas. However, they tend to be expensive, more complicated to use, and puncture and deflate easily.

All boom types are greatly affected by the conditions on the water; the higher the waves swell, the less booms are effective.

Booms can be fixed to a structure, such as a pier or a buoy, or towed behind or alongside one or more vessels. When stationary or moored, the boom is anchored below the water surface. It is necessary for stationary booms to be monitored or tended due to changes produced by shifting tides, tidal currents, winds, or other factors that influence water depth, direction, and force of motion.

Boom tending requires round-the-clock personnel to monitor and adjust the equipment. The forces exerted by currents, waves, and wind may significantly impair the ability of a boom to hold oil. Currents may wash oil beneath a boom's skirt. Wind and waves can force oil over the top of the boom's freeboard or even flatten the boom into the water, causing it to release the contained oil. Mechanical problems and improper mooring can also cause a boom to fail.

Most booms perform well in gentle seas with smooth, long waves. Rough and choppy water is likely to contribute to boom failure. In some circumstances, lengthening a boom's skirt or freeboard can aid in containing the oil. However, because they have more resistance to natural forces such as wind, waves, and currents, these oversized booms are more prone to failure or leakage than are smaller ones. Generally, booms will not operate properly when waves are higher than one meter or currents are moving faster than one knot per hour.

When a spill occurs and no containment equipment is available, barriers can be improvised from whatever materials are at hand. Although they are most often used as temporary measures to hold or divert oil until more sophisticated equipment arrives, improvised booms can be an effective way to deal with oil spills, particularly in calm water such as streams, slow-moving rivers, or sheltered bays and inlets. Improvised booms are made from such common materials as wood, plastic pipe, inflated fire hoses, automobile tires, and empty oil drums. They can be as simple as a board placed across the surface of a slow-moving stream, or a berm built by bulldozers pushing a wall of sand out from the beach to divert oil from a sensitive section of shoreline.

2.3 Skimmers

A skimmer is a device for recovering spilled oil from the water's surface. Skimmers are typically used with booms that concentrate the oil to make it thick enough to be skimmed efficiently. Skimmers may be self-propelled, used from shore, or operated from vessels. The effectiveness of a skimmer is determined by how quickly it can collect the oil, and how well it minimizes water collected with the oil. The efficiency of skimmers is highly dependent upon conditions of the water surface. In moderately rough or choppy water, skimmers tend to recover more water than oil.

A wide variety of skimmers is available that use different methods for separating oil from water. Vessel-based skimming systems are utilized to remove oil from open water, while vacuum trucks are often used to remove oil that has collected near the shoreline.

Three types of skimmers are typically available. Each type offers advantages and drawbacks depending on the type of oil being recovered, the water surface conditions during cleanup efforts, and the presence of ice or debris in the water:

Weir skimmers use a dam or enclosure positioned at the oil/water interface. Oil floating on top of the water will spill over the dam and be trapped in a well inside, bringing with it as little water as possible. The trapped oil and water mixture can then be pumped out through a pipe or hose to a storage tank for recycling or disposal. These skimmers are prone to becoming jammed and clogged by floating debris.

Oleophilic ("oil-attracting") skimmers use belts, disks, or continuous mop chains of oleophilic materials to blot the oil from the water surface. The oil is then squeezed out or scraped off into a recovery tank. Oleophilic skimmers have the advantage of flexibility, allowing them to be used effectively on spills of any thickness. Some types, such as the chain or "rope-mop" skimmer, work well on water that is choked with debris or rough ice.

Suction skimmers operate similarly to a household vacuum cleaner. Oil is sucked up through wide floating heads and pumped into storage tanks. Although suction skimmers are generally very efficient, they are vulnerable to becoming clogged by debris and require constant skilled observation. Suction skimmers operate best on smooth water, where oil has collected against a boom or barrier.

2.4 Sorbents

Sorbents are insoluble materials or mixtures of materials used to recover liquids through the mechanism of **ab**sorption, or **ad**sorption, or both.

Absorbents are materials that pick up and retain liquid distributed throughout the molecular structure causing the solid to swell (50 percent or more). The absorbent must be at least 70 percent insoluble in excess fluid.

> **Ad**sorbents are insoluble materials that are coated by a liquid on its' surface, including pores and capillaries, without the solid swelling more than 50 percent in excess liquid.

To be useful in combating oil spills, sorbents need to be both oleophilic (oil-attracting) and hydrophobic (water-repellent). Although they may be used as the sole cleanup method in small spills, sorbents are most often used to remove final traces of oil, or in areas that cannot be reached by skimmers.

Sorbent materials used to recover oil must be disposed of in accordance with approved local, state, and federal regulations. Any oil that is removed from sorbent materials must also be properly disposed of or recycled.

Sorbents can be divided into three basic categories: natural organic, natural inorganic, and synthetic:

> **Natural organic sorbents** include peat moss, straw, hay, sawdust, ground corncobs, feathers, and other readily available carbon-based products. Organic sorbents can adsorb between 3 and 15 times their weight in oil, but there are disadvantages to their use. Some organic sorbents tend to adsorb water as well as oil, causing the sorbents to sink. Many organic sorbents are loose particles such as sawdust, and are difficult to collect after they are spread on the water. These problems can be counterbalanced by adding flotation devices, such as empty drums attached to sorbent bales of hay, to overcome the sinking issue, and wrapping loose particles in mesh to aid in collection.

> **Natural inorganic sorbents** consist of clay, perlite, vermiculite, glass wool, sand, or volcanic ash. They can adsorb from 4 to 20 times their weight in oil. Inorganic sorbents, like organic sorbents, are inexpensive and readily available in large quantities. These types of sorbents are not used on the water's surface but may be used at shoreline locations.

> **Synthetic sorbents** include man-made materials that are similar to plastics, such as polyurethane, polyethylene, and polypropylene and are designed to adsorb liquids onto their surfaces (like a sponge). Other synthetic sorbents include cross-linked polymers and rubber materials, which absorb liquids into their solid structure, causing the sorbent material to swell. Most synthetic sorbents can absorb up to 70 times their own weight in oil.

The characteristics of both sorbents and oil types must be considered when choosing sorbents for cleaning up oil spills:

- **Rate of absorption** -- The absorption of oil is faster with lighter oil products. Once absorbed the oil cannot be re-released. Effective with light hydrocarbons (e.g., gasoline, diesel fuel, benzene).

- **Rate of adsorption** -- The thicker oils adhere to the surface of the adsorbent more effectively.
- **Oil retention** -- The weight of recovered oil can cause a sorbent structure to sag and deform, and when it is lifted out of the water, it can release oil that is trapped in its pores. Lighter, less viscous oil is lost through the pores more easily than are heavier, more viscous oils during recovery of adsorbent materials causing secondary contamination.
- **Ease of application** -- Sorbents may be applied to spills manually or mechanically, using blowers or fans.

Many natural organic sorbents that exist as loose materials, such as clay and vermiculite, are dusty, difficult to apply in windy conditions, and potentially hazardous if inhaled.

> ***IMPORTANT!***
>
> ***Chemical based sorbent agents need to be listed on the National Contingency Plan, Subpart J, Product Schedule (see Section 3). A chemical based sorbent should only be used with approval of the Federal OSC.***

2.5 Dispersing Agents

Dispersing agents, also called dispersants, are chemicals that contain surfactants and/or solvent compounds that act to break petroleum oil into small droplets. In an oil spill, these droplets disperse into the water column where they are subjected to natural processes, such as waves and currents, which help to break them down further. This helps to clear oil from the water's surface, making it less likely that the oil slick will reach the shoreline.

Heavy crude oils do not disperse as well as light to medium weight oils, and dispersants should not be used on gasoline or diesel spills. Dispersants are most effective when applied immediately following a spill, before the lightest materials in the oil have evaporated; however, dispersant manufacturers have claimed that the "window-of-opportunity" to apply dispersants effectively is widening.

Environmental factors, including water salinity and temperature, and conditions at sea also influence the effectiveness of dispersants. Studies have shown that most dispersants work best at salinities close to that of normal seawater. EPA policy does not allow the use of dispersants in freshwater unless authorized by an On-Scene Coordinator to protect human health. The effectiveness of dispersants also depends on water temperature. While dispersants can work in colder water, they work best in warm water.

Some countries rely almost exclusively on dispersants to combat oil spills because frequently rough or choppy conditions at sea make mechanical containment and cleanup difficult. However, dispersants have not been used extensively in the United States because of possible long term environmental effects, difficulties with timely and effective application, disagreement among scientists and research data about their environmental effects, effectiveness, and toxicity concerns.

New technologies that improve the application of dispersants are being designed. The effectiveness of dispersants is being tested in laboratories and in actual spill situations, and the information collected may be used to help design more effective dispersants. Dispersants used today are less toxic than those used in the past, but long term cumulative effects of dispersant use are still unknown.

> ***IMPORTANT!***
>
> ***A dispersant material can be used only with approval of the Federal OSC. The material must be listed on the National Contingency Plan, Subpart J, Product Schedule (see Section 3).***

2.6 Gelling Agents

Gelling agents (also known as *solidifiers)* are chemicals that react with oil to form rubber-like solids. With small spills, these chemicals can be hand applied and left to mix on their own. For larger spills, the chemicals are applied to the oil and then mixed in by the force of high-pressure water streams. Gelled oil is removed from the water using nets, suction equipment, or skimmers, and is sometimes reused after being mixed with fuel oil.

Gelling agents can be used in calm to moderately rough seas, since the mixing energy provided by waves increases the contact between the chemicals and the oil, resulting in greater solidification. One drawback to the use of gelling agents is that large quantities of the material must often be applied, as much as three times the volume of the spill. For large oil spills it is impractical to store, move, and apply such large quantities of material.

> ***IMPORTANT!***
>
> ***A gelling agent can be used only with approval of the Federal OSC. The material must be listed on the National Contingency Plan, Subpart J, Product Schedule (see Section 3).***

2.7 Biological Agents

Biological agents are chemicals or organisms that increase the rate at which natural *biodegradation* occurs. Biodegradation is a process by which *microorganisms* such as bacteria, fungi, and yeast break down complex compounds into simpler products to obtain energy and nutrients. Biodegradation of oil is a natural process that slowly - sometimes over the course of several years - removes oil from the aquatic environment. However, rapid removal of spilled oil from shorelines and wetlands is necessary in order to minimize potential environmental damage to these sensitive habitats.

Bioremediation refers to the act of adding materials to the environment, such as fertilizers or microorganisms, that will increase the rate at which natural biodegradation occurs. Two technologies currently being used in the United States for oil spill cleanups are:

Fertilization (nutrient enrichment) involves adding nutrients such as phosphorus and nitrogen to a contaminated environment to stimulate the growth of microorganisms capable of biodegradation. Limited supplies of these nutrients in nature usually control the growth of native microorganism populations. Adding these nutrients can may increase the rate of biodegradation by allowing the native microorganism population to grow rapidly.

S*eeding* involves the addition of microorganisms to the existing native oil-degrading population. Sometimes species of bacteria that do not naturally exist in an area will be added to the native population. As with fertilization, the purpose of seeding is to increase the population of microorganisms that can biodegrade the spilled oil.

IMPORTANT!

A biological agent can be used only with approval of the Federal OSC. The material must be listed on the NCP, Subpart J, Product Schedule (see Section 3).

3.0 National Contingency Plan (NCP) Product Schedule

The approach for addressing oil spills is described in the National Contingency Plan (40 CFR Part 300). One significant aspect of the NCP is the Product Schedule which lists the chemicals and additives that are available for oil spill response. A brief description of the Product Schedule is summarized in this section, including:

- Regulatory Basis for the NCP Product Schedule – why the Schedule was developed
- Significance of Listing on the Product Schedule – EPA qualifications on listing
- Listing of Products on the Schedule – names of chemicals

3.1 Regulatory Basis for the NCP Product Schedule (Reference 3, 4)

Section 311(d)(2) of the Clean Water Act and Section 4201(a) of the Oil Pollution Act of 1990 require the preparation of a "schedule of dispersants, other chemicals, and other spill mitigating devices and substances, if any, that may be authorized for use on oil discharges..." [40 CFR 300.905(a)]. The EPA prepares and maintains this schedule, known as the NCP Product Schedule. The Product Schedule contains five product categories:

Dispersants – used to break up oil on the water's surface, causing it to disperse down into the water column where natural forces can degrade the oil droplets (Marine and Coastal waters only)

Surface washing agents – used on solid surfaces to lift and float oil to better absorb or vacuum it up

Surface collecting agents (“herding agents”) – used to control the thickness layer of oil to aid mechanical collection

Bioremediation agents – microbes, nutrients, enzymes or a combination intended to encourage the degradation of the oil

Miscellaneous oil spill control agents—any other spill mitigating agents, such as chemical or biological based sorbents and elastizers.

Subpart J (40 CFR Part 300.910) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) governs the use of dispersants and other chemical and biological agents that may be listed on this schedule. EPA prepares and maintains this schedule, known as the NCP Product Schedule. Vendors, response personnel, other federal agencies, state agencies, and the public request and use Product Schedule information.

3.2 Significance of Inclusion on the NCP Product Schedule

A product is included on the NCP Product Schedule when data submission requirements have been satisfied. The product may then be authorized for use on a particular oil spill by the OSC and/or RRT.

Inclusion of a product on the NCP Product Schedule does not mean that the US EPA approves, recommends, licenses, certifies, or authorizes the use of the product on an oil discharge. To prevent possible misrepresentation or misinterpretation, all product labels, literature, or advertisements that refer to placement on the Schedule must either reproduce in its entirety EPA's written statement that it will add the product to the NCP Product Schedule under 40 CFR 300.920(a)(2) or (b)(2), or include the disclaimer shown below. If the disclaimer is used, it must be conspicuous and must be fully reproduced. Failure to comply with these restrictions or any other improper attempt to demonstrate the approval of the product by any NRT or other U.S. Government agency shall constitute grounds for removing the product from the NCP Product Schedule. [40 CFR 300.920(e)]

DISCLAIMER
[PRODUCT NAME] is on the U.S. Environmental Protection Agency's NCP Product Schedule. This listing does NOT mean that EPA approves, recommends, licenses, certifies, or authorizes the use of [PRODUCT NAME] on an oil discharge. This listing means only that data have been submitted to EPA as required by subpart J of the National Contingency Plan, Sec. 300.915.

3.3 Product Categories (Reference 3)

The Product Schedule contains five product categories listed below.

- Dispersants;
- Surface washing agents;
- Surface collecting agents (none presently listed);
- Bioremediation agents; and
- Miscellaneous oil spill control agents.

The Product Schedule presents summary information on the conditions under which the products may be used. Depending on the type of product, the summarized data may include: special handling and worker precautions; ventilation requirements; emergency procedures in the event of skin or eye contact; protective clothing requirements; minimum and maximum storage temperatures; temperatures of phase separations and chemical changes; shelf life; recommended application procedures; physical properties, including flash point, pour point, viscosity, specific gravity, and pH; analyses of heavy metals, chlorinated hydrocarbons and cyanide; toxicity; and effectiveness.

3.3 NCP Product Schedule-Listed Bioremediation Agents

- B&S INDUSTRIAL (see STEP ONE)
- BET BIOPETRO (formerly BET BIOPETRO HEAVY)
- BILGEPRO® (see S-200)
- INIPOL EAP 22
- LAND AND SEA RESTORATION
- MICRO-BLAZE®
- OIL SPILL EATER II (OSE II)
- OPPENHEIMER FORMULA
- PRISTINE SEA II
- S-200
- S-200D (see S-200)
- SHEENCLEAN (see S-200)
- STEP ONE
- SYSTEM E.T. 20 (formerly MCW.B.20)
- VB591 ™ WATER, VB997 ™ SOIL, and BINUTRIX (formerly MYCOBAC TX-20)
- WMI-2000

3.4 NCP Product Schedule-Listed Dispersants

- BIODISPERS (formerly PETROBIODISPERS)
- COREXIT 9500
- COREXIT 9527
- DISPERSIT SPC 1000 ™
- FINASOL OSR 52
- JD-109
- JD-2000 ™
- MARE CLEAN 200 (formerly MARE CLEAN 505)

- NEOS AB 3000
- NOKOMIS 3-F4
- SEA BRAT #4
- SEACARE E.P.A. (see DISPERSIT SPC 1000 ™)

3.5 NCP Product Schedule-Listed Surface Washing Agents

- AQUACLEAN (formerly D-52)
- BIOSOLVE®
- CLEAN SPLIT (see SPLIT DECISION SC)
- CN-110
- COREXIT 7664 (formerly D-4)
- COREXIT 9580 SHORELINE CLEANER (formerly D-38)
- CYTOSOL
- DO-ALL #18
- DUO-SPLIT (see SPLIT DECISION SC)
- ECP RESPONDER - SW (see GOLD CREW SW)
- ENVIRO CLEAN 165
- F-500
- FM-186-2
- GOLD CREW SW
- MICRO CLEAN (see NATURE'S WAY HS)
- NALE-IT
- NATURE'S WAY HS
- NATURE'S WAY PC (see NATURE'S WAY HS)
- PETRO-CLEAN
- PETRO-GREEN ADP-7 (formerly D-14)
- PETROTECH 25
- POWERCLEAN (see NATURE'S WAY HS)
- PREMIER 99 (formerly D-41)
- SC-1000™
- SIMPLE GREEN® (formerly D-46)
- SPLIT DECISION SC (formerly SPLIT DECISION)
- SUPERALL #38 (see TOPSALL #30)
- SX-100®
- TOPSALL #30 (formerly D-20)

3.6 NCP Product Schedule-Listed Miscellaneous Oil Spill Control Agents

- ALSOCUP
- CI AGENT (formerly CHEAP INSURANCE and PETRO-CAPTURE)
- MARI-ZYME (see Zyme-Flow)
- PES-51
- PX700

- RAPIDGRAB 2000™
- UNITED 658 PETRO-ZYME (see ZYME-FLOW)
- WASTE-SET 3200®
- WASTE-SET 3400®
- ZYME-FLOW
- ZYME-TREAT (see ZYME-FLOW)

4.0 References

1. Region I Regional Response Team**,** Oil Spill Prevention, **Preparedness, and Response Measures Pamphlet Series** (**www.uscg.mil/d1/staff/m/rrt/spillinfo.html**)

2. US EPA Oil Program (**www.epa.gov/oilspill**)

3. US EPA NCP Product Schedule (November 2003) **(www.epa.gov/oilspill/pdfs/schedule.pdf)**

4. US EPA 9360.8-35 Questions and Answers on the National Oil and Hazardous Substances Pollution Contingency Plan, Subpart J, Product Schedule 40 CFR 300.900, 540-N-01-008, July 2001

5. US EPA Office of Emergency and Remedial Response, Understanding Oil Spills and Oil Spill Response, EPA 540-K-99-007, OSWER 9200.5-104A, PB2000-963401, December 1999 (http://www.epa.gov/oilspill/pdfbook.htm)

Additional References

For additional general information on oil spill response:

Oil in the Sea,

EPA's Oil Program Website

EPA's Spill Prevention, Control and Countermeasures Guides

Coast Guard's Marine Safety and Environmental Protection Website

NOAA HAZMAT Website

National Response Team Website

For information on the National Contingency Plan:

National Oil and Hazardous Substances Pollution Contingency Plan (NCP)

For additional information on bioremediation:

Nation Response Team fact sheet on Bioremediation Technologies

Guidelines for the Bioremediation of Marine Shorelines and Freshwater Wetlands *(PDF, 1.3M, 163 pages)*

For additional information on the NCP Product Schedule and Notebook:

NCP Product Schedule (November 2003) *(PDF download, 119K, 15 pages)*

NCP Product Schedule Notebook (November 2003) *(PDF download, 944K, 173 pages)*

Q's & A's on the NCP Product Schedule *(PDF download, 80K, 2 pages)*