Annex C
Oil Spill Best Management Practices

Table of Contents

Section **Page**

Table of Contents iv

Oil Spill Best Management Practices 1

1 Introduction 1
2 Wildlife 1
3 Supporting Actions Common to Most Responses 4
3.1 Use of Vessels 4
3.2 Use of Vehicles or Heavy Machinery 5
3.3 Staging Area Establishment and Use 6
3.4 Foot Traffic at the Spill Site 7
3.5 Use of Aircraft in a Spill Response 8
3.6 Use of Uncrewed Aerial Systems (UAS) in a Spill Response 8
4 On-Water Response Actions 9
4.1 Booming 9
4.2 Removal of Floating Oil – Sorbents 11
4.3 Removal of Floating Oil – Skimmers 12
4.4 Decanting 13
4.5 In-Situ Burning 15
4.6 Chemical Dispersion of Floating Oil 17
4.7 Barriers, Berms, Culverts Blocks, and Underflow Dams 19
4.8 Submerged Aquatic Vegetation Cutting 20
5 Shoreline Response Actions 21
5.1 Removal of Surface Oil 21
5.1.1 Manual Removal of Oil 22
5.1.2 Passive Collection of Oil (Sorbents) 23
5.1.3 Vacuum Removal of Oil 24
5.2 Oiled Debris Removal 25
5.3 Mechanical Removal of Surface Oil and Contaminated Sediments 26
5.4 Trenching/Recovery Wells 27
5.5 Removal of Oiled Sediment 29
5.5.1 Oiled Sediment Reworking 31
5.5.2 Oiled Sediment Removal with Replacement 32
5.6 Flushing with Ambient (Temperature, Salinity) Water 33
5.6.1 Ambient Water Flooding (Deluge) 34
5.6.2 Ambient Water, Low-Pressure Flushing 35
5.6.3 Ambient Water, High-Pressure Flushing 36
5.7 Warm Water, Moderate-Pressure Washing 37
5.8 Hot Water Moderate-Pressure Washing 39
5.9 Vegetation Cutting 40
6 Nutrient Enhancement and Microbial Enhancement 41

7 Submerged Oil Detection and Recovery 42
8 Natural Attenuation (with monitoring) 44
9 Places of Refuge for Disabled Vessels..... 44
10 Decontamination 46

Oil Spill Best Management Practices

1 Introduction

This chapter provides a summary of the best management practices (BMPs) to protect resources put at risk due to the response to oil spills in Oregon, Washington and Idaho. The chapter introduces the response actions typically used, organized by the common response settings in which they occur, and followed by the BMPs associated with their implementation. Most BMPs address all kinds of resources to be protected, even if the majority of the BMPs prescribed are intended to assure compliance with the Endangered Species Act (ESA) as outlined in the Biological Assessment prepared by the NWAC and the Biological Opinions passed down from the US Fish and Wildlife Service and the NOAA - National Marine Fisheries Service. Additional BMPs, provided by tribes, address concerns for the protection of cultural resources at risk, as were BMPs described in the Inadvertent Discovery Plans utilized in Oregon and Washington. Finally, BMPs to address socio-economic resources placed at risk due to oil spills typically involve early notification so that protective measures can be put into motion. These notifications are detailed in the Geographic Response Plans or Geographic Response Strategies.

2 Wildlife

The BMPs in this this section were developed as measures to reduce impacts to wildlife and their habitats during an oil spill response, and for responder safety. These should be considered general guidance during a spill response. Not all BMPs will be applicable to every response, which is why incident-specific guidance is developed through the ESA Section 7 consultation process and direction from the Wildlife Branch and Environmental Unit. Best available information and professional judgment should be used when determining how to implement these BMPs during each response.

General Best Management Practices for Wildlife

- Do NOT attempt to capture any live wildlife. A separate Wildlife Recovery and Rehabilitation Plan will be prepared and executed by the Wildlife Branch in the Operations Section.
- Report potentially impacted wildlife (including carcasses) to the Wildlife Branch or supervisor.
- Avoid operating equipment in close proximity to wildlife.
- Avoid transporting or introducing invasive species attached to equipment.

On-land Operation BMPs for Wildlife

- Ensure work areas are well-lit to minimize inadvertent impacts to wildlife or their habitat.
- Use existing access and egress areas and roadways.

- Minimize foot traffic through oiled areas on non-solid substrates (sand, mudflats, gravel, dirt, etc.) to reduce the likelihood that oil will be worked into the sediment. Creation of temporary pathways (matting, plywood, etc.) where necessary is recommended to further reduce this likelihood. Restrict foot traffic over sensitive areas (shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for wildlife disruption and mechanical damage to sensitive habitats.
- Minimize removal of clean (unoiled) sediments.
- Minimize the amount of sediment removed with any mechanical oil collection efforts.
- Staging areas, waste collection areas, and support infrastructure should be located away from sensitive habitats, including shorelines, scrub, riparian habitat, and other vegetated areas.
- Stage equipment only on hardened surfaces.
- All heavy equipment use should be as low on the beach as possible and avoid the high tide or wrack line while conducting clean-up activities.
- Ensure that personnel and equipment are removed from intertidal areas prior to flooding.
- Activities that require removal of riparian, forested, scrub, shrub, or other vegetated habitat require approval by the Environmental Unit.

On-water operation BMPs for Wildlife

- If marine mammals or birds become trapped or entangled in boom, anchor lines, or other response equipment, notify Wildlife Branch for instructions.
- Monitor underwater equipment and boom to ensure fish and wildlife are not trapped.
- Monitor passive sorbent materials deployed in the intertidal zone. Promptly remove any material as it becomes saturated. Remove or resecure sorbent if it breaks free from its moorings.
- Avoid blocking major wildlife egress points in channels, rivers, passes, and bays.
- Any device used for pumping water from fish-bearing waters must be equipped with a fish guard to prevent fish from being sucked into, or pinned against, the pump intake. The pump intake must be screened with material that has openings no larger than: 5/64 inch (for square holes), measured side to side OR 3/32-inch diameter (for round holes). In addition, the screen must have at least one square inch of functional screen area for every gallon per minute (gpm) of rated pump capacity. For example, a 100 gpm-rated pump would require at least a 100 square inch screen. Note: in Washington, pumping of ambient water requires a hydraulic project approval (HPA) permit from WDFW. In Oregon, pumping from Waters of the State may require emergency authorization with the Oregon Water Resources Division.

- Killer (Orca) Whales: Vessels must not approach within 300 yards of any killer whale and must stay out of the path of oncoming whales out to 400 yards. If your vessel is closer than 300 yards, place engine in neutral and allow whales to pass. Always approach and depart whales from the side, moving in a direction parallel to the direction of the whales. Stay on the offshore side of the whales when they are traveling close to shore. Reduce speed to less than 7 knots when within 400 yards of the nearest whale and avoid abrupt course changes.
- Nearshore Operations: Be cautious and quiet when around seal and sea lion haul-outs and bird colonies or concentrations. Reduce speed and minimize wake, wash and noise, and then slowly pass without stopping. Avoid approaching closer than 100 yards to any marine mammals or birds. Do not disturb, move, feed or touch any marine wildlife, including seal pups.
- Wildlife Impacts: Contact the Wildlife Branch or your supervisor to report any bird or marine mammal impacted by operations or that has signs of oil impacts.
- Follow the carcass collection guidance established by the Wildlife Branch.

Air operation BMPs for Wildlife

- Adhere to the incident-specific flight restrictions over sensitive habitats and avoid hovering or landing either manned or unmanned aircraft in these areas.
- Adhere to flight altitude restrictions over wildlife management areas and other managed lands.
- The Environmental Unit (Planning Section) may recommend Flight Restriction Zones to minimize disturbance or injury to wildlife during an oil spill. By keeping a safe distance and altitude from identified sensitive areas, pilots/operators can decrease the risk of aircraft/bird collisions, prevent the accidental hazing of wildlife into oiled areas, and prevent abandonment of nests or marine mammal pupping areas.
- The Air Operations Branch (Operations Section) will manage all aircraft operations related to a response and will coordinate the establishment of any Flight Restriction Zones as appropriate. Environmental Unit (Planning Section) staff will work with the Air Operations Branch Director to resolve any conflicts that arise between flight activities and sensitive resources.
- Unmanned Aerial Systems (UAS): Biological resource incidents are more than just collisions, and include, but are not limited to; displacement of wildlife, nest or den abandonment, aggressive behavior towards the UAS by wildlife, and out-of-ordinary vocalization or alarm calling by wildlife. To reduce the risk of adverse interactions:
    - Do NOT launch UAS devices towards wildlife.
    - Do NOT approach wildlife vertically.
    - If using a fixed-wing drone do NOT make rapid banking maneuvers

when waterfowl, shorebirds, or sea birds are observed.
- Do NOT fly over observable active bird nests.
- Cease flying immediately if the drone attracts attention from birds of prey (i.e. osprey, eagles, hawks).
- To avoid an aggressive bird, the first option is to ascend rapidly. Birds cannot ascend as fast as a drone. If the drone is already at maximum altitude, move laterally away from the bird. Once clear of the bird, move laterally until enough distance has been created to safely descend and land the drone. Do not resume operations until the bird has left the area.

3 Supporting Actions Common to Most Responses

3.1 Use of Vessels

Vessels are vital to most spill responses. Vessel types range from small hand-launch watercraft to large ships. Smaller vessels provide access to shallow or narrow habitats. Larger vessels are associated with deep water and responses to large volumes of oil.

The use of vessel resources varies depending on the specific response. Vessels may be used as a component of the response itself (e.g., skimmers, platforms for applying dispersants, deploying or collecting boom), or as a mode of transportation to and from remote locations for response personnel. As a result, vessels and other watercraft may be used in shallow or deep water, nearshore or offshore, fresh water or marine environments, etc. Vessels are essential to both open water and shoreline spill responses.

Geographic Response Plans (GRPs) outline boat and watercraft use restrictions within 200 yards of offshore National Wildlife Refuge sites or other sensitive areas. As a standard practice, the response organization immediately requests a waiver from the National Marine Fisheries Service and/or United States Fish and Wildlife Service regarding approaching or hazing marine mammals inadvertently during open water response operations.

Best Management Practices for Use of Vessels

- Take in consideration sensitive habitats (e.g. nesting areas or spawning areas) based on presence and distribution of wildlife such as birds and mammals (to the extent that information is available in GRPs). Avoid these areas when possible.
- Observe instruction in GRPs that outline boat and watercraft use restrictions within 183 meters (200 yards) of National Wildlife Refuge sites or other sensitive areas.
- Do not stage boats such that shoreline vegetation is crushed. Boats should not rest on or press against vegetation at any time.

- Avoid anchor or prop-scarring of submerged vegetation.
- Follow BMPs for wildlife, as appropriate.

3.2 Use of Vehicles or Heavy Machinery

During an incident, the types of vehicles used is determined based on its capabilities relative to spill-specific needs. Vehicle types range from small all-terrain vehicles (ATVs) to large earthmovers. Operation of vehicles may adversely affect shoreline habitats that are susceptible to erosion. When available, keep vehicles to durable surfaces to limit physical impacts to the environment.

ATVs may be used in support of open water and shoreline responses. The use of ATVs is often dependent upon the accessibility of the site (e.g., proximity of roads) to this kind of equipment and the type of shoreline in which they are to be used. It is possible to use ATVs on any accessible shoreline type in which an ATV can safely be driven; however, some shoreline types (e.g., marshes, vegetated low banks) are more sensitive to the use of motorized equipment (as well as human foot traffic) than other shoreline types, both in the presence and absence of oil. For example, it is recognized that the use of ATVs may adversely affect unoiled shoreline habitats that are susceptible to erosion. Some oiled shoreline types, such as marshes, are particularly vulnerable to the introduction and mixing of oil into subsurface sediments. As a result of these concerns relating to shoreline damage, care is taken to weigh the tradeoffs of ATV use on a particular shoreline type, whether oiled or unoiled. Therefore, in a practical sense, ATV use may be limited to situations in which it is judged that the benefits of using ATVs outweigh any potential adverse effects of their use.

Generally, responders use ATVs on sand beaches and are restricted to transiting outside of oiled areas, along the upper part of the beach with the exception of areas where plovers nest in the foredune/upper beachface. The decision process for use of ATVs near sensitive aggregations of wildlife (e.g., sea lion rookery) is similar to that described for shoreline habitats discussed above. ATVs may be used for a variety of purposes, including the transportation of response personnel and for the collection and disposal of oil, oiled sediments, or oiled debris in support of response activities in nearshore open water and on shorelines.

Best Management Practices for Use of Vehicles or Heavy Equipment

- Minimize traffic through oiled areas on non-solid surfaces (e.g. sand, gravel, and dirt) to reduce the likelihood that oil will be worked into the sediment.
- Take into consideration sensitive habitats (e.g. nesting areas or spawning areas based on the presence and distribution of fish and wildlife in the areas. Avoid these areas when possible.
- Consult GRPs if they are established for the response area. Set staging areas in locations already identified in the GRP.
- On beaches, only transit outside of the oiled area along the upper part of the

beach and away from the foredunes.
- Use vehicles near listed plants and wildlife only if the benefits outweigh potential impacts.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow BMPs for wildlife, as appropriate.

3.3 Staging Area Establishment and Use

Incident personnel and equipment report to staging areas to await tactical assignment. Staging areas may include on-site storage and transport of hazardous and nonhazardous materials. If possible, establish staging areas at existing large, paved areas that provide access to both the spill site and transportation networks. In areas with GRPs, staging areas are pre-determined for use during a response. For spills in navigable waters, established boat ramps and piers are used as staging areas if possible. When spills occur in remote areas, staging areas may need to be constructed on developed or undeveloped land (including points of access), but this is avoided when possible.

Best Management Practices for Staging Area Establishment and Use

- Use the same access points for repeat entries to the area.
- Construct new access points only when no other options are available to reach the location (emergency consultation may be necessary).
- If new access points area needed, conduct a preliminary survey to determine the best route.
- Locate staging areas and support facilities in the least sensitive area possible. Use areas identified in GRPs, if available.
- Conduct a survey prior to developing new staging areas and constructing access roads. Seek out developed areas, such as existing parking lots, rather than undeveloped environments.
- Establish special restrictions for sensitive areas where foot traffic and equipment operation may be damaging, such as soft substrates.
- Establish work zones and access in a manner that reduces contamination of clean areas.
- Observe species-specific buffer zones (100-300 yards) for marine mammals when planning and implementing response actions.
- Do not cut, burn, or otherwise remove vegetation unless specifically approved by the EU.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource.

Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow BMPs for wildlife, as appropriate.

3.4 Foot Traffic at the Spill Site

Foot traffic can disturb or destroy habitat through soil compaction, erosion, trampling vegetation, and may include general impacts from human presence, such as increased noise and light. Walking on contaminated soil and sediment may cause the oil to mix and sink deeper into the substrate, making clean up more difficult. In areas with muddy sediments, such as sheltered tidal flats, the sediment can be very soft and may not support even light foot traffic in many areas. If entrance to an area with soft substrates is unavoidable, use walkways constructed from plywood or access the area on the seaward side using boats.

Foot traffic and other human-presence effects such as increased light and noise can disrupt wildlife. Oiled wildlife may avoid the shore, making capture for assessment and cleaning more difficult. Minimize human-related disturbances that may cause wildlife to stay at sea or search for a more isolated location to come ashore. Consider limiting public access, allowing only responders into the impacted area. There may be periods when shoreline access should be avoided, such as during bird nesting seasons. Foot traffic to and from the clean-up area should not disturb wildlife unreasonably.

Best Management Practices for Foot Traffic at the Spill Site

- Walk on durable surfaces to the extent practicable.
- Place plywood or other material on footpaths over sensitive areas to reduce compaction.
- Restrict foot traffic from sensitive areas (e.g. marshes, shellfish beds, salmon redds, algal mats, bird-nesting areas, dunes, etc.) to reduce the potential for mechanical damage.
- Restrict access to specific areas for periods of time to minimize impacts on sensitive biological populations (e.g. nesting, breeding, or fish spawning).
- Minimize foot traffic through oiled areas on non-solid substrates (sand, gravel, dirt, etc.) to reduce the likelihood that oil will be worked into the sediment.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow BMPs for wildlife, as appropriate.

3.5 Use of Aircraft in a Spill Response

Aircraft, such as airplanes and helicopters, may be used in open water and shoreline responses to support response activities. Aircraft may be used in many response activities, such as being a platform for applying dispersants or igniting floating oils, directing on-water recovery operations, or transporting workers. Aircraft is essential for pre- or post-response monitoring, such as wildlife surveys. Aircraft may be used over any aquatic or terrestrial environment. Before aircraft is used, consult the Environmental Unit on designated Flight Restriction Zones near sensitive wildlife and habitats, such as marine mammal rookery or bird breeding colonies. Flight restrictions are more likely to be imposed only during times of the year that species are most sensitive, but may be imposed year-round in some locations.

Typically, the area within a 1,500-foot radius and below 1,000 feet in altitude is restricted from flying in areas that have been identified as sensitive. This restricting may apply near national wildlife refuges and wilderness areas, such as the Olympic Coast National Marine Sanctuary and Olympic National Park. In addition to restrictions associated with wildlife, tribal authorities may also request notification when overflights are likely to affect culturally sensitive areas within reservations.

Best Management Practices for the Use of Aircraft

- Observe flight restriction zones specified in the GRPs including minimum ceiling height (altitude of 305 m (1,000 feet) above ground is advised) and distance from known or suspected wildlife areas (e.g. nesting areas) in order to reduce wildlife exposure to noise or presence of airplanes or helicopters.
- Follow BMPs for wildlife, as appropriate.

3.6 Use of Uncrewed Aerial Systems (UAS) in a Spill Response

The use of uncrewed aerial systems (UAS) (e.g. drones) is becoming more common during spill responses. A UAS may be use for aerial photography, shoreline surveys, identifying the leading edge of the spill, and monitoring and recording response activities. Spill responders can use UAS photo, video, or remote sensing capabilities to look for moderate to heavy oil in inaccessible areas. When UAS are used, responders must follow all applicable Federal Aviation Administration (FAA) regulations. The FAA does not permit the operation of UAVs above 400 feet. A waiver can be obtained if the response requires flights above 400 feet. Only responders trained in the use of UAS should operate this equipment. Consult the NOAA Uncrewed Aircraft Systems Oil Spill Response Job Aid for more information on UAS use during a spill response.

Best Management Practices for the Use of UAS

- Trained UAS operators must follow all FAA regulations.
- Consult the Wildlife Branch and Environmental Unit before using UAS in a spill response.

- Follow BMPs for wildlife, as appropriate.

4 On-Water Response Actions

This section describes on-water response actions that may be used to contain and recover spilled oil or divert oil away from sensitive areas. We also discuss chemical dispersant use and in-situ burning, techniques that may be used to prevent shoreline oiling. On-water response actions are often most effective if implemented early in a response.

4.1 Booming

Booms are flexible floating barriers that are placed on the surface of the water to control the spread of spilled oil and to protect ecologically sensitive areas. Oil spill containment booms generally have five operating components: flotation chamber, freeboard, skirt, tension member, and ballast. The overall height of the boom is divided between the freeboard (the portion above the surface of the water) and the skirt (the portion below the water surface). Boom heights range from approximately 6 inches to over 90 inches, to address different types of water bodies and environmental conditions. Flotation attached to the freeboard and ballast (e.g., chain, weights) attached to the skirt enable the boom to float upright in the water, with the plane created by the boom perpendicular to the surface of the water. Boom is typically made up of 50- or 100-foot sections; the sections, and the connectors between sections, provide flexibility both in boom length and shape. Depending on the specific booming strategy employed, the boom is towed through the water, anchored in place (typically in water less than 100 feet deep), or attached to the shoreline or to a vessel.

Responders in the Northwest Area may employ four basic booming strategies, either individually or in combination:

(1) Containment - boom used to contain and concentrate the oil until it can be removed;
(2) Deflection - boom used to re-direct floating oil away from sensitive areas;
(3) Diversion - boom used to re-direct floating oil toward recovery sites that have slower flow, better access for equipment and personnel, and a way to remove the oil;
(4) Exclusion - boom used to keep oil out of a sensitive area.

Boom may also be used to enhance recovery of oil by skimmers or to collect and concentrate a sufficient thickness of oil on the water surface to allow *in-situ* burning (both described in greater detail below). During a response, boom is typically in place for several days to a week, depending on the spill. During that time, boom may be moved and repositioned to maximize its effectiveness at containing, excluding, diverting, or deflecting oil, and to adjust to environmental conditions.

Boom can potentially be used in all open water habitats, depending on environmental conditions, but boom placement may be constrained by water depth and boat accessibility (except in the cases of very small bodies of water, where a boom may be deployed by hand). Sorbent boom could also be used (see section 9301.4.2). A boom may come in contact with the substrate in shallow water or along shorelines. However, this is undesirable in most cases, as a typical floating boom that comes into contact with the substrate is likely to lie flat and lose its ability to contain oil. A boom designed for this specific purpose (i.e., to maintain containment after coming in contact with the substrate), known as intertidal or tidal seal boom, may be used for oil containment along shorelines. Like other boom, intertidal boom floats up and down over tidal cycles. However, the skirt is replaced by one or two continuous tubes filled with water, which forms a seal with the substrate. As a result, a vertical plane is maintained by the boom, which continues containing oil as the tide recedes. Traditional boom attached to the shoreline typically comes in contact with substrate along shorelines for only a short distance, usually less than 10 feet, depending on the slope of the shoreline. In addition to shallow water depths, the effectiveness of booming strategies can be significantly reduced by wind, currents, waves, and the presence of large quantities of floating debris. For maximum boom effectiveness, the depth of the water should be at least five times the draft of the boom. Once deployed, response personnel use small boats to check and reposition boom to maximize its effectiveness in changing environmental conditions.

Best Management Practices for Booming

- Monitor for the presence of marine mammals and seabirds. Ensure that EU provides information on possible presence and impacts to ESA-listed (protected) species or critical habitats.
- Evaluate need to restrict access to sensitive habitats (e.g., nesting areas or spawning areas) based on presence and distribution of wildlife such as birds and mammals.
- Arrange booms to minimize impacts to wildlife and wildlife movements.
- Locate boom anchor points using strategies identified in GRPs, if available.
- If cultural resources are known or suspected to be in the area use natural anchors (tie off boom to trees or boulders), rather than driving anchor points into the shoreline.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

4.2 Removal of Floating Oil – Sorbents

The objective of this response method is to remove floating oil by allowing it to adhere to pads or rolls made of oleophilic material. The dimensions of sorbent pads are typically 2 by 2 feet. Sorbent rolls are approximately the same width as pads and may be 100 feet long. Sorbents pads may also be strung with a rope (sweep) so that it can be fastened or anchored to stay in place, and sorbent material can be incorporated into a boom with a netted cover (sorbent boom or "sausage" boom). Finally, non-pourous polyethylene strands are bound into "pom-poms" for use in adsorbing heavier oils. The use of sorbents is a passive oil collection technique that requires no mechanized equipment. Sorbents are left temporarily in the affected environment to adsorb oil in a specific locale.

Sorbents are most likely to be used to remove floating oil in nearshore environments that contain shallow water. They are often used as a secondary method of oil removal following gross oil removal, such as skimming. Sorbents may be used for all types of oil; lighter oils absorb into the material, and heavier oils adsorb onto the surface of sorbent material, requiring sorbents with greater surface area.

Retrieval of sorbent material is mandatory. At least daily monitoring is required to check that sorbents are not adversely affecting wildlife or breaking apart after lengthy deployments. As a best practice, sorbent materials generally should not remain in the environment for longer than one day.

Sorbents are also used to clean surface oil from the shoreline and land-based spills.

Best Management Practices for Removal of Floating Oil – Sorbents

- Passive collection of oil using sorbent material may be used on all shoreline types but is most useful with light to moderate oiling.
- Retrieval of sorbent material, and at least daily monitoring to check that sorbents are not adversely affecting wildlife or breaking apart, are mandatory.
- Continually monitor and collect passive sorbent material deployed in the intertidalzone to prevent it from entering the environment as non-degradable, oily debris.
- Monitor passive absorbents placed in the mid- or lower intertidal zone for potential entrapment of small crustaceans; coordinate with the EU for corrective actions if entrapment is observed.
- Minimize (ground, seafloor, riverbed, lakebed, etc.) disturbances.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If cultural resources are known or suspected to be in the area use natural anchors (tie off boom to trees or boulders), rather than driving anchor points

into the shoreline.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.
- Follow BMPs for booming, as appropriate.

4.3 Removal of Floating Oil – Skimmers

Floating oil may be removed from the water surface using mechanized equipment known as skimmers. There are numerous types or categories of skimming devices, including weir, centrifugal, submersion plane, and oleophilic, described below. Weir skimmers use gravity to drain oil from the water surface into a submerged holding tank. Once in the holding tank, oil may be pumped away to larger storage facilities.

Centrifugal (also vortex) skimmers create a water/oil whirlpool in which the heavier water forces oil to the center of the vortex. Once in the center, oil may be pumped away from the chamber within the skimmer.

Submersion plane skimmers use a belt or inclined plane to push the oil beneath the water surface and toward a collection well in the hull of the vessel. Oil is scraped from the surface or removed by gravity and then flows upward into a collection well, where it is subsequently removed with a pump.

Oleophilic (i.e., having an affinity for oil) skimmers may take on several forms (e.g., disc, drum, belt, rope, brush), but the general principle of oil collection remains the same: oil on the surface of the water adheres to a rotating oleophilic surface. Once oil has adhered to the surface, it may be scraped off into containers or pumped directly into large storage tanks.

Skimmers are placed at the oil/water interface to recover, or skim, oil from the water surface. Skimmers may be operated independently from shore, be mounted on vessels, or be completely self-propelled. To minimize the amount of water collected incidental to skimming oil, booming may be used in conjunction with skimming to concentrate the floating oil in a wedge at the back of the boom, which provides a thick layer of oil to the skimmer head.

In shallow water, hoses attached to vacuum pumps may be used instead of other skimming devices described earlier in this section. Oil may be removed from the water surface using circular hose heads (4 to 6 inches in diameter); however, this is likely to result in the intake of a large water-to-oil ratio and inefficient oil removal. Inefficient oil

removal of this kind may also result in adverse effects to organisms in the surrounding water. Instead, flat head nozzles, sometimes known as "duckbills" are often attached to the suction end of the hose in order to maximize the contact between the oil and vacuum, minimizing the amount of water that is removed from the environment. Duckbills (very much like an attachment to a vacuum cleaner) are typically 18 inches or less in width and less than 2 inches in height. In other words, duckbills are relatively small and designed to maximize the amount of oil removed from the water surface relative to the volume of water removed. Vacuum hoses may also be attached to small, portable skimmer heads to recover oil they have collected. Adequate storage for recovered oil/water mixtures, as well as suitable transfer capability, must be available.

Recovery systems that use skimmers are often placed where oil naturally accumulates in pockets, pools, or eddies. Skimming can be used in all water environments (weather and visibility permitting) for most oils. The presence of large waves, strong currents, debris, seaweed, kelp, and viscous oils will reduce skimmer efficiency.

Best Management Practices for Removal of Floating Oil – Skimmers

- Adequate storage for recovered oil/water mixtures, as well as suitable transfer capability, must be available.
- Protect nearby sensitive areas from increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures.
- Minimize (ground, seafloor, riverbed, lakebed, etc.) disturbances.
- Keep all onshore equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.
- Follow BMPs for booming, as appropriate.

4.4 Decanting

Efforts are made to minimize the amount of water collected during skimming (as

discussed above). However, in some cases it may be impossible to avoid collecting water in addition to oil, which can fill up storage facilities prematurely. To maximize temporary storage space during removal operations, decanting may be used to drain off excess water captured during skimming. Decanting is the process of draining off recovered water from portable tanks, internal tanks, collection wells, or other storage containers. The liquid in the tanks is allowed to sit for a sufficient period of time to permit oil to float to the top of the tanks. Water is then drained from the bottom of the tank (stopping in time to retain most of the oil). The water removed from the bottom of the tank is discharged back into the environment, usually in front of the skimmer or back into a boomed area. When decanting is conducted properly, minimal oil is discharged back into the environment. The decanting process is monitored visually to ensure prompt detection of oil discharges in decanted water and that water quality standards set forth in the Clean Water Act are not violated.

Decanting may be allowed because of storage limitations; however, it may not be permitted in all cases. In these cases, The Northwest Regional Contingency Plan (NWRCP) Decanting Policy (see Section 4101) addresses “incidental discharges” associated with oil spill response activities. Incidental discharges include, but are not limited to, the decanting of oily water, oil, and oily water returns associated with runoff from vessels and equipment operating in an oiled environment and the wash down of vessels, facilities, and equipment used in the response. Incidental discharges, as addressed by this policy, do not require additional permits and do not constitute a prohibited discharge. See 33 Code of Federal Regulations 153.301, 40 Code of Federal Regulations 300, Revised Code of Washington 90.56.320(1), Washington Administrative Code 173-201A-110, Oregon Revised Statutes 468b.305 (2)(b). However, the NWACP advises the Federal On-Scene Coordinator (FOSC) to consider and authorize the use of decanting on a case-by-case basis, after an evaluation of the environmental tradeoffs of allowing oil to remain in the environment (because of storage limitations) or discharging decanted water. The response contractor or responsible party will seek approval from the FOSC and/or State On-scene Coordinator (SOSC) prior to decanting by presenting the Unified Command with a brief description of the area in which decanting approval is sought, the decanting process proposed, the prevailing conditions (wind, weather, etc.), and protective measures proposed. The FOSC and/or SOSC will review such requests promptly and render a decision as quickly as possible. FOSC authorization is required in all cases and, in addition, SOSC authorization is required for decanting activities in state waters. See Section 4101 of the NWRCP for more information.

Best Management Practices for Decanting

- Decanting shall be monitored at all times, so that discharge of oil in the decanted water is promptly detected.
- Liquid waste management must be addressed in the disposal plan. Follow standard protocols for waste management actions. Coordinate the locations

of any temporary waste staffing or storage sires with the EU.

- The response contractor and/or responsible party will seek approval from the FOSC and/or SOSC prior to decanting.
- Minimize the amount of water collected during skimming.
- Conduct decanting actions in the designated response area: within a collection area, vessel collection well, recovery belt, weir area, or directly in front of a recovery system. Deploy containment boom around the collection area, where feasible, to prevent loss of decanted oil or entrainment of species in recovery equipment.
- Decanting operations cannot be conducted from the shoreline.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.
- Follow BMPs for booming, as appropriate.

4.5 In-Situ Burning

The objective of in-situ burning is to remove oil from the water surface or habitat by burning it in place, or in situ. Oil floating on the water surface is collected into slicks a minimum of 2 to 3 millimeters thick and ignited. The oil is typically collected in a fire-resistant boom that is towed through the spill zone by watercraft or collected by natural barriers such as the shore. Although in-situ burning may be used in any open water environment, the environment dictates the specific procedure employed in a given burn. For example, in offshore and nearshore marine environments, bays and estuaries, large lakes, and large rivers, boom may be towed at 1 knot or less during the burning process to maintain the proper oil concentration or thickness. In rivers and small streams, oil carried by currents may be collected and concentrated in a stationary boom attached to the shoreline or other permanent structures (e.g. pilings). In small lakes and ponds the body of water may be too small or shallow to tow a boom, and there may not be any consistent current. In a process known as “herding,” wind or mechanically generated currents may be used to collect and concentrate oil along the shoreline or in a stationary boom attached to the shoreline.

Once an oil slick is sufficiently thick, an external igniter is used to heat the oil, generating enough vapors above the surface of the oil to sustain a burn. It is these vapors, rather than the liquid oil on the water surface, that actually burn. When enough oil burns, to the point that the remaining oil layer is less than 1 to 2 millimeters thick, the fire goes out. The fire is extinguished at this oil thickness because the oil slick is no longer sufficiently

thick to provide insulation from the cool water. This insulation is necessary to sustain the heat that produces the vapors, which are subsequently burned. The small quantity of burn residue remaining in the boom is then manually recovered for disposal.

In-situ burning generates a thick black smoke that contains primarily particulates, soot, and various gases (carbon dioxide, carbon monoxides, water vapor, nitrogen oxides, sulfur oxides, and polyaromatic hydrocarbons). The components of the smoke are similar to those of car exhaust. Of these smoke constituents, PM2.5 (particulate matter with a diameter of 2.5µm or less) is considered to pose the greatest risk to the health of humans and wildlife as it can be inhaled deep into the lungs and may enter the bloodstream. For this reason, the In-situ Burn Policy does not allow for pre-approval of in-situ burning within 3 miles of a population, defined as >100 people per square mile (see Chapter 4000, "Planning"). All other areas are considered on a case-by-case basis (see the RRT10 In-Situ Burning Policy Map).

Decisions to burn or not to burn oil in areas considered case-by-case are made based on the potential for humans to be exposed to the smoke plume, and pollutants associated with it. A cap on exposure to PM2.5 has been set in the NWACP at 35 micrograms per cubic meter averaged over a 24-hour period which also corresponds to the EPA's NAAQS (see Section 4093 for more details). Smoke plume modeling is suggested to predict which areas might be adversely affected. In addition, in-situ burning responses require downwind air monitoring for pollutants. Aerial surveys are also conducted prior to initiating a burn to minimize the chance that concentrations of marine mammals, turtles, and birds are in the operational area and affected by the response. Special Monitoring for Advanced Response Technologies (SMART) protocols are used. They recommend that sampling be conducted for particulates at sensitive downwind sites prior to the burn (to gather background data) and after the burn has been initiated. Data on particulate levels are recorded and forwarded with recommendations to the Unified Command. Readers interested in learning more about SMART protocols can visit the following site: https://response.restoration.noaa.gov/oil-and-chemical-spills/oil- spills/resources/smart.html.

It is possible for as much as 95% of the oil contained in a boom to be burned, depending on the thickness of the initial layer of oil and whether it is possible to ignite the oil. Burning drastically reduces the requirement for waste storage and disposal. Weathered and emulsified oils that contain more than 50% water are extremely difficult to ignite. Therefore, it is important to make the decision to burn within 24–48 hours of the spill. The NWACP requires that trade-offs between the effects of the emissions produced from in-situ burning, such as polyaromatic hydrocarbons, and the contamination that may result from floating oil or oil that washes ashore, are carefully weighed in making the decision to conduct an in-situ burn.

Consult the In-Situ Burning Operations Planning Tool when considering in-situ burning

in a response.

Best Management Practices for In-Situ Burning

- Monitor for the presence of wildlife and plants.
- Minimize erosion and runoff using engineered controls (to the extent practicable).
- Prior to an in-situ burn, an on-site survey must be conducted to determine if any threatened or endangered species are present or at risk from burn operations, fire, or smoke. A Net Environmental Benefit Analysis would be conducted to evaluate the possible risk to species in the area of the in-situ burn and compare it to the risk of not using in-situ burning.
- Protection measures may include moving the location of oil (in water) to an area where listed species are not expected to be present; temporary employment of hazing techniques, if effective; and physical removal of individuals of listed species only under the authority of the trustee agency.
- Provisions must be made for mechanical collection of burn residue following any burn(s) (e.g., collection with nets, hand tools, or strainers).
- SMART will be used to measure efficacy. SMART is a standardized program designed to monitor chemical dispersion and in-situ burning activities.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for aircraft, as appropriate.
- Follow BMPs for wildlife, as appropriate.
- Follow BMPs for booming as appropriate.

4.6 Chemical Dispersion of Floating Oil

The objective of chemical dispersion is to reduce the impact of an oil spill to sensitive shoreline habitats and animals that use the water surface by chemically dispersing oil into the water column. Dispersants are chemicals that reduce the oil-water interfacial tension, thereby decreasing the energy needed for the slick to break into small droplets and mix into the water column. Specially formulated products containing surface-active agents (surfactants) are sprayed (generally at concentrations of 2–5% by volume of the oil) from aircraft or boats onto the slick. Agitation from wind and waves is required to achieve dispersion. Depending on the level of energy, very small droplets of oil (10–100 microns in diameter) are mixed in the upper meter of the water column, creating a sub-surface plume. This plume of dispersed oil droplets rapidly (within hours) mixes and expands in three dimensions (horizontal spreading and vertical mixing) down to as much as 10 meters below the surface (Lewis et al. 1998; Lunel 1995; Lunel and Davies 1996; NRC 1989). As a result of this mixing, oil concentrations decrease rapidly from the initial peak concentrations, for example from 10 or 100 parts per million (ppm) down to 1 ppm or less, within hours to a day.

Dispersion of oil and actual measurements of dispersed oil concentrations have been conducted and studied in several field studies (Cormack and Nichols 1977; McAuliffe *et al.* 1980; McAuliffe *et al.* 1981; Lichtenthaler and Daling 1985; Brandvick *et al.* 1995; Walker and Lunel 1995; Coelho *et al.* 1995). Dispersed oil concentrations were generally between 1 and 4 ppm within 1 hour after application of the dispersant in all of these studies.

Dispersing oil changes the trajectory of the oil plume from onshore to along- shore, as dispersed oil is no longer transported by the wind. Therefore, oil dispersion may help protect sensitive shoreline environments, as wind usually is the dominant environmental factor that carries floating oil ashore to strand. Dispersants and dispersant applications are rarely 100% effective, however, so some oil will likely remain floating on the water surface.

Due to the relatively short window of opportunity in which oil may be dispersed effectively, the decision to use and deployment of this response technique are time-critical. In order to be used on a spill, a dispersant must be listed on the National Oil and Hazardous Substances Pollution Contingency Plan Product Schedule maintained by the United States Environmental Protection Agency (see Section 4082, "Dispersant Use Policy").

Dispersant use zones are shown on the RRT10 Dispersant Policy Map. The NWACP describes the dispersant review and authorization process in the Dispersant Authorization Process and Decision Support Tools.

Best Management Practices for Chemical Dispersion of Floating Oil

- Requires Regional Response Team approval prior to use unless in a Pre-Authorization Zone.
- The EU would prepare a Net Environmental Benefit Analysis to evaluate the potential risk to animals and habitats in the area compared to not using dispersants.
- Aircraft should spray while flying into the wind and avoid spraying into strong crosswinds.
- Monitor wildlife; establish species-specific buffer zone(s); use in water with adequate volume for dilution; apply only under conditions known to be successful; use only chemicals that are approved for use; implement wildlife deterrent techniques as needed.
- SMART will be used to measure efficacy. SMART is a standardized program designed to monitor chemical dispersion and in-situ burning activities.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for aircraft, as appropriate.
- Follow BMPs for wildlife, as appropriate.

4.7 Barriers, Berms, Culverts Blocks, and Underflow Dams

The objective of using barriers, berms, culvert blocks, and underflow dams is to prevent entry of oil into a sensitive area or to divert oil to a collection area. A physical barrier is placed across an area to prevent moving oil from passing. Oil may be removed using sorbent material (placed in the water where oil is trapped by the barrier), skimmers, or vacuums. Barriers can consist of earthen berms, filter fences, boards, or other solid barriers. Because of the time and labor required to construct berms, they are likely to be in place for one to five weeks, depending on the specific event, if the decision is made to implement this response.

This response is more likely to be implemented in shallow and small water bodies than deep ones. Earthen berms are fortified with sandbags or geotextile fabric (fabric or synthetic material that enhances water movement and retards soil movement) to minimize the amount of siltation that may result from the structure. Silt fences and settling ponds (or a series of them) are used to contain any suspended sediments that may be mobilized in the water while the berm is being constructed in place or being removed. In-stream barriers may be removed using manual or mechanical means, or both, depending on the accessibility of the site, the size of the structure and stream, and the sensitivity of the area to the use of heavy machinery.

If it is necessary for water to pass the barrier because of water flow volume or down-stream water needs, underflow dams (for low flow rates) can be used. Underflow dams contain oil with a solid barrier (e.g., boards, earthen berms) at the water level, while a submerged pipe (e.g., polyvinyl chloride or opening along the bottom of the barrier) allows some water to flow beneath and past the barrier. This strategy is used in small rivers, streams, and drainage ditches or at the entrances to shallow sloughs when the flow of oil threatens sensitive habitats. The importance of maintaining water quality and sufficient flow downstream of barriers is recognized (this response is often used to protect sensitive habitats that are located downstream of the barrier), so these features of affected habitats are monitored. This type of response activity may require permitting and will require coordination with the appropriate trustee agency. Contact the Environmental Unit (EU) to determine if any permits are required.

Best Management Practices for Barriers/Berms and Underflow Dams

- Line the bottom of trenches that do not reach the water table (dry) with plastic to prevent the collected oil from penetrating deeper into the substrate.
- Minimize suspension of sediment to limit effects on water quality.
- Minimize erosion and sediment runoff using engineered controls (e.g., silt fences and settling ponds).
- Coordinate with the Services prior to constructing underflow dams.
- Coordinate with the EU to ensure all necessary permits are in place before

work starts.
- Minimize (ground, seafloor, riverbed, lakebed, etc.) disturbances.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

4.8 Submerged Aquatic Vegetation Cutting

The objective of vegetation cutting is to remove oil trapped in the canopy of kelp beds to prevent the oiling of wildlife or remobilization of trapped oil. Thick layers of oil may adhere to kelp fronds or collect under the kelp canopy. This response option may be used in nearshore marine areas along the outer coasts and in northern Puget Sound. The upper 1 to 2 feet of the kelp canopy is cut away by hand (bull kelp) or with a mechanical kelp harvester (*Macrocystis*). The oiled kelp cuttings are collected for disposal. Trapped tar balls in the kelp are freed and can be manually collected or flushed to a collection site. Submerged aquatic vegetation cutting is used when a large quantity of oil is trapped in the kelp canopy and the oil poses a risk to sensitive wildlife using the kelp habitat or when the remobilization of oil to other adjacent sensitive environments is likely to occur. *Macrocystis* kelp plants grow very rapidly and continue to provide protective habitat to marine fishes and invertebrates. Other types of kelp (such as *Nereocystis* or bull kelp) may be more sensitive to cutting and removal. Bull kelp fronds comprise one layer, so cutting may result in loss of protective habitat for associated fishes and invertebrates. If the reproductive cycle is not taken into account, the kelp forest may not return the following spring. Consult resource experts in the EU regarding these concerns prior to vegetation cutting activities.

Best Management Practices for Submerged Aquatic Vegetation Cutting

- Do not cut, burn, or otherwise remove vegetation unless specifically approved by the EU.
- Kelp is a natural resource for many tribes. EU should include tribes in decision-making processes.
- Monitor operations to minimize the degree of root destruction and mixing of oil deeper into the sediment.
- For plants attached to rock boulders or cobble beaches, sources of population recruitment must be considered.

- Concentrate on removal of vegetation and wood material that is moderately to heavily oiled. Leave lightly oiled and clean vegetation and wood material in place.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

5 Shoreline Response Actions

Within this section, response methods have been consolidated based on similarity of (1) the habitats in which they are used (e.g., sand beaches, rocky shorelines); (2) the types of effects that may potentially result from them (e.g., increases in water temperature, siltation); and (3) the overall activities associated with each (e.g., boat activity, use of machinery). Each type of response is described below.

5.1 Removal of Surface Oil

The objective of this response method is to remove stranded oil on the shoreline while removing a minimum amount of sediment. Collected oil is placed in bags or containers and removed from the shoreline. No mechanized machinery is used, with the possible exception of all terrain vehicles (ATVs) that may be used to transport containers of collected oil to a staging area for retrieval. ATVs are generally used on sand beaches and restricted to transiting outside of the oiled areas along the upper part of the beach, unless plover nesting areas are present.

The techniques used in the removal of surface oil can be used on most shoreline types, but they are most effective on sand or gravel beaches. Generally, removal of surface oil is not recommended on soft mud substrates where mixing oil deeper into the sediment might occur, unless this activity can take place from a boat when the substrate is under water. It is most appropriate for light to moderate oiling by medium to heavy oils. Light oils such as gasoline and diesel rapidly evaporate, spread out to very thin layers, and are not easily picked up. Removal of surface oil is not recommended for mud flats because of the potential for mixing the oil down into the soft sediments. For similar reasons, removal of surface oil is typically only used along the edges of sheltered, vegetated, low riverbanks and marshes, and must be closely monitored.

Best Management Practices for the Removal of Surface Oil

- Removal of surface oil may be performed on all shoreline types, with the exception of tidal flats; not recommended for these shorelines because of the likelihood of mixing oil deeper into the sediments.
- Cleanup should commence after the majority of oil has come ashore, unless significant burial (on sand beaches) or remobilization is expected; minimize

burial and/or remobilization by conducting cleanup between tidal cycles. Consult with the EU before starting cleanup activities.
- Minimize the amount of sediment removed with the oil.
- Separate and segregate any contaminated wastes generated to optimize waste management/disposal and minimize what has to be sent to hazardous waste sites.
- Establish temporary upland collection sites for oiled waste materials for large spill events; collection sites should be appropriately lined and surrounded by berms to prevent secondary contamination from run-off.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

There are three primary methods used to remove surface oil during a response: (1) manual removal of oil, (2) passive collection of oil (sorbents), and (3) vacuum removal of oil. A brief description of each variation follows.

5.1.1 Manual Removal of Oil

Using the manual method, surface oil is removed by using tools such as hand rakes, shovels, and other manual means. Collected oil is placed in bags or containers and removed from the shoreline. This variation of the response can be used on most shoreline types except for tidal flats, where the threat of mixing oil deeper into sediments as a result of foot traffic is typically greater than the benefits gained through use of this method. Manual removal of oil is recommended for use on sheltered rocky shorelines and man-made structures and on sheltered rubble slopes. It is conditionally recommended on exposed rocky shorelines, sand beaches, gravel beaches, sheltered vegetated low banks, and marshes.

Best Management Practices for Manual Removal of Oil

- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO

and local affected Tribes when planning response activities.

- Do not remove clean, natural shoreline debris. Instead, move large accumulations of clean wrack and debris above the high-water line to prevent it from becoming contaminated. Consult with EU on the potential replacement of non-oiled shoreline wrack to the shoreface to provide habitat and forage after the threat of oiling has passed.
- Consult the EU before large woody material is moved. Large woody material is wood greater than four inches in diameter and over six feet long. Permits may be required before woody material is moved. Caution must be practiced when working around large woody material where they may be moved by incoming waves or tides.
- Minimize the amount of sediment removed with the oil. Sediments should be removed only to the depth of oil penetration.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If cultural resources are known or suspected to be in the area use natural anchors (tie off boom to trees or boulders), rather than driving anchor points into the shoreside.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPS for wildlife, as appropriate.

5.1.2 Passive Collection of Oil (Sorbents)

Passive collection of oil allows for oil adsorption onto oleophilic material placed in the intertidal zone or along the riverbank. Sorbent material is placed on the surface of the shoreline substrate, allowing it to adsorb oil as it is released by tidal or wave action. The sorbents most typically used for medium to heavy oils are snares (shaped like cheerleader pompoms) or sorbent sweep made of oleophilic material. Snares are attached at 18-inch intervals along a rope that can be tied, anchored, or staked along the intertidal shoreline. As the snares are moved about by tidal or wave action, they also help remobilize oil by rubbing across sediment and/or rock surfaces. Snare lines are monitored regularly for their effectiveness at picking up oil and to collect and replace oiled sorbents with new material. This method is often used as a secondary treatment method after gross oil removal and along sensitive shorelines where access is restricted. Passive collection with sorbents can also be used in conjunction with other techniques (e.g., flushing, booming) to collect floating oil for recovery. Passive collection of oil using sorbents is recommended for sand beaches, gravel beaches, sheltered rocky shores and man-made structures, sheltered rubble slopes, sheltered vegetated low banks, and marshes. It is conditionally recommended on exposed rocky shores and on tidal flats.

Best Management Practices for Passive Collection of Oil

- Passive collection of oil using sorbent material may be used on all shoreline types but is most useful with light to moderate oiling.
- Retrieval of sorbent material, and at least daily monitoring to check that sorbents are not adversely affecting wildlife or breaking apart, are mandatory.
- Continually monitor and collect passive sorbent material deployed in the intertidal zone to prevent it from entering the environment as non-degradable, oily debris.
- Monitor passive absorbents placed in the mid- or lower intertidal zone for potential entrapment of small crustaceans; coordinate with the EU for corrective actions if entrapment is observed.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If cultural resources are known or suspected to be in the area use natural anchors (tie off boom to trees or boulders), rather than driving anchor points into the shoreside.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for the use of sorbents, as appropriate.
- Follow BMPs for booming, as appropriate.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

5.1.3 Vacuum Removal of Oil

The objective of vacuum removal is to remove free oil that has pooled on the substrate. This method entails the use of a vacuum unit with a suction head to recover free oil. Equipment can range in size from small portable units that fill individual 55-gallon drums to large vacuum trucks (aka “supersuckers”) that are truck-mounted and have the capacity to lift large rocks. Vacuum trucks are primarily used when circumstances (e.g., the length or number of hoses used) require greater suction capacity. This system can also be used with water spray systems to flush the oil towards the suction head. Booming and associated equipment are often used to contain and direct oil to vacuum removal systems. This response variation is used when free, liquid oil is stranded on the shoreline (usually along the high-tide line) or trapped in vegetation that is readily accessible. Vacuum removal of oil is not recommended on any shoreline habitat. It is

conditionally recommended on exposed rocky shores, sand beaches, gravel beaches, sheltered rocky shores and man-made structures, sheltered rubble slopes, sheltered vegetated low banks, and marshes.

Vacuum removal of oil is not the preferred method in culturally sensitive areas.

Best Management Practices for Vacuum Removal of Oil

- Vacuum removal of oil may be used on any shoreline type where liquid oil has pooled, with the exception of tidal flats; not recommended for these shorelines because of poor access and potential for mixing oil deeper into the sediments.
- Closely monitor vacuum operations in wetlands; site specific restrictions may be required to minimize the impact to marsh plant root system, which could lead to erosion.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If cultural resources are known or suspected to be in the area use natural anchors (tie off boom to trees or boulders), rather than driving anchor points into the shoreside).
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.
- Follow BMPs for booming, as appropriate.

5.2 Oiled Debris Removal

The objective of this response is the removal of oiled debris (organic and man- made) from the shoreline. Debris (e.g., seaweed, trash and logs) is removed when it becomes heavily contaminated and when it is either a potential source of chronic oil release, an aesthetic problem, or a source of contamination for organisms on the shoreline. If time and resources permit, unoiled, man-made debris (e.g., trash, mooring lines, etc.) may be removed or placed above the high tide line prior to oil reaching a shoreline (based on oil spill trajectory) in order to minimize the amount of oiled debris generated by the spill. Oiled debris removal is recommended for sand beaches, gravel beaches, sheltered rocky shores and man-made structures, and sheltered rubble slopes. It is conditionally recommended on exposed rocky shores, tidal flats, sheltered vegetated low banks, and

marshes.

Best Management Practices for Oiled Debris Removal

- Removal of oily debris may be used on all shoreline types; removal of oily debris from shorelines with soft mud substrates (mudflats, marshes) is usually restricted to debris stranded at the high tide line where debris can be recovered without grinding oil into the substrate.
- Minimize foot traffic through oiled areas on non-solid substrates (sand, gravel, dirt, etc.) to reduce the likelihood that oil will be worked into the sediment.
- Minimize quantity of oiled vegetative debris removed by concentrating on debris that is moderately to heavily oiled; leave lightly oiled and clean stranded seaweed and wood material in place to provide habitat for small invertebrates and to help stabilize shoreline.
- Consult the EU before large woody material is moved. Large woody material is wood greater than four inches in diameter and over six feet long. Permits may be required before woody material is moved.
- Restrict foot traffic over sensitive areas (shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for mechanical damage.
- Shoreline access to specific areas may be restricted for periods of time to minimize the impact of human presence/excessive noise on nearby sensitive biological populations (bird nesting, marine mammal pupping, breeding, fish spawning, etc.).
- Separate and segregate any contaminated wastes generated to optimize waste management/disposal and minimize what must be sent to hazardous waste sites.
- Establish temporary upland collection sites for oiled waste materials for large spill events; collection sites should be lined with asphalt pad and surrounded by berms to prevent secondary contamination from run-off.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

5.3 Mechanical Removal of Surface Oil and Contaminated Sediments

Mechanical removal with heavy equipment (e.g. bulldozers, backhoes, etc.) is usually implemented when the spill area or debris size exceeds the capacity of manual removal. Heavy equipment is typically used in sand, gravel, or cobble, where surface sediments are amendable to and accessible by heavy equipment.

Dredging of sediments is rare. Typically, it is only considered for sinking oils. Sediment reworking may be used on gravel beaches with high erosion rates or low sediment replenishment rates. It is also considered where the remoteness of the location or other logistical limitations make sediment removal unfeasible.

Best Management Practices for the Mechanical Removal of Surface Oil and Contaminated Sediments

- Implement after the majority of oil has come ashore, unless significant burial (sand beaches) or remobilization is expected; implement between tidal cycles to minimize burial and/or remobilization of oil.
- Protect nearby sensitive areas from increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures.
- Minimize the amount of oiled sediment removed by closely monitoring mechanical equipment operations.
- In areas prone to erosion, replace removed sediment or soil with clean sediment.
- Minimize erosion and runoff using engineered controls.
- Monitor for the presence of special status animals and plants.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If cultural resources are known or suspected to be in the area use natural anchors (tie off boom to trees or boulders), rather than driving anchor points into the shoreside.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

5.4 Trenching/Recovery Wells

The objective of trenching or the use of recovery wells is to remove subsurface oil from permeable substrates. Trenches or wells are dug down to the depth of the oil (or water table) to intercept oil migrating through the substrate. The oil collected in the trench or well is then recovered by vacuum pump or skimmer and disposed of offsite. The oil must be liquid enough to flow at ambient temperatures. Water flooding or flushing the

substrate can be used to speed up oil migration into the trench or well. If the trench or well is not deep enough to reach the water table, the bottom must be lined with plastic to prevent oil penetration deeper into the sediment. Trenches are not dug in the lower portions of the beach where attached plants and organisms may be abundant.

Trenching and recovery wells are conditionally recommended for sand beaches, gravel beaches (pebble- to cobble-size substrate), and sheltered vegetated low banks.

Best Management Practices for Trenching and the Use of Recovery Wells

- Trenching and recovery wells may be used on sand and gravel shorelines with grain sizes ranging from fine sand to pebble-size gravel.
- Line the bottom of trenches that do not reach the water table (dry) with plastic to prevent the collected oil from penetrating deeper into the substrate.
- Restrict trenches from the lower intertidal zone where attached algae and organisms are abundant.
- Collapse or fill in trenches/well when response action is completed; ensure that sides and bottom of trenches are clean before collapsing.
- Minimize foot traffic through oiled areas on non-solid substrates (sand, gravel, dirt, etc.) to reduce the likelihood that oil will be worked into the sediment.
- Restrict foot traffic over sensitive areas (shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for mechanical damage.
- Shoreline access to specific areas may be restricted for periods of time to minimize the impact of human presence/excessive noise on nearby sensitive biological populations (bird nesting, marine mammal pupping, breeding, fish spawning, etc.).
- Separate and segregate any contaminated wastes generated to optimize waste management/disposal and minimize what must be sent to hazardous waste sites.
- Establish temporary upland collection sites for oiled waste materials for large spill events; collection sites should be lined with asphalt pad and surrounded by berms to prevent secondary contamination from run-off.
- Remove structures and fill trenches once response action is completed.
- Coordinate with the Services prior to constructing underflow dams
- Underflow dams require an HPA in Washington. In Oregon emergency removal/fill authorizations or permits may be required by the Division of State Lands.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If cultural resources are known or suspected to be in the area use natural

anchors (tie off boom to trees or boulders), rather than driving anchor points into the shoreside.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

5.5 Removal of Oiled Sediment

In this method, oiled sediment is removed by either use of hand tools or use of various kinds of motorized equipment. Oiled sediment removal is restricted to the supratidal and upper intertidal areas to minimize disturbance of biological communities in the lower intertidal and subtidal zones. After removal, oiled sediments are transported and disposed of offsite. New sediments are not typically transported to replace those that were removed; however, a variation of this response that includes sediment replacement (described below) is used for beaches with low natural replenishment rates or high rates of erosion. This method of cleanup is most effective when there is a limited amount of oiled sediment that must be removed. Close monitoring is required so that the quantity of sediment removed, siltation, and the likelihood of erosion may be minimized in all cases. Such operations are generally restricted in fish spawning areas. Sensitive areas that are adjacent, and may be potentially affected by released oil sheens, must also be protected.

It should be noted that oiled sediment removal (and removal of adjacent sediment) may be used along riverbanks or other upland areas to prevent oil from leaching into the adjacent aquatic environment. For example, this technique may be necessary when a tanker truck or rail car overturns and spills oil in an upland area adjacent to a stream. As a primary response, the source of the oil in the environment, including the sediment and/or adjacent soil into which it was spilled, is removed before it has a chance to remobilize into nearby water. The tools used to remove source sediment and/or adjacent soil vary with the scale of the spill and the accessibility of the site; however, both manual and mechanized removal tools are used regularly. In areas that are prone to erosion, contaminated sediment and/or soil that is removed is typically replaced with clean sediment.

Typically, oiled sediment removal is conditionally recommended for sand beaches, gravel beaches, sheltered rubble slopes, and sheltered vegetated low banks.

Best Management Practices for the Removal of Oiled Sediment

- Oiled sediment removal (without replacement) is used primarily on sand beaches not subject to high rates of erosion; small quantities of oiled sediment removal may be permitted on gravel beaches (pebble- to cobble-size gravel or riprap) and sheltered vegetated stream banks.
- Cleanup should commence after the majority of oil has come ashore, unless significant burial (sand beaches) or remobilization is expected; minimize burial and/or remobilization by conducting cleanup between tidal cycles.
- Consult with the EU when planning for the removal of oiled sediment.
- Restrict sediment removal to supra and upper intertidal zones (or above waterline on stream banks) to minimize disturbance of biological communities in lower intertidal and subtidal zones.
- Take appropriate actions to protect nearby sensitive environments (salmon spawning streams, shellfish bed, nursery areas) from the effects of increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of protection measures.
- Minimize the amount of oiled sediment removed by closely monitoring mechanical equipment operations.
- Minimize erosion and runoff using engineered controls.
- Coordinate the locations of any temporary oiled sediment staging or storage sites near the shoreline with the EU.
- Minimize vehicle traffic through oiled areas to reduce the likelihood that oil will be worked into the sediment and contamination carried offsite by cleanup equipment.
- Restrict foot or vehicular traffic over sensitive areas (shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for mechanical damage.
- Monitor for the presence of special status animals and plants
- Shoreline access to specific areas may be restricted for periods of time to minimize the impact of human presence/excessive noise on nearby sensitive biological populations (bird nesting, marine mammal pupping, breeding, fish spawning, etc.).
- Separate and segregate any contaminated wastes generated to optimize waste management/disposal and minimize what has to be sent to hazardous waste sites.
- Establish temporary upland collection sites for oiled waste materials for large spill events; collection sites should be lined with asphalt pad and surrounded by berms to prevent secondary contamination from run-off.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.

- If cultural resources are known or suspected to be in the area use natural anchors (tie off boom to trees or boulders), rather than driving anchor points into the shoreside.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- An HPA may be required in Washington. In Oregon emergency removal/fill authorizations or permits may be required by the Division of State Lands.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for staging area establishment and use.
- Follow BMPs for wildlife, as appropriate.

5.5.1 Oiled Sediment Reworking

The objective of this variation of oiled sediment removal is to re-work oiled sediments to break up oil deposits, increase surface area, and mix oxygen into deep subsurface oil layers; this activity exposes the oil to natural removal processes and enhances the rate of oil degradation. Oiled sediment is not removed from the beach. Instead, beach sediments are rototilled or otherwise mechanically mixed with the use of heavy equipment. The oiled sediments in the upper beach area may also be relocated to the mid-tidal portion of the beach. Relocation enhances natural cleanup during reworking by wave activity. This procedure is also known as surf washing, or berm relocation. Generally, sediment reworking is used on sand or gravel beaches where high erosion rates or low natural sediment replenishment rates are issues. Sediment reworking may also be used where remoteness or other logistical limitations make sediment removal unfeasible. Sediment reworking is not used on beaches near shellfish harvest or fish spawning areas because of the potential for release of oil or oiled sediments into these sensitive habitats. Sediment reworking is conditionally recommended for sand beach and gravel beach habitats.

Best Management Practices for Oiled Sediment Reworking

- Oiled sediment reworking (rototilling) breaks up oil crusts or aerates light surface oiling; used primarily on sand or mixed sand and gravel beaches, especially those prone to erosion.
- Berm relocation or surf washing may be used on sand, mixed sand and gravel, or gravel (pebble- to cobble-size) beaches exposed to at least moderate wave energy.
- Restrict rototilling to mid- and upper-intertidal zones to minimize disturbance of biological communities in lower intertidal and subtidal zones.

- Restrict berm relocation/surf washing in vicinity of sensitive environments (salmon spawning streams, shellfish bed, nursery areas, etc.) to prevent adverse effects from increased oil runoff/sheening or siltation.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- An HPA may be required in Washington. In Oregon emergency removal/fill authorizations or permits may be required by the Division of State Lands.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for staging area establishment and use.
- Follow BMPs for wildlife, as appropriate.

5.5.2 Oiled Sediment Removal with Replacement

The objective of this response variation is to remove oiled sediment and replace it with cleaned or new material. Oiled sediments are excavated using heavy equipment on the beach at low tide. After removal of the oiled sediment, new clean sediment of similar composition is brought in for replacement. The oiled sediment may also be cleaned and then replaced on the beach. The sediments are loaded into a container for washing. Cleansing methods include a hot water wash or physical agitation with a cleaning solution. After the cleansing process, the rinsed materials are returned to the original area. Cleaning equipment must be placed close to beaches to reduce transportation problems. This variation is conditionally recommended on sand beaches, gravel beaches, and sheltered rubble slopes, although the beaches must be exposed to wave activity so the replaced sediments can be re-worked into a natural distribution.

Best Management Practices for Oiled Sediment Removal and Replacement

- Oiled sediment removal (with replacement) is used primarily on sand, mixed sand and gravel, gravel, and vegetated stream bank shorelines subjected to high rates of erosion.
- Restrict sediment removal and replacement to supra and upper intertidal zones (or above waterline on stream banks) to minimize disturbance of biological communities in lower intertidal and subtidal zones.
- Take appropriate actions to protect nearby sensitive environments (salmon spawning streams, shellfish bed, nursery areas) from the effects of increased oil runoff/sheening or siltation by the proper deployment of booms, siltation curtains, sorbents, etc.; monitor for effectiveness of

protection measures.

- Coordinate the locations of any temporary oiled sediment staging or storage sites near the shoreline with the EU.
- Keep all equipment on hardened surfaces, if possible. Utilize existing hardened access paths and paved areas when approaching shorelines.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- An HPA may be required in Washington. In Oregon emergency removal/fill authorizations or permits may be required by the Division of State Lands.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for staging area establishment and use.
- Follow BMPs for wildlife, as appropriate.

5.6 Flushing with Ambient (Temperature, Salinity) Water

The objective of ambient water flushing is to remobilize oil stranded on surface substrate, as well as oil from crevices and rock interstices, to the water's edge for collection. Water is pumped from hoses onto an oiled beach, beginning above the highest level where the oil is stranded and slowly working down to the water level. The flow of water remobilizes oil stranded on the surface sediments and flushes it down to the water's edge. The remobilized oil is contained by boom and recovered for disposal. Increased water pressure may be needed to assist in the remobilization as the oil weathers and begins to harden on the substrate. Because of the potential for higher pressures to cause siltation and physical disruption of the softer substrates, flushing with higher pressures is restricted to rock or hard man-made substrates.

Intake and outflow hoses may range from 2 to 4 inches in diameter and, depending on the pump used, pump between 200 and 400 gallons of water per minute. Intake hoses are fitted with screens to minimize the extraction of debris, flora, and fauna. The pump intake must be screened with material that has openings no larger than: 5/64 inch (for square holes), measured side to side OR 3/32-inch diameter (for round holes). In addition, the screen must have at least one square inch of functional screen area for every gallon per minute (gpm) of rated pump capacity. For example, a 100 gpm-rated pump would require at least a 100 square inch screen. Intake hoses are propped off the bottom using rebar in about 3 feet of water to further minimize the amount of sediment and debris, and the number of organisms, taken into the hose and pump.

Best Management Practices for Ambient Water Flushing

- Cleanup should commence after the majority of oil has come ashore, unless significant burial (sand beaches) or remobilization is expected; minimize burial and/or remobilization by conducting cleanup between tidal cycles.
- Consult the EU when planning any ambient water flushing operations.
- Protect sensitive nearby environments (salmon spawning streams, shellfish bed, submerged aquatic vegetation, nursery areas, etc.) from the effects of increased oil runoff by the proper deployment of booms, sorbents, etc.; monitor for effectiveness of protection measures.
- Restrict foot or vehicular traffic over sensitive areas (shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for mechanical damage.
- Shoreline access to specific areas may be restricted for periods of time to minimize the impact of human presence/excessive noise on nearby sensitive biological populations (bird nesting, marine mammal pupping, breeding, fish spawning, etc.).
- An HPA may be required in Washington. In Oregon, pumping from Waters of the State may require emergency authorization with the Oregon Water Resources Division.Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for staging area establishment and use.
- Follow BMPs for wildlife, as appropriate.

5.6.1 Ambient Water Flooding (Deluge)

The objective of this variation of ambient water flushing is to mobilize stranded oil from rock crevices and interstices. Ambient water is pumped through a header pipe at low pressure above and inshore from the fouled area of shoreline. The pipe is meant to create a sheet of water that simulates tidal washing over the affected area. Removing stranded oil may be particularly important when a more sensitive habitat is nearby and in danger of becoming fouled with oil after the intertidal zone is washed over the next tidal cycle, remobilizing oil. The effects of flooding may also be desired when a spring tide has deposited oil above the normal high water mark or when the wave energy of the adjacent water is not great enough to sufficiently wash the affected area over the following tidal cycle. After oil has been loosened from the substrate, it is collected and removed using a variety of mechanical, manual and passive methods. Ambient water flooding is recommended for use on gravel beaches. Ambient water flooding is conditionally recommended for sand beaches, sheltered rocky shorelines and man-made structures, sheltered rubble slopes, sheltered vegetated low banks, and marshes.

Best Management Practices for Ambient Water Flooding (Deluge)

- Ambient water flooding (deluge) could be used on all shoreline types, with

the exception of fine- to coarse-grained sand beaches. Use in this habitat could mobilize contaminated sediment into the environmentally sensitive subtidal zone or cause excessive siltation.
- Closely monitor flooding of shorelines with fine sediments (mixed sand and gravel, sheltered rubble, sheltered vegetative banks, marshes) to minimize excessive siltation or mobilization of contaminated sediments into the subtidal zone.
- Ambient water flooding is not generally useful on exposed rocky shorelines or submerged tidal flats because these areas are naturally well flooded.
- Use the lowest pressure that is effective and prevent suspension of bottom sediments (do not create a muddy plume).
- An HPA may be required in Washington. In Oregon, pumping from Waters of the State may require emergency authorization with the Oregon Water Resources Division. Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for staging area establishment and use.
- Follow BMPs for wildlife, as appropriate.

5.6.2 Ambient Water, Low-Pressure Flushing

The objective of this variation of ambient water flushing is to mobilize liquid oil that has adhered to the substrate or man-made structures, pooled on the surface, or become trapped in vegetation to the water's edge for collection. Low-pressure washing (<50 pounds per square inch) with ambient seawater sprayed through hoses is used to flush oil to the water's edge for pickup. Oil is trapped by booms and picked up with skimmers or sorbents. This variation may also be used in concert with ambient water flooding, which helps move the oil without the potential effects associated with higher water pressures. Low-pressure flushing is conditionally recommended for exposed rocky shores, sand beaches with coarser sediments (mixed sand and gravel), gravel beaches, sheltered rocky shorelines and man-made structures, sheltered rubble slopes, sheltered vegetated low banks and marshes.

Best Management Practices for Ambient Water, Low-pressure Flushing

- Ambient water, low-pressure flushing could be used on all shoreline types with the exception of sand beaches (fine- to coarse-grained) and mud flats (exposed or sheltered).
- In marshes conduct flushing at high tide, either from boats or from the high-tide line to prevent foot traffic in vegetation.
- Conduct all flushing adjacent to marshes from boats.

- Flushing on exposed rocky shorelines may be hazardous to response personnel; ensure presence of adequate safeguards and monitoring to ensure personnel safety.
- Prevent pushing or mixing oil deeper into the sediment by not directing the stream of water directly into the oil; direct hoses to place the stream of water above or behind the surface oil to create a sheet of water to re- mobilize and carry oil down the beach to a containment area for recovery.
- Closely monitor flushing of shorelines with fine sediments (mixed sand and gravel, sheltered rubble, sheltered vegetative banks, marshes) to minimize excessive siltation or contaminated sediments mobilization into the subtidal zone.
- Restrict flushing in marshes from boats or on shore above the high tide line during high tide to minimize mixing oil into the sediments or mechanically damaging the marsh plants.
- Use the lowest pressure that is effective and prevent suspension of bottom sediments (do not create a muddy plume).
- An HPA may be required in Washington. In Oregon, pumping from Waters of the State may require emergency authorization with the Oregon Water Resources Division. Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

5.6.3 Ambient Water, High-Pressure Flushing

The objective of this variation of ambient water flushing is to mobilize oil that has adhered to hard substrates or man-made structures to the water's edge for collection. It is similar to low-pressure washing except the water pressure may reach 100+ pounds per square inch, and it can be used to flush floating oil or loose oil out of tide pools and between crevices on riprap. Compared to the lower pressure spray, high-pressure spray will more effectively remove oil that has adhered to rocks. Because water volumes are typically low, this response method may require the placement of sorbents directly below the treatment area or the use of a deluge to carry oil to the water's edge for collection. High-pressure flushing is conditionally recommended for exposed rocky shores, gravel beaches, particularly those consisting of cobble- and boulder-size rocks, and riprap, sheltered rocky shorelines and man-made structures, and sheltered rubble slopes.

Best Management Practices for Ambient Water, High-pressure Flushing

- Ambient water, high-pressure flushing may be used on rocky (exposed and sheltered) and riprap shorelines.
- Flushing on exposed rocky shorelines may be hazardous to response

personnel; ensure the presence of adequate safeguards and monitoring to ensure personnel safety.

- Prevent pushing or mixing oil deeper into the riprap by not directing the stream of water directly into the oil; direct hoses to place the stream of water above or behind the surface oil to create a sheet of water to re- mobilize and carry oil down to a containment area for recovery.
- If small volumes of high-pressure water are used to remobilize weathered oil from rocky surface, include larger volume of low-pressure water to help carry remobilized oil into containment area for recovery.
- Implement after the majority of oil has come ashore.
- Restrict use to certain tidal elevations so that the oil/water effluent does not drain across sensitive low-tide habitat. Closely monitor operations in sensitive habitats and report impacts to the EU.
- Monitor booms and oil collection methods to prevent transport of oil and oiled sediment away from site to near shores and down coast. Monitor wildlife such as birds and mammals. Evaluate the need for hazing and/or buffer zones between nesting areas, aquatic vegetation, spawning areas, etc.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource. Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- An HPA may be required in Washington. In Oregon, pumping from Waters of the State may require emergency authorization with the Oregon Water Resources Division. Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

5.7 Warm Water, Moderate-Pressure Washing

The objective of warm water, moderate-pressure washing is to mobilize thick and weathered oil that has adhered to rock surfaces, prior to flushing it to the water's edge for collection. Seawater is heated (typically between the ambient temperature and 90 degrees Fahrenheit [$^{\circ}$F]) and applied at moderate pressure to mobilize weathered oil that has adhered to rocks. If the warm water is not sufficient to flush the oil down the beach, flooding, or additional low- or high- pressure washing may be used to float the oil to the water's edge for pickup. Oil is then trapped by boom and may be picked up with skimmers or sorbents.

Warm water, moderate-pressure washing is conditionally recommended for exposed rocky shores, gravel beaches (including riprap), and sheltered rocky shorelines and man-made structures. One variation of the response exists: hot water, moderate-pressure washing (described below).

Best Management Practices for Warm Water, Moderate-pressure Washing

- Warm water, moderate-pressure flushing may be used on heavily oiled gravel beaches, riprap, and hard, vertical, manmade structures such as seawalls, bulkheads, and docks.
- Restrict use to certain tidal elevations so that the oil/water effluent does not drain across sensitive low-tide habitats (damage can result from exposure to oil, oiled sediments, and hot water).
- Closely monitor operations in sensitive habitats and report observations to the EU.
- Flushing on exposed, rocky shorelines may be hazardous to response personnel; ensure the presence of adequate safeguards and monitoring to ensure personnel safety.
- If small volumes of warm water are used to remobilize weathered oil from rocky surface, include larger volume of ambient water at low pressure to help carry re-mobilized oil into containment area for recovery.
- Cleanup should commence after the majority of oil has come ashore. Consult the EU before starting flushing activities.
- Protect nearby sensitive environments (salmon spawning streams, shellfish bed, submerged aquatic vegetation, nursery areas, etc.) from the effects of increased oil runoff by the proper deployment of booms, sorbents, etc.; monitor for effectiveness of protection measures.
- Monitor booms and oil collection methods to prevent transport of oil and oiled sediment away from the site to near shores and down coast.
- Restrict foot traffic over sensitive areas (shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for mechanical damage.
- Shoreline access to specific areas may be restricted for periods of time to minimize the impact of human presence/excessive noise on nearby sensitive biological populations (bird nesting, marine mammal pupping, breeding, fish spawning, etc.).
- An HPA may be required in Washington. In Oregon, pumping from Waters of the State may require emergency authorization with the Oregon Water Resources Division.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.

- Follow BMPs for wildlife, as appropriate.

5.8 Hot Water Moderate-Pressure Washing

The objective of this variation of warm water, moderate-pressure washing is to dislodge and mobilize trapped and weathered oil from inaccessible locations and surfaces not amenable to mechanical removal, prior to flushing oil to water's edge for collection. Water heaters are mounted on offshore barges or on small land- based units. The water is heated to temperatures from 90°F to 170°F, which is usually sprayed in small volumes by hand using moderate-pressure wands. Used without water flooding, this procedure requires immediate use of vacuums (vacuum trucks or super suckers) to remove the oil/water runoff. With a deluge system, the oil is flushed to the water's edge for collection with skimmers or sorbents. This response is generally used when the oil has weathered to the point that even warm water at high pressure is ineffective for the removal of adhered oil, which must be removed due to the threat of continued release of oil or for aesthetic reasons. Hot water washing is conditionally recommended for exposed rocky shores, gravel beaches (specifically riprap), and sheltered rocky shorelines and man-made structures

Best Management Practices for Hot Water, Moderate-pressure Washing

- Hot water, moderate-pressure flushing is used only on heavily oiled hard, man-made structures such as seawalls, bulkheads, docks, and riprap, primarily for aesthetic purposes.
- Restrict use to certain tidal elevations so that the oil/water effluent does not drain across sensitive low-tide habitats (damage can result from exposure to oil, oiled sediments, and hot water).
- If small volumes of hot water are used to remobilize weathered oil from rocky surface, remobilized oil must be recovered using sorbent material at the base of the structure; or a second stream with ambient water can be used to flush the remobilized oil to the water's edge for recovery.
- Cleanup should commence after the majority of oil has come ashore. Consult the EU before starting flushing activities.
- An HPA may be required in Washington. In Oregon, pumping from Waters of the State may require emergency authorization with the Oregon Water Resources Division.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

5.9 Vegetation Cutting

The objective of vegetation cutting is the removal of oiled vegetation attached to the shoreline to prevent the oiling of wildlife or remobilization of trapped oil. Thick layers of oil may adhere to plant leaves or pool on the substrate under a layer of overlapping plant leaves. The upper parts of the oiled plant are cut away using hand tools or "weed eater" type power tools. The oiled plant cuttings are raked up and removed for disposal. Any remaining oil pooled around the roots/stems can then be flushed out for recovery. These attached plants provide protective habitat to fish and invertebrate species, so cutting of this type will result in a temporary loss of habitat. Cut vegetation may or may not recover depending on the reproductive cycle of the plant and whether the plant roots are oiled or damaged in the cutting operation. Responders may cut invasive species (such as Himalayan Blackberry) or trim branches to access a site. For any cutting beyond what is necessary for site access, responders should consult resource experts in the EU prior to initiating vegetation cutting.

This response method is generally used when large quantities of potentially mobile oil are trapped in the vegetation or when the risk of oiled vegetation contaminating wildlife is greater than the value of the vegetation that is to be cut, and there is no less destructive method to remove the oil. When conducted in marshes, boards are generally laid down for workers to walk; this distributes the workers' weight to prevent damage to plant root systems and to avoid working oil deeper into the soft sediments. This response is conditionally recommended for exposed rocky shorelines, gravel beaches, sheltered rocky shorelines and man-made structures, sheltered rubble slopes, sheltered vegetated low banks, and marshes.

Best Management Practices for Vegetation Cutting

- Do not cut, burn, or otherwise remove vegetation unless specifically approved by the EU. Permitting may be required.
- Vegetation cutting may be used on marsh, rock, gravel (boulder/riprap), and vegetated riverbanks.
- Cleanup should commence after the majority of oil has come ashore.
- Strict monitoring of the operations must be conducted so corrective actions can be taken if there is harm to roots or if oil is mixing deeper into the sediment.
- Minimize foot traffic through oiled areas on non-solid substrates (sand, gravel, dirt, etc.) to reduce the likelihood that oil will be worked into the sediment.
- Minimize mechanical impacts on vegetation being cut by taking appropriate actions to ensure continued health and survival of the vegetative ecosystem.
- Restrict foot traffic over sensitive areas (shellfish beds, salmon redds, algal mats, bird nesting areas, dunes, etc.) to reduce the potential for mechanical damage.

- Shoreline access to specific areas may be restricted for periods of time to minimize the impact of human presence/excessive noise on nearby sensitive biological populations (bird nesting, marine mammal pupping, breeding, fish spawning, etc.).
- Separate and segregate any contaminated wastes generated to optimize waste management/disposal and minimize what must be sent to hazardous waste sites.
- Establish temporary upland collection sites for oiled waste materials for large spill events; collection sites should be lined with asphalt pad and surrounded by berms to prevent secondary contamination from run-off.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

6 Nutrient Enhancement and Microbial Enhancement

Nutrient enhancement and microbial enhancement may be used alone or together, along with other amendments to increase the in situ (or ex situ) remediation of petroleum hydrocarbons. Together, these enhancements, along with wetting agents/surfactants and other additives to increase their efficiency are known as bioremediation. They are described in more detail below.

The objective of nutrient enhancement is to increase the rates of natural degradation of oil by adding nutrients (specifically nitrogen and phosphorus). Microbial enhancement is the addition of microbes specifically designed or propagated from existing microbes to degrade oil and presumes that nutrients are the limiting factor. Microbial biodegradation is the conversion by microorganisms of hydrocarbons into oxidized products via various enzymatic reactions. Some hydrocarbons are converted into carbon dioxide and cell material, while others are partially oxidized or left unaltered as a residue. Oxygen is often a limiting factor as well for heavily impacted sediments, and addition of any microbes or nutrients should be considered only after the specific limiting factors are evaluated. If oxygen is in deficit in heavily impacted zones, the addition of microbes or nutrients is unlikely to be successful.

Nutrients are applied to the shoreline using one of several methods: (1) soluble inorganic formulations are dissolved in water and applied as a spray at low tide, requiring frequent applications; (2) slow- release formulations are applied as a solid to the intertidal zone and designed to slowly dissolve; and (3) oleophilic formulations that adhere to the oil itself and are sprayed directly on the oiled areas. This response method is limited to areas where the substrate can be penetrated by the application of liquid amendments. Nutrient and/or microbial enhancement is conditionally recommended on sand beaches, gravel beaches,

sheltered rubble, slopes and marshes.

Some microbial or bioremediation amendments contain additives that may preclude safe use around waterways and therefore should be restricted to upland applications where deep penetration or runoff is not possible. Such additives include wetting agents/surfactants aimed at enhancing contact between the microbes and the impacted media, dispersants which break down the oil into smaller particles so that microbes or nutrients can be more effective, and perfumes meant to mask odors associated with the enhancement products or the breakdown of the petroleum. Without specific information about the safety of using enhancements that contain these additional products, they should not be approved in settings where surface water or groundwater used for beneficial uses (including surface water recharge) could be impacted.

Nutrient and microbial enhancement in areas that impact water bodies or shorelines requires Regional Response Team (RRT) approval on a case-by-case basis, as well as the development of a detailed operations and monitoring plan. Additionally, state regulatory programs may require permits for application of some enhancements.

Best Management Practices for Nutrient and Microbial Enhancement

- An assessment of the limiting factors (oxygen, nutrients, microbes) should be conducted before addition of enhancements, and treatment aim to address the factors limiting natural biodegradation
- Nutrient and microbial enhancements must be approved by the RRT in areas where applications could impact surface water
- Enhancements may require state permitting for applications to land and/or water
- Enhancements containing nutrients should be conducted to minimize the potential for introducing nutrients to surface water or groundwater aquifers
- Enhancements containing wetting agents/surfactants and/or dispersants cannot be used near waterways without RRT approval
- Enhancements containing perfumes should not be used in areas where waterways may be impacted from runoff or breakdown products unless the safety/efficacy has been proven
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

7 Submerged Oil Detection and Recovery

Spills of non-floating oil pose a substantial threat to water-column and benthic aquatic resources, particularly where significant amounts of oil have accumulated on the

substrate. When oils sink or become suspended in the water column, traditional oil recovery methods (booms, skimmers, etc.) are no longer effective. Specialized equipment and techniques can be used to detect and recover non-floating oil. Because some of these techniques have the potential to cause more damage than the original oiling, it is important to consider the benefits and trade-offs associated with a particular method when selecting a response option.

Methods used to detect non-floating oil include the use of sonar systems, underwater cameras, laser fluorosensors, induced polarization, bottom sampling, water-column sampling, diver observations, and visual observations. Non-floating oil recovery options include suction dredge, diver-directed pumping and vacuuming, mechanical removal, sorbent/ Vessel-Submerged Oil Recovery System (V-SORs), trawls and nets, manual removal, and agitation/refloat. These methods are further discussed in Section 9412 Non-Floating Oils Spill Response Tool.

Prior to recovery operations, consider conducting a Net Environmental Benefit Analysis (NEBA). The Non-Floating Oils Spill Response Tool provides more information on NEBA and specific impacts to resources at risk during a non-floating oil response.

Best Management Practices for Non-Floating Oil Detection and Recovery

- Priority given to preventing, minimizing, and containing non-floating oils.
- Respond rapidly and aggressively to recover oils when on the surface (if safe to do so) before the oils start to sink.
- Systems should be designed and operated to minimize incidental water and sediment collection.
- Activity which spreads oil deeper into sediments or moves it further off site (e.g. foot access through soft sediments or creating sediment plumes that leave site) should be avoided.
- Operation of suction systems through the water column should be minimized until the inlet is close to the surface of the bed to reduce potential for fish entrainment.
- Drive mechanisms (wheels, tracks, tires, etc.) of equipment should not enter the water.
- Water discharged from the treatment plant back into the environment shall be done in a manner that minimizes erosion of bank and bed sediments.
- Conduct a NEBA to determine if recovery techniques have the potential to cause more damage than the original oiling.
- Permits may be required for the selected method. Refer to the Permit Summary Table tool.
- If operating in an archaeologically and/or culturally sensitive area, take measures to protect cultural resources. Understand what cultural resources might look like. When in doubt, assume the material is a cultural resource.

Promptly notify the EU of any discoveries. EU should consult with the SHPO and local affected Tribes when planning response activities.
- Follow BMPs for decanting, as appropriate.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

8 Natural Attenuation (with monitoring)

Sometimes choosing not to respond to an oil spill is the best option. Under most conditions, spilled oil will degrade naturally in the environment over time. The rate of natural attenuation is a function of the oil's chemical and physical properties, as well as the character of the environment the oil was spilled. Light refined products like gasoline and diesel tend to degrade much faster than heavier, more persistent products. Oil spilled in high-energy environments (surf zones, rivers, etc.) or areas with high natural flushing mechanisms (tides and rain) will attenuate much faster than oil spill in calm, low-energy environments. Another factor to consider is the volume spilled. Consider if the mobilization of equipment, and waste generated from other response options would be a greater burden on the environment than the original spilled oil. Natural attenuation may not be appropriate for oiled areas that are heavily used by people or wildlife. Natural attenuation of spilled oiled should be monitored to confirm effectiveness. Monitoring should be done in a way that minimizes additional impact to the environment.

Best Management Practices for Natural Attenuation (with monitoring)

- Prepare monitoring plan with appropriate schedule and information on contacts/reports to be made if situation changes or impacts to wildlife/habitat are noted.
- Minimize presence of people and equipment.
- May consider relocation or hazing activities if appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.

9 Places of Refuge for Disabled Vessels

A ship in need of assistance may require a temporary place of refuge with adequate water depth for lightering or repairs to protect the marine environment from a significant accident. Ships may need to be brought into a harbor, anchored or moored in protected waters, or temporarily beached to safely make repairs and stop the loss of oil or other hazardous substances. Disabled ships need to be repaired to resume safe navigation and prevent an incident resulting in the loss of fuel or cargo. If leaking ships are not repaired, spilled oil and hazardous substances may affect health and human safety, natural resources, and shorelines. There is no single place of refuge for all ships and all situations.

Decisions relating to places of refuge encompass a wide range of security, environmental, social, economic, and operational issues that vary according to each situation, including the environmental sensitivity and protected status of the areas within or adjacent to a potential place of refuge.

The initial decision to permit a ship to seek a place of refuge, as well as the decisions and actions implementing that decision, are inherently based upon an assessment of the risk factors involved and the exercise of sound judgment and discretion. Places of refuge are sites that could potentially be used for disabled or damaged ships needing shelter for repairs. While information on potential sites may be pre-surveyed, this does not imply that any of these sites will be the location of choice in a future event. Selection of a place of refuge by the United States Coast Guard (USCG) Captain of the Port (COTP) in consultation with other federal agencies, states, tribal and local governments, and other stakeholders will always be made on a case-by-case basis. If time allows, the COTP will activate a Unified Command under the Incident Command System (ICS) to address a request for a place of refuge.

Places of Refuge tool provides additional background information, process and procedures for establishing an incident-specific Place of Refuge to avert a more significant incident from occurring. The NWAC and RRT have also gathered information of 4 specific areas (Pistol River Beach, Coos Bay, Yaquina Bay, and Grays Harbor) to help the USCG/COTP in the initial stages of identifying potential places of refuge. Datasheets on these four potential PORs can be found on the private side of the RRT10/NWAC website.

Best Management Practices for Places of Refuge for Disabled Vessels

- Early identification and monitoring of vessels in distress and in potential need of a places of refuge is crucial.
- Consult the Places of Refuge tool to understand the management structure and decision making process.
- Early request for a place of refuge and the development of options.
- Consult places of refuge datasheets on the RRT10/NWAC website; use information gathering template to develop alternatives as potential places of refuge.
- Involve and inform state and local authorities and stakeholders during the decision-making process (see Attachment A in Places of Refuge for starting list of potential stakeholders).
- Conduct Incident-Specific Consultation of Stakeholders.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.

10 Decontamination

Decontamination prevents oil from re-contaminating clean areas. Proper decontamination procedures also protect worker health and safety, as well as the environment. A decontamination area should be established at each staging area and other work areas as appropriate. Decontamination operations may be different depending on the nature of the spill. The scope of the incident, oil type, weather, equipment used, and the number of response workers will dictate the methods, size, and type of decontamination operation. In the Northwest Region, decontamination procedures are included in the response's Site Health and Safety Plan, see the Health and Safety Plan tool for more information. BMPs for the decontamination of wildlife can be found in the Northwest Wildlife Response Plan, see Annex D for more information.

Best Management Practices for Decontamination

- Address decontamination areas for personnel and equipment in the disposal plan.
- Set up decontamination and exclusion zones in each staging area. Line the area with plastic to prevent pollution from oiled PPE and equipment. Collect oiled PPE and equipment in plastic barrels.
- Maintain adequate response equipment during decontamination to respond quickly and appropriately to re-release of pollution.
- Consider the placement of the decontamination area, containment of material, and safety controls to reduce the risk of oil re-entering the environment.
- Follow appropriate cleaning and waste disposal protocols and regulations.
- Follow BMPs for use of vehicles and heavy equipment, as appropriate.
- Follow BMPs for the use of vessels, as appropriate.
- Follow BMPs for foot traffic, as appropriate.
- Follow BMPs for wildlife, as appropriate.