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Standard Guide for Describing Shoreline and Inland Response Techniques[1]

This standard is issued under the fixed designation F2204/F2204M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide describes methods to clean and remediate stranded oil on marine and lake shorelines, on river banks and other inland water body shorelines, and terrestrial habitats. The primary goal of any countermeasure is to aid recovery while minimizing additional impact.

1.2 This guide describes 22 different tactics that are available for consideration. These options range from natural recovery to active physical or biochemical intervention.

1.3 The tactics listed might not be appropriate under all possible circumstances, and multiple countermeasures could be appropriate on the same shoreline, river bank, lake shore or terrestrial habitat.

1.4 This guide describes technical considerations for selecting appropriate response countermeasures or techniques.

1.5 Selection of specific countermeasures for use during a spill response is guided by properties of the oil, degree of oiling, site accessibility, geomorphology, substrate and vegetation type, mobility of available equipment, hydrologic (coastal and inland) and meteorological conditions, and the presence of sensitive natural and archeological resources. It is advisable to consult with appropriate regulatory authorities since certain response options may require government authorization or approval, or both.

1.6 This guide does not address response to submerged, sunken or buried oil.

1.7 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents: therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1686 Guide for Surveys to Document and Assess Oiling Conditions

F1687 Guide for Terminology and Indices to Describe Oiling Conditions on Shorelines

F1872 Guide for Use of Chemical Shoreline Cleaning Agents: Environmental and Operational Considerations

F2205 Guide for Ecological Considerations for the Use of Chemical Dispersants in Oil Spill Response: Tropical Environments

F2532 Guide for Determining Net Environmental Benefit of Dispersant Use

3. Key Terms

3.1 *Shoreline and Inland Habitats*—For the purpose of this guide, marine and estuarine shorelines, river banks, and lake shores will be collectively referred to as shorelines, shores, or shore-zones. Shore types include a range of impermeable (bedrock, ice, and man-made structures), permeable (flats, beaches, and man-made), and coastal wetland (marshes, mangroves,) habitats. Other non-shoreline, inland habitats include wetlands (pond, fen, bog, swamp, tundra, and shrub) and drier terrains (grassland, desert, forests), and will be collectively referred to as either wetlands or terrains, respectively.

3.2 *Mixed Sediment Substrates*—These are described based on the size of the inorganic sediments (Guide F1687). The penetration and retention of oil is largely controlled by sediment size. Only light oils (for example, a diesel) can penetrate

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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sand, whereas all but the more viscous oils can easily penetrate into pebbles and cobbles ("coarse sediment"). Substrates composed of mixed sands, pebbles, and cobbles are sometimes referred to as "gravel." The surface layer often has predominantly coarse sediments with increasing amounts of sand in the subsurface. In mixed-sediment substrates, coarser fractions (pebbles and cobbles) are infilled with the finer sediments (sands and granules) so that these substrates are permeable only for some medium oils and all light oils. Pebble-cobble ("coarse sediment") substrates have open interstitial spaces, so oil typically penetrates them, but can be easily remobilized by wave flushing, tidal pumping, or by river currents.

3.3 *Debris*—Scattered organic or inorganic materials that have washed up onto shorelines, wetlands, or accumulated in rivers and streams, or a combination thereof. These materials are not part of a natural habitat, such as sediments, attached animals (for example, mussels or barnacles), live sea grasses, or aquatic plants. Accumulations of large logs that have washed ashore on sedimentary coasts or mid-channel islands can provide protection against wave action and, in some areas, are considered to be a critical element of the shore zone. Likewise, log jams or beaver dams in rivers and streams can provide critical habitat. A decision to remove oiled logs and other debris may require approval from regulatory agencies.

3.4 *Hot versus Warm Water Washing*—Washing oil from a substrate (solid or otherwise) typically uses ambient (unheated) water pumped from the adjacent water body. The removal of sticky or weathered stranded oil can require an increase in pressure or temperature, or both, to be effective. Conventional water heaters raise water temperatures up to 160°F [70°C]. An operational example is the successful use of warm washing during the *Exxon Valdez* response. Hot water washing involves heating water to temperatures greater than 160°F [70°C]. Hot water heaters are occasionally combined with high-pressure spray systems, require more energy than warm-water heaters, and are only applicable for removal of small amounts of oil ("spot washing") on man-made structures.

3.5 *Waste Generation*—Each spill response technique, generates different volumes and types of waste depending on the amount and type of spilled oil and the substrate materials. The types of waste generated during spill response include: oily water or liquids, oiled sediments, or oiled debris. Recovered oil and oil-water mixtures are usually temporarily stored prior to recycling, treatment or disposal, or a combination thereof. Operational waste is generated by cleanup or treatment activities and can include personal protective equipment, sorbents, and packaging. Waste management can be an issue during response, particularly in remote areas where disposal options are limited and travel distances to approved sites are long. Estimates of the types and volumes of potential waste should be included in the countermeasure selection process. **(1)**[3]

3.6 *Response Techniques*—For the purpose of this guide, the term, "response techniques," will be used to generically refer to response countermeasures, clean-up techniques, tactics, or methods, or a combination thereof.

4. Significance and Use

4.1 Once the extent and type of oiling has been defined and documented using proper procedures (see Guides F1686 and F1687), decisions are made on the appropriate course of action for site cleaning and restoration. In some cases, natural recovery (accompanied by monitoring) can be the preferred approach whereas in other cases, active response may be preferred and appropriate. This guide summarizes the principal response techniques available for shoreline, wetland, and terrain habitats.

4.2 This guide is intended to minimize the potential for added impact to the environment from use of response techniques in an overly-aggressive manner or in unsuitable conditions or habitats.

4.3 In Section 5, typical considerations, which can limit the applicability of a given technique are addressed in *Constraints*. An example that is applicable to all techniques other than natural recovery, is special permission will likely be needed for any response operations at sites with known culturally or historically important resources. Also, in Section 5, a synopsis of main trade-offs from use of a particular technique is provided in *Environmental Effects*.

5. Onshore Response Techniques

5.1 This section lists and describes those techniques that can be considered for use in an onshore (shoreline, wetland, or terrestrial) oil spill response. Some of these options may require special consideration and authorization prior to work. Also, some of these techniques have greater personnel and equipment requirements or can generate more waste relative to others. Tradeoffs need to be considered when selecting an appropriate option(s), particularly in remote areas. In most cases, government agencies will be involved in the decision-making process. Government approval may be required for some techniques, and these are typically considered on a case-by-case basis. Contingency plans should provide for use of a range of techniques. The response techniques described in this guide are consistent with Environment and Climate Change Canada (ECCC), US NOAA, and American Petroleum Institute terminology. **(2, 3, 4, 5)**

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[3] The boldface numbers in parentheses refer to the list of references at the end of this standard.

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A description of each response technique is discussed in separate sections below.

5.2 *Natural Recovery:*

5.2.1 *Objective*—Stranded oil is not removed either to minimize environmental impacts from treatment, because no effective response technique is available, or because predicted impacts from use of a technique are judged to be unacceptable. In some circumstances, safety concerns can preclude cleanup activities. Oil is left to degrade naturally.

5.2.2 *Description*—Site conditions can be monitored for changes and recovery progress. Prevention of oil remobilization or migration of oil offsite may need active response.

5.2.3 *Applicable Habitat Types*—Can be used on all shoreline, wetland, or terrestrial habitat types.

5.2.4 *When to Use*—When natural oil removal rates are acceptable in terms of the resources at risk, when the degree of oiling is light, or when cleanup actions are likely to result in more harm than allowing oil to degrade by natural forces.

5.2.5 *Constraints*—May be inappropriate for sites used by high numbers of mobile animals (for example, birds, mammals, and crabs) or endangered or threatened species.

5.2.6 *Environmental Effects*—No effects beyond that of the oil alone.

5.2.7 *Waste Generation*—None.

5.3 *Barriers/Berms:*

5.3.1 *Objective*—To either physically prevent oil from entering into a sensitive area, restrict water movement, or to divert oil towards a collection area, or a combination thereof. (**6**)

5.3.2 *Description*—A physical barrier is placed across an area in front of encroaching oil to prevent it from entering a sensitive area. Barriers can be earthen berms, trenches, shore-sealing booms, sheet piling, or filter fences. When passage of water is desired, underflow or overflow dams are used. Sheet piles can be driven into substrates and used to restrict oil leaching from land onto shorelines towards adjacent water bodies.

5.3.3 *Applicable Habitat Types*—On most terrain slopes and at the mouths of creeks, streams, or rivers. For tidal habitats, where a berm can be built above the high-water line to prevent oil from over-washing a low shoreline and entering a sensitive back-beach habitat, such as a lagoon.

5.3.4 *When to Use*—When sensitive habitats are threatened and other barrier options are not feasible.

5.3.5 *Constraints*—Disturbance to bird nesting areas, beaver dams, wetlands, or other sensitive areas should be minimized. Placement of dams, filter fences and sheet pile barriers can cause physical disruption, especially in wetlands and tundra habitats.

5.3.6 *Environmental Effects*—Can disrupt or increase localized oiling of substrates and vegetation. Trenching can enhance oil penetration into substrates and increase the degree of substrate oiling.

5.3.7 *Waste Generation*—Oiled barrier substrates and filter fence materials need to be disposed of as oily wastes. Sheet piles can be removed, cleaned and re-used. Water used for cleaning needs to be collected and treated or disposed. Disposal must be in accordance with all applicable regulations.

5.4 *Manual Oil Removal/Cleaning:*

5.4.1 *Objective*—Physically remove oil and oily debris with hand tools and manual labor.

5.4.2 *Description*—Surface oil and oily debris are removed by manual means (for example, gloved hands, rakes, forks, shovels, sieves, and sorbents) and placed in containers for removal and subsequent disposal. No mechanized equipment is used except during transfer and transport of waste.

5.4.3 *Applicable Habitat Types*—Can be used for all habitat types.

5.4.4 *When to Use*—Generally used on areas where small amounts of oil can be easily removed by non-mechanical means. Most appropriate for light to moderate oiling conditions. Manual removal is applicable to viscous oils and weathered oil patches and tar balls.

5.4.5 *Constraints*—Foot traffic over sensitive areas (for example, wetlands, shellfish beds, bird nesting areas, dunes) should be limited or restricted. There can be time periods when access is not appropriate (for example, bird nesting, seal pupping, and periods when land habitats are inundated).

5.4.6 *Environmental Effects*—Minimal, if surface disturbance by responders and oily waste management activities are limited.

5.4.7 *Waste Generation*—Can generate significant amounts of oily substrate and debris, which requires proper disposal or treatment. Decontamination of tools can yield oily waste water which also requires proper treatment. Worker personal protective equipment can be disposed of daily or decontaminated and re-used. Oily waste water resulting from decontamination must be treated properly. Disposal must be in accordance with applicable regulations.

5.5 *Mechanical Oil Removal:*

5.5.1 *Objective*—To physically remove oil and oily debris using mechanical equipment. (**7**)

5.5.2 *Description*—Surface oil, oiled substrate, and oily debris are removed using mechanical equipment (such as front-end loaders, back-hoes, graders, bulldozers, elevating scrapers, dredges, and beach cleaning machines). This technique necessitates that response resources be provided for temporary storage, transportation, treatment, and disposal of recovered oil, oily debris, and oily waste.

5.5.3 *Applicable Habitat Types*—Locations where surface substrates are amenable to and accessible by mechanical equipment.

5.5.4 *When to Use*—When large quantities of oiled materials are to be removed. Care should be taken to remove substrates only to the depth of oil penetration. This technique should be used sparingly where removal of large volumes of substrate can lead to erosion. Buried oil recovery can include the temporary removal of clean overburden, removal of oiled substrates, and subsequent replacement of clean overburden. Vehicle traffic should be controlled to minimize further oil penetration.

5.5.5 *Constraints*—Special restrictions should be established for sites where traffic and equipment operations could be damaging. It could be useful to check soils in advance for

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