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StandardGuide for Cleaning of Various Oiled Shorelines and Habitats[1]

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1. Scope

1.1 This guide provides information on shoreline types and sensitive habitats that can be used as guidance for selecting appropriate cleaning techniques following an oil spill. The emphasis is on typical physical and biological attributes of coastal habitats that could be at risk from marine oil spills. It reviews and encompasses the entire spectrum of shoreline types representing a wide range of sensitivities. It is largely based on NOAA's *Characteristic Coastal Habitats*, and the API 4706 Publication *Environmental Considerations for Marine Oil Spill Response*.

1.2 This guide provides only very broad guidance on cleaning strategies for the various habitats. For more in-depth guidance, the reader is referred to Section 2, Referenced Documents.

1.3 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1686 Guide for Surveys to Document and Assess Oiling Conditions on Shorelines

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

F2204 Guide for Describing Shoreline Response Techniques

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

2.2 *American Petroleum Institute (API) Publication:*[3]

Environmental Considerations for Marine Oil Spill Response, API Publication 4706, 2001, 319 pp.

2.3 *National Oceanic and Atmospheric Administration (NOAA) Publication:*[4]

Characteristic Coastal Habitats, Choosing Spill Response Alternatives, 2000, Office of Response and Restoration. 88 pp.

3. Significance and Use

3.1 One of the key considerations in making sound clean-up decisions for oiled shorelines and marine resources is the relative sensitivity of the impacted area. Some areas may be so sensitive that cleaning methods could cause more harm than benefit. In such cases, natural recovery will be the preferred approach. In other cases, depending on the type of oil, the amount of oil present may be so extensive that recovery will be significantly delayed or not occur at all unless active intervention is carried out.

3.2 This guide presents summary information taken from API Publication 4706 and NOAA Publication *Characteristic Coastal Habitats* on the relative physical and biological sensitivities of shorelines and other marine habitats. It is to be used along with Guides F1686, F1687, and F2204 as well as the other referenced publications to make informed decisions prior to undertaking cleaning operations.

3.3 The relative sensitivities of shorelines and resources relate to a number of factors:

3.3.1 Shoreline type (substrate, grain size, tidal elevation, etc.),

3.3.2 Biological productivity, diversity and vulnerability,

3.3.3 Exposure to wave and tidal energy, and

3.3.4 Ability to conduct cleanup without undue ancillary damage.

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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.

[3] Available from the American Petroleum Institute (API), 1220 L. Street, NW, Washington, DC 20005–4070, www.api.org

[4] Available from the National Oceanic and Atmospheric Administration (NOAA), 7600 Sand Point Way, NE, Seattle, Washington, 98115, http://response.restoration.noaa.gov/oilaids/reports.html.

4. Description and Relative Sensitivity of Shorelines

4.1 This section summarizes the types of shorelines and habitats that may be impacted by an oil spill. The Environmental Sensitivity Index (ESI) is frequently used to characterize relative sensitivity of shorelines to oil spills. Areas exposed to high levels of physical energy and containing low biological activity would rank low (ESI=1, example: exposed rocky shores). Sheltered areas with associated high biological activity have the highest ranking (ESI=10, example: mangroves). Broad guidelines are provided on preferred strategies for cleaning these shorelines following an oil spill incident.

4.2 *Exposed Rocky Shores*—Also known as exposed wave-cut cliffs. The inter-tidal zone is steep (more than 30-45º slope) and narrow with little width. Access can be difficult and dangerous. Sediment accumulation is uncommon and usually transitory because waves remove the debris from the eroding cliffs. There is strong vertical zonation of inter-tidal biological communities. Species density and diversity vary greatly but can be abundant. Oil would generally be held offshore by reflection of the waves. Any oil that is deposited would be rapidly removed naturally. Cleanup is usually not required.

4.3 *Exposed Man-made Structures*—These are solid structures such as seawalls, piers, and port facilities. They are common in developed areas, providing protection to residential and industrial zones. Many structures are constructed of concrete, wood, stone, or metal. They are built to protect from erosion by waves, boat wakes, and currents. They are exposed to rapid natural removal processes. Attached animals and plants are sparse to moderate. Oil would be held offshore by waves reflecting off the steep, hard surfaces in exposed settings. Cleanup may not be required.

4.4 *Exposed Wave-Cut Platforms*—These shores are characterized by gently sloping bedrock shelves, called platforms, of highly variable width. A steep scarp or low bluff may back the shoreline. They often co-occur with gravel beaches. The platform surface is irregular and tidal pools are common. Small accumulations of gravel can be found in the tidal pools and crevices in the platform. Pockets of sandy “tidal flats” can occur on the platform in less exposed settings. These habitats can support large populations of encrusting animals and plants, including barnacles, snails, mussels, and macroalgae. Birds and seals use platforms for feeding and resting during low tide. Oil does not adhere to the wet surface, but could penetrate crevices or sediment veneers. Cleanup may not be required. Where the high-tide area is accessible, it may be feasible to manually remove heavy oil accumulations and oiled debris.

4.5 *Sand Beaches*—Beaches are generally flat to moderately sloping and relatively hard-packed. They are commonly backed by dunes or seawalls along exposed outer coasts. There can be heavy accumulations of wrack (remnants of stranded marine vegetation or wrecked ships) or other debris. Beaches can undergo rapid erosion/deposition cycles as currents and storms relocate the sand. Biological populations are typically of low density. Birds use beaches for resting, feeding, and nesting. Marine turtles use beaches to lay their eggs. Oil penetration can be as much as 15 cm in fine- to medium-grain sand and up to 30 cm in coarse-grain sand. Cleanup should concentrate on removing persistent oil and oily debris manually from the upper swash zone.

4.6 *Tundra Cliffs*—These shorelines are found in extremely cold regions near permafrost areas. They are generally comprised of vegetation overlying peat and permafrost. The cliff height ranges from less than 1 meter to as much as 10 meters. The vegetation on the tundra is a living plant community that is sensitive to disturbance. The main users of this shoreline are migratory birds during the summer season and they are most at risk by oiling. Oil can be removed by sorbing with natural peat from beach deposits or by manual and mechanical methods as long as there is no damage to the peat substrate.

4.7 *Mixed Sand and Gravel Beaches*—These moderately sloping beaches contain significant (over 25 % each) amounts of both sand and gravel. The high-tide berm area is usually composed of sand and fine gravel and the lower part of the beach is coarser with cobbles to boulders. There can be large-scale changes in the sediment distribution patterns depending upon season, because of the transport of sand offshore during storms. Desiccation and sediment mobility on exposed beaches result in low densities of attached animals and plants. The presence of algae, mussels, and barnacles indicates beaches that are relatively sheltered. Oil penetration into the beach sediments may be up to 50 cm. If the sand fraction exceeds 40 %, oil behavior will be much as it is for a sand beach. Heavy accumulations of pooled oil should be removed from upper beach faces using low-pressure flushing. All oiled debris should be removed; sediment removal should be limited as much as possible. Movement of oiled sediment from high-tide zones to upper inter-tidal zones can be effective in areas regularly exposed to wave activity.

4.8 *Gravel Beaches*—These beaches are composed of substrate ranging in size from pebbles to boulders. They can be very steep, with multiple wave-built berms forming the upper beach. Density of animals and plants in the upper inter-tidal zone is low on exposed beaches, but can be high on sheltered gravel beaches and on the lower inter-tidal zone. Stranded oil is likely to penetrate deeply into gravel beaches because of the high permeability/pore space. Heavy accumulations of pooled oil should be removed quickly from the upper beach. All oiled debris should be removed. Substrate removal should be limited as much as possible.

4.9 *Riprap*—Riprap is composed of cobble to boulder-sized blocks of granite, limestone, concrete, or other materials which are intentionally added to the marine environment for the protection of shorelines. Examples are breakwaters and jetties around inlets and marinas. Riprap is common in highly developed waterfront areas. Attached biological communities vary from rich to sparse. Birds use riprap as resting sites. Persistent oil can penetrate deeply between the riprap and can readily adhere to rough surfaces. High pressure ambient water flushing may be effective for removal if the oil is fresh and liquid, but the oil must be recovered. Special care must be taken in cleaning riprap as personnel injuries have been often reported for this particular shoreline type.

4.10 *Exposed Tidal Flats*—These are broad inter-tidal areas composed primarily of sand and mud and minor amounts of