Treatment tactics for Solid Manmade structure (boat, dock, etc.) and the use of shoreline cleaners (Corexit 9580) in the context on an environmental emergency

In Canada, Environment Canada is responsible for administrating and enforcing the Fish Habitat and Protection and Pollution Prevention section of the Fisheries Act, although other laws may apply in the context of a marine incident.

The paragraph 36 (3) of the Fisheries Act states that

> *no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.*

Therefore, Environment Canada requires that all discharges to the environment, even in the context of a spill cleanup, are not harmful to fish, if these discharges could reach any type of water frequented by fish.

However, Environment Canada recognizes that certain circumstances justify the use of spill treatment agent to ensure an effective and environmentally beneficial response.

Typically, in Canada, the choice of the cleaning method should be based on a net environmental benefit assessment. For example, a hierarchy of shoreline cleaning methods exists and some of these methods should be tested before using Corexit 9580 (i.e. flooding, low / high pressure ambient / hot water washing, etc.). The use of Corexit 9580 should be the last option.

The hierarchy of cleaning methods should be respected. If Corexit 9580 was to be used, it must be proven that all other methods according to the hierarchy were used with "diligence" and that the use of surfactant provides a real net benefit to the environment.

If the use of Corexit 9580 is considered as the best option, then there are some common conditions to consider:

- It must be included in a standard operating procedure including mitigation measures such as the use of booms and sorbents. Sheen is expected to be created and it has to be appropriately contained and recovered.
- It must be tested on a little plot prior to be used on the whole impacted site.
- If applicable, the use of Corexit 9580 with soaked cloths should be preferred.
- Ultimately, if necessary, Corexit 9580 could be locally sprayed in small quantities.
- Visual monitoring of the application should be assured to ensure that a minimum of oil is released to the environment.

Environment Canada Environnement Canada

A Field Guide to Oil Spill Response on Marine Shorelines

Canada

4.4 SOLID MANMADE SHORELINE

Definition

These shorelines consist of manmade (anthropogenic) structures that are composed of impermeable materials.

Subtypes

- Solid manmade features and structures vary greatly in design, form, and material. They include structures for moorage (docks, wharfs, and marinas), protected anchorages (breakwaters), commercial activities, and backshore protection (seawalls).
- This type of shoreline includes historic structures and archaeological or historic sites in the intertidal or backshore areas.

Character

- Solid manmade structures have stable, impermeable surfaces consisting of a wide range of materials such as concrete, metal, plastic, and wood. The surface of each of these materials is different in texture and roughness.
- The structure may present a vertical face, such as a dock or wharf or be sloped, as a solid sea wall. Examples of solid manmade structures are shown in Figure 4.6.

Behaviour of Oil

- Solid manmade structures are considered to be impermeable. Oil would coat the surfaces or penetrate a few millimetres in open grain woods or concrete.
- These structures are built of a wide range of materials, each of which has a different surface texture and roughness. The adhesion potential will vary with the type of oil and the material. For example, one type of oil may not stick to a smooth, sloping metal surface, but may stick to a vertical, rough concrete surface.
- Oil generally behaves in a similar way on solid manmade structures as on bedrock shorelines, as both are impermeable.
- Oil is more likely to be deposited in the upper half of the intertidal zone. The lower tidal zones usually stay wet and often have a biofilm.
- Often oil does not strand on exposed coasts due to wave reflection. If stranded, the oil may be washed off rapidly by wave action, i.e., in days to weeks.
- Oil may be splashed above the limit of normal wave action on exposed coasts.
- Oil that comes into sheltered locations is likely to be deposited as a band near the last high-water level on the upper intertidal zone.
- In sheltered locations, because of the relatively low wave-energy conditions, heavy oils or weathered crudes may persist for months or years as there is insufficient energy to remove these types of oil naturally.
- Even in sheltered locations, light oil will probably be washed off a solid manmade surface in a short time, ranging from hours to days.

Figure 4.6 Solid Manmade Shorelines – Concrete Seawall and Boat Ramp

Sensitivity

- Manmade historic, cultural, and archaeological structures typically have a high social value and are assigned a high sensitivity. They may be relatively fragile in the context of intrusive treatment tactics. Both oil and the methods used to remove it can deface or alter the physical integrity of such structures.
- Most other solid manmade structures are relatively low in sensitivity, although their importance and priority will vary with location and human use, e.g., outer breakwater structures compared to inner harbour recreational areas.
- As moorings, docks, and seawall walkways are frequently used by people, there is a high potential that people will come in contact with the oil.
- Biota attached to these structures are usually treated as less sensitive than those on bedrock shorelines. There are usually fewer biological communities on solid manmade structures than on bedrock shorelines as many have smooth surfaces and/or are vertical so there is less intertidal area for colonization.
- Fish may frequent the waters in the shade and shelter at the base of structures such as seawalls, docks, and wharves.
- On coasts where ice is common on water or on shore, the biological community is usually scraped off the surface every year, so that plants and animals can only survive in cracks and crevices where they are protected. As a result, ice-scoured solid surfaces do not have extensive, diverse, or rich biological communities.

Table 4.4 Summary of Tactics for Solid Manmade Shoreline

Oil on the surface	Volatile	Light	Medium	Heavy	Solid
Natural recovery	■	■	■	▪	▪
Low-pressure ambient washing	■	■	■	▪	▪
Low-pressure warm/hot washing	■	■	■	■	■
High-pressure ambient washing			■	■	■
High-pressure warm/hot washing			■	■	■
Steam cleaning			▪	▪	▪
Sandblasting				▪	▪
Manual removal		▪	▪	▪	▪
Passive sorbents	▪	▪	▪	▪	
Dispersants		■	■		
Shoreline cleaners		■	■		

■ Preferred option ▪ Possibly applicable for small amounts of oil

Special consideration should be given to historic structures to avoid damage or degradation.

- **Sorbents** can be deployed to passively collect small amounts of low to medium viscosity oil.
- **Dispersants** and **shoreline cleaners** can be used on oil types for which the product is designed and are effective for small amounts of oil if properly applied. Note that government approval is typically required for use of dispersants and shoreline cleaners.

Typical Combinations of Response Tactics

- Shoreline cleaners can be combined with flooding or low-pressure washing to remove and collect the oil.

Precautions

- Avoid all unnecessary access to oiled manmade historic, cultural, and archaeological structures until there is a special treatment plan.
- Control civilian access on oiled mademade structures to avoid tracking and spreading the oil.
- On steep manmade structures or those with shelves, be extremely careful to avoid falls and slips, particularly on open coasts where there is strong wave action or ice.
- If there are plants, e.g., *Fucus sp.* and animals, e.g., barnacles and mussels, in the intertidal zone, avoid washing oil from the upper into the lower intertidal zones. These lower intertidal zones often are not oiled and more damage can be caused if oil is washed downslope during cleanup. This can be avoided by working only during the upper half of the tidal cycle (the flooding tide from mid-tide to high-tide and the ebb to mid-tide) when the lower tidal zones are always under water.
- Avoid high-pressure, warm/hot water washing (including steam cleaning and sandblasting) if there are healthy organisms in the area. When organisms are present, these techniques may be of value for spot washing if the oil has already smothered or killed the biological community. Removing the plants and animals, even if they have been killed by the oil, may delay recolonization due to habitat modification.

4.5 PERMEABLE MANMADE SHORELINE

Definition

These shorelines consist of manmade (anthropogenic) features and structures that are composed of permeable material(s).

Subtypes

- Permeable manmade features and structures include a wide range of designs, such as berms, breakwaters, bulkheads, cribwork, dikes, gabion baskets, piers, seawalls, rip-rap, and artificial islands. They also include shore land extensions, landfill, and areas filled for flood control. Examples of permeable manmade structures are given in Figure 4.7.
- This type of shoreline includes historic structures and archeological or historic sites, for example, cobble fish weirs.

Applications

Burning can be used for oiled logs and debris collected on any type of shoreline or when oil has been collected in sumps or drums and can be ignited with sustained combustion.

Burning is effective for directly removing light, medium, and heavy oil from glacial and solid ice (on ice or in ice leads), salt marshes, and snow-covered shorelines (Table 5.24).

Constraints and Limitations

Even when collected in sumps, heavy or emulsified oils are often difficult to ignite and/or it is difficult to sustain combustion.

Burning heavily oiled marsh vegetation when soils are dry can destroy the root systems and have a major impact on the ecosystem. Wet soils protect the root systems from heat damage so that recovery from burning is more rapid (Lin et al., 2005).

Generation of smoke may be an undesirable side effect, although this is not a health or safety issue if standard safety precautions are observed. Burning generally requires a permit from local authorities, especially if it is planned on a large scale.

5.6 CHEMICAL AND BIOLOGICAL TREATMENT (TACTIC GROUPS 17 TO 20)

This group of treatment tactics includes:

- **dispersants** (tactic group 17);
- **shoreline cleaners** (tactic group 18);
- **solidifiers** and visco-elastic agents (tactic group 19); and
- **bioremediation** (tactic group 20).

When these tactics are used, chemical or chemical/biological agents are added to the stranded oil or oiled sediments to:

- facilitate removal of the oil from the shore zone; or
- accelerate **natural recovery**, degradation, and weathering processes on site.
- the effects of adding another substance that could adversely affect the ecosystem; and
- the effects of moving oil from the shore into the water column.

Chemical and biological agents are regulated by the federal government and the appropriate approvals and compliance are required for their use.

5.6.2 SHORELINE CLEANERS (TACTIC GROUP 18)

Objectives

Shoreline cleaners are used to remove or lift oil from shoreline substrates by adding a chemical agent so that the oil can be contained and recovered on the adjacent waters.

Description

Shoreline cleaners, also known as surface washing agents or beach cleaners, contain a surfactant or solvent to facilitate or increase the efficiency of removal of stranded oil by washing. Whereas hydrocarbon solvents alter the viscosity of the oil, surfactants alter the surface tension of the oil by a mechanism often referred to as **detergency** so that the oil does not stick to substrate materials. The oil is lifted by the tides and may drift away from the shore unless it is recovered.

Applications

As shown in Table 5.26, shoreline cleaners can be used to remove medium and light oil from bedrock, solid manmade and permeable manmade shorelines, and pebble/cobble and boulder beaches. This technique can also be used on coarse-sediment beaches to minimize oil penetration into the subsurface.

The agent can be applied directly to an oiled area with a hand spray or hose system. It can be used directly or as a pre-soak that is left for some time before **flooding** or **washing** is carried out. The soak time varies depending on the temperature and the character of the oil. Shoreline cleaning agents can also be used in a protection mode to pre-treat shorelines and prevent oil from becoming stranded on the substrate.

Table 5.26 Applications for Shoreline Cleaners

Marine Shoreline Category	Volatile	Light	Medium	Heavy	Solid
Bedrock shoreline		■	■		
Solid manmade shoreline		■	■		
Permeable manmade shoreline		▪	▪		
Pebble/Cobble beach		▪	▪		
Boulder beach		▪	▪		

■ Preferred option ▪ Possibly applicable for small amounts of oil

Shoreline cleaners are used in conjunction with oil collection techniques, such as **sorbents** and skimmers, to contain and recover the oil as is it released. Unlike dispersed oil, these mixtures can be recovered.

The effectiveness of this technique depends on the type of oil and decreases as the specific gravity of the oil increases. Its success also depends somewhat on the mixing of the agents with the oil and the ability to contain and recover the released oil.

As shoreline cleaning agents and **dispersants** have opposite mechanisms, a good shoreline cleaner is a poor dispersant and visa versa.

Constraints and Limitations

Shoreline cleaners expose intertidal and nearshore biota to a chemical that may have toxic side effects. Regardless of its impact, the action of adding a chemical to the environment requires compliance with federal regulations.

The effectiveness of shoreline cleaners must be verified not only to ensure that they are removing oil, but also that the oil being re-floated is contained.

5.6.3 SOLIDIFIERS (TACTIC GROUP 19)

Objective

Solidifiers are a chemical agent added to the stranded oil to alter the viscosity of the oil and thereby facilitate its collection and recovery.

Description

Solidifying agents are also known as elastomizers, gelling agents, or spill recovery enhancers. Solidifiers change the oil from a liquid to a solid in order to make recovery easier or to prevent the oil from remobilizing or spreading. The visco-elastic agents or elasticity modifiers change the elasticity of the oil.

Applications

These agents may be available in a liquid or powder form. The latter can either be applied directly or mixed with water before application. The agent is spread manually or sprayed over and mixed with the stranded oil or oiled sediments. These agents are used in conjunction with removal techniques, such as manual pickup.

Solidifiers and visco-elastic agents are most appropriate on light and medium oils. They should not be used on beach sediments with large pore spaces, such as cobble or boulders, as oil may penetrate into the subsurface sediments and become difficult to remove.

In practice, the potential applicaton of solidifiers is limited to very small areas or small volumes of oil. This tactic has rarely been used on spills.