

Shoreline In Situ Treatment (Sediment Mixing and Relocation) Job Aid

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Shoreline In Situ Treatment (Sediment Mixing and Relocation) Job Aid

Introduction and Purpose

The purpose of this Job Aid is to provide:

- A non-technical tool for planning and conducting shoreline in situ treatment for use by:
 - o Shoreline Cleanup Assessment Technique (SCAT) teams as they develop Shoreline Treatment Recommendations (STRs);
 - o Environmental Unit personnel and planners during the decision process; and
 - o Shoreline Operations to implement the treatment tactics.
- Decision Guides and Checklists to assist in:
 - o understanding the advantages and consequences of shoreline in situ treatment options; and
 - o the decision, review, and approval process for shoreline in situ treatment.

This Job Aid is part 3 of a series of tools developed for Shoreline In Situ Treatment planning and decisions:

1. Shoreline In Situ Treatment Library¹: a database of guidance, papers and reports relating to shoreline in situ treatment, natural cleaning, and the formation of Oil-Particle Aggregates (OPA).
2. Shoreline In Situ Treatment (Sediment Mixing and Relocation) Fact Sheet²: a document explaining the applications and advantages of using shoreline in situ treatment techniques.
3. Shoreline In Situ Treatment (Sediment Mixing and Relocation) Job Aid (this document).

There are four basic groups of techniques available for shoreline oil response, including natural recovery:

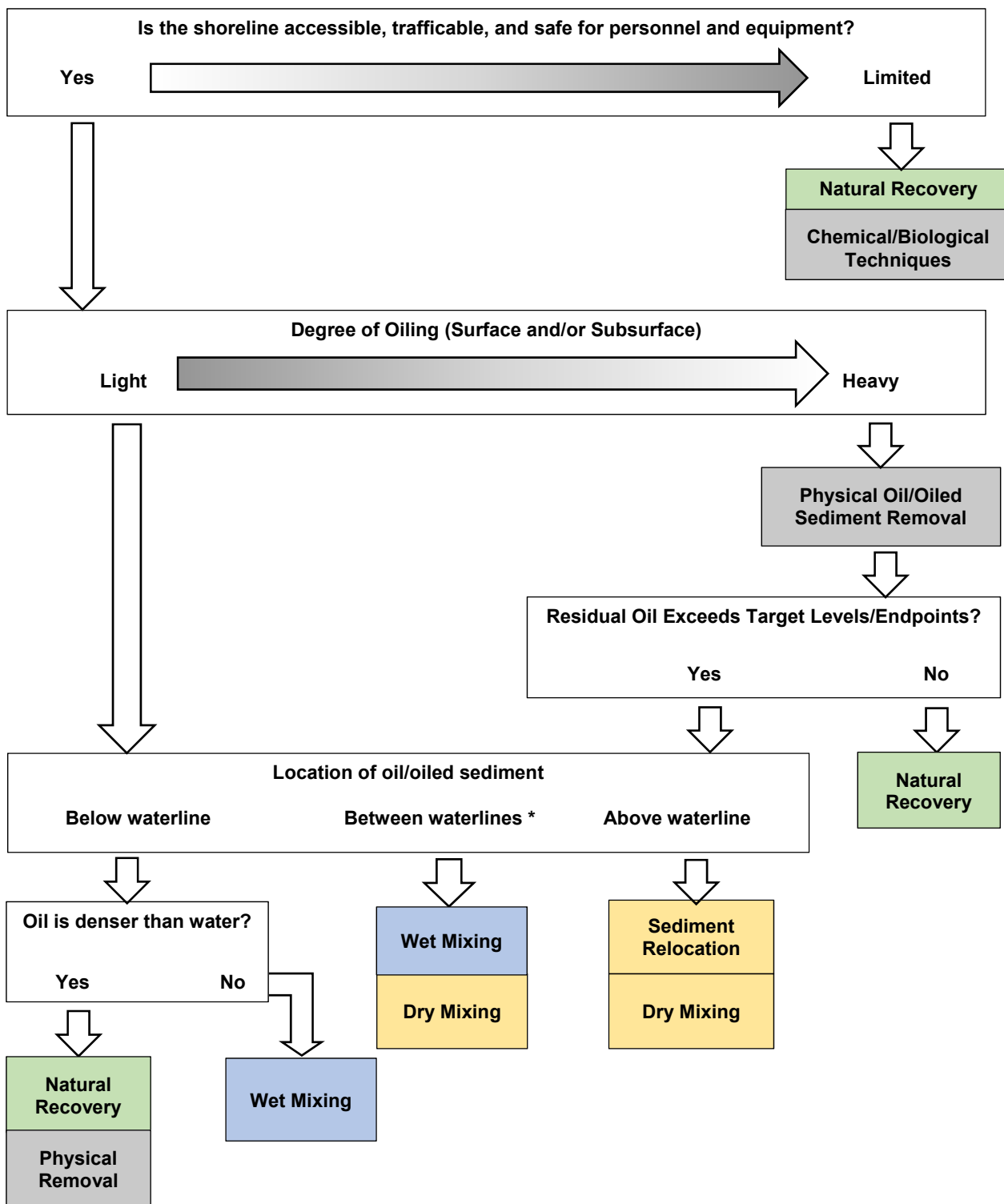
Natural Recovery	Removal	In situ	Chemical and Biological
•No intervention •Shoreline recovery may be monitored	•Manual removal •Mechanical removal •Flushing •Washing •Vacuum removal	•Dry mixing •Wet mixing •Sediment relocation •Burning	•Dispersants •Shoreline cleaners •Solidifiers •Bioremediation

This Job Aid provides guidance for the planning and implementation of in situ techniques on shorelines and rivers, including wet and dry **mixing** (also known as tilling or aeration) and **sediment relocation** (also known as surf washing or berm relocation) for oil spill cleanup. Burning on the shoreline is outside the scope of this Job Aid.

¹ API. (2016). Shoreline In Situ Treatment Library: www.shorelineinsitutreatment.com.

² API. (2016). Shoreline In Situ Treatment (Sediment Mixing and Relocation) Fact Sheet. API Technical Report 1155-3.

Shoreline/River Sediment In Situ Treatment Decision Guide



* The same location can be treated by dry mixing during low water levels and by wet mixing during high water levels.



Dry Mixing



Wet Mixing

Sediment
Relocation

This Job Aid is organized as follows:

1. Summary of Shoreline In Situ Treatment

- Objectives
- Application
- Advantages
- Safety

2. STRATEGIES: Scope and Application

- Comparison with other treatment techniques
- Summary of in situ treatment applications, advantages and limitations

3. TACTICS: Dry Mixing

- Applicable oiling and shoreline conditions
- Equipment and personnel requirements
- Operational and Environmental considerations
- Sampling and monitoring
- Information requirements and Decision Checklist

4. TACTICS: Wet Mixing

- Applicable oiling and shoreline conditions
- Equipment and personnel requirements
- Operational and Environmental considerations
- Sampling and Monitoring
- Information requirements and Decision Checklist

5: TACTICS: Sediment Relocation

- Applicable oiling and shoreline conditions
- Equipment and personnel requirements
- Operational and Environmental considerations
- Sampling and Monitoring
- Information requirements and Decision Checklist

1 Summary of Shoreline In Situ Treatment

Objectives

Oiled shoreline or riverbank treatment operations are conducted to accelerate the natural recovery processes by a range of physical removal or treatment tactics, or by chemical or biological treatment. In situ treatment involves techniques that significantly promote natural weathering and removal of oil, require few resources, and do not generate oiled sediment waste. Unlike removal techniques, in situ treatment does not involve the removal, recovery, or transfer of oil or oiled materials from the treatment location, although wet mixing can involve recovery if oil is released to the water surface. Unlike chemical or biological techniques, in situ treatment does not involve the addition of treatment agents. In situ techniques can be used in combination with other tactics as part of a phased response, for example, “polishing” after bulk oil removal.

The objectives of each of the three tactics and the fate of the treated oil are summarized in the following table:

Tactic	Objective	Fate of Oil
Dry Mixing	Physically break up stranded oil, which reduces sediment adhesion and compaction, and increases the surface area of the oil available for weathering.	The increase in surface area accelerates the natural weathering processes of evaporation, biodegradation, and photo-oxidation.
Wet Mixing	Cause shallow, underwater agitation of oil that is less dense than water to release that oil from intertidal and subtidal or river sediments.	Oil is released from the sediment to the water surface, which accelerates natural weathering and removal processes. Released oil may be collected for disposal/treatment.
Sediment Relocation	Relocate oiled sediments from one section of a beach to an area where the waves or current energy is greater, and/or where fine particles are present for OPA formation.	The physical energy and/or formation of OPA increases the surface area of the oil, and therefore accelerates the natural weathering processes of evaporation, biodegradation, and photo-oxidation.

In most cases, the formation of Oil Particle Aggregates (OPA) is critical for in situ treatment recommendations. The mixing of oil with fine particles, for example, clays, creates an OPA emulsion that significantly increases the surface area of the oil that is exposed to biodegradation and photo-oxidation. OPA and weathering processes are discussed in more detail in the *Shoreline In Situ Treatment Fact Sheet* (API Technical Report 1154-2). It is important to recognize that the various processes associated with OPA generate buoyant or neutrally buoyant emulsions that do not sink. Therefore, the intention of techniques that promote OPA formation is to release oil from sediment and to enhance natural dispersion as opposed to sinking the oil.

Application

In situ treatment techniques can be applied in a variety of situations, including:

- Oiled sediments, ranging from mud to cobbles
- Marine, estuarine and freshwater (e.g. lake and river) environments
- High and low energy environments
- Dry and wet (underwater) environments
- Surface and subsurface oiling.

The following table compares the applicability of the different shoreline in situ treatment tactics for different shoreline or river environments and oil types.

	Dry Mixing	Wet Mixing	Sediment Relocation
Sediment Type *			
Mud	✓	✓	✓
Sand	✓	✓	✓
Mixed Sediment (sand-pebble-cobble)	✓	✓	✓
Pebble	✓	✓	✓
Cobble	✓	✓	✓
Boulder			
Shoreline Location			
Supra-tidal Zone (SUTZ)	✓		✓
Upper Intertidal Zone (UITZ)	✓		✓
Middle Intertidal Zone (MITZ)		✓	✓
Lower Intertidal Zone (LITZ)		✓	
Subtidal (to 3 ft water depth)		✓	
River Location			
Above the water line (dry)	✓		✓
Below the water line (wet)		✓	
Oiling Depth			
Surface	✓	✓	✓
Subsurface: <0.2 ft (0.5 m)	✓	✓	✓
Subsurface: 0.2–3 ft (0.5–1 m)	✓		✓
Subsurface: 3–6 ft (1–2 m)			✓
Subsurface: >6 ft (2 m)			✓
Oil Type			
Volatile		✓	
Light	✓	✓	✓
Medium	✓	✓	✓
Heavy	✓	✓	✓
Solid			
Oil Character			
Pooled		✓	
Emulsion (Mousse)	✓	✓	✓
Surface Residue	✓		✓
Asphalt Pavement	✓		
Tarballs		✓	

* Man-made shorelines may be considered the equivalent of similar sized natural sediments, e.g. rip-rap = man-made boulder.