



MARINE-BASED STORAGE & TRANSFER

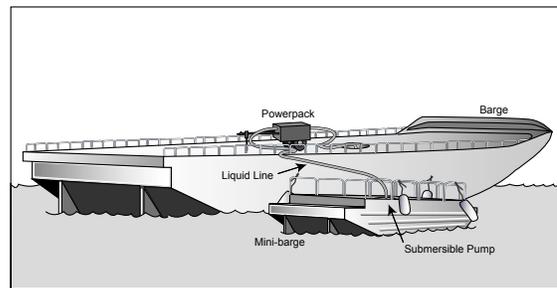
OBJECTIVE & STRATEGY

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Marine-Based Storage and Transfer is used to relocate recovered oil and wastes that has been collected in primary storage during Marine Recovery, Open-water Free-oil Recovery, or Shoreside Recovery into marine-based storage devices for transportation to disposal.

The general strategy is to:

1. Identify the transfer site and assess the conditions.
2. Determine the appropriate transfer and storage systems based on oil type, site conditions, and vessel capabilities.
3. Mobilize and deploy transfer and storage equipment to the site.
4. Transfer recovered oil from on-scene primary storage to on-water tanks, bladders or barges.
5. Man and monitor the system as appropriate.



TACTIC DESCRIPTION

Marine-based storage and transfer requires vessel crews and technicians skilled in mooring and anchoring techniques. Vessel to vessel transfer presents significant safety concerns for personnel and equipment and requires planning and training to execute properly. The equipment used in the storage and transfer should be adaptable to the specific site considerations and waste types being handled. Components include pumps, hoses, fittings, and storage systems consisting of storage tanks, bladders, or barges. Site considerations include the operating environment and the distances and elevation the liquid has to be moved. Waste considerations include explosive potential, debris content, and viscosity of the fluids. Components should be selected to maximize safety and efficiency and transfers should be kept to a minimum to reduce the risk of secondary spills.

Pumping Systems

Pumping systems should be configured to meet the requirements of the task. Consideration of the abilities and weaknesses of a pumping system and the site specific conditions will inform responders of the best pump for the job. Refer to the Tactic Pumping Oily Liquids for further review of pump systems and procedures.



Storage Systems

The two options for marine based storage are onboard tanks and towable on-water storage. Onboard systems include tankers and deck tanks. These are subject to significant regulation and require prior inspection and approval by the US Coast Guard. Towable on-water storage includes barges, bladders and open storages devices. A brief description of each follows.

Tank vessels – This onboard option should be considered for larger spills and when lightering operations might be necessary. Drawbacks include high freeboard, deep draft, and lack of immediate availability in most spill scenarios.

Deck tanks – Use of these onboard systems requires extreme caution as vessel stability can be significantly altered. Onboard oil storage systems can be on deck or below deck, with both types subject to numerous US Coast Guard regulations and inspection.

Barges – For most recovery scenarios, barges are the preferred on water storage devices. Consideration must be given to the amount of freeboard when pumping from small skimming systems. Barges containing less than 249 barrels of storage volume (sometimes called mini-barges) are considered equipment and do not require a US Coast Guard inspection.

Bladders and Tanks – Flexible tow tanks (dracones) must be towed at slow rates and can be fragile. They may be difficult to handle in high seas.

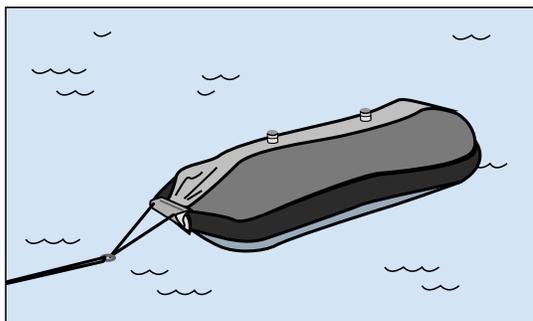


Figure MST-1. Towable, flexible storage device.

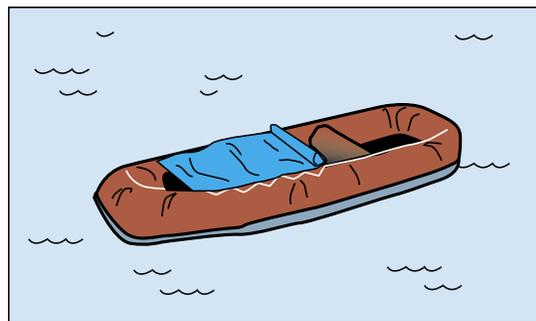


Figure MST-2. Towable open storage device.

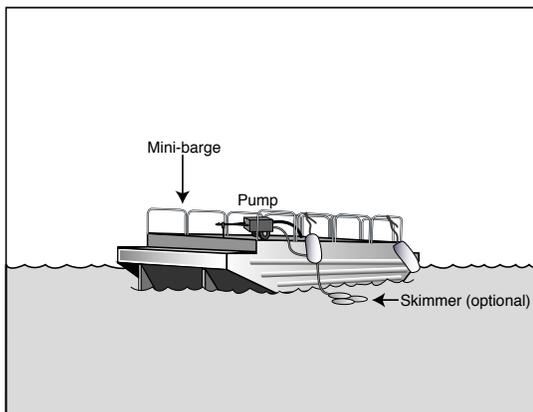


Figure MST-3. Towable Mini-barge storage device.

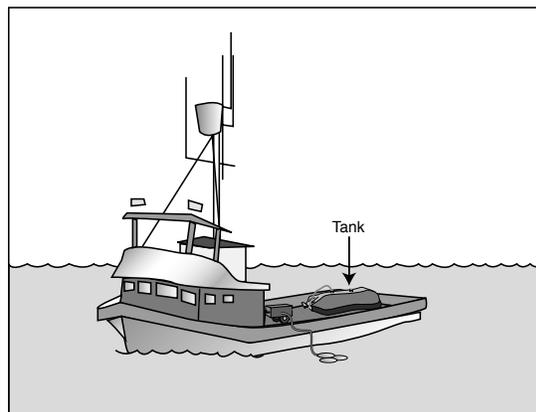


Figure MST-4. Deck tank primary storage device.

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Open Storage Devices – These inflatable barge type devices provide some freeboard and protection from seas.

Operating Environments

Recommended operating environments for marine-based storage and transfer are protected and calm water. Operation may occur in open and fast water under optimal weather and sea state conditions. Transfer operations are not recommended broken ice environments.

OPEN WATER

A successful marine-based storage and transfer operation in open water requires optimal weather and sea state conditions. Although possible, operations are not recommended in open water environment because of the probability of secondary spills and the difficulty of vessel to vessel mooring. If the option is available, transfers and storage would be safer if moved to protected waters.

Components for open water operations should be able to withstand seas up to 6 feet and winds up to 30 knots while towing cargo. For safety, vessels and accompanying storage devices involved in storage and transfer should be able to transit higher seas from the site to protected waters.

PROTECTED WATER

Vessels used in protected water for storage and transfer should be able to withstand seas up to 3 feet and winds up to 25 knots. Vessels towing the barges/bladders should be able to transit seas up to 6 feet with winds up to 30 knots for safety. Vessels involved in marine-based transfer and storage may be deep draft or shallow draft, depending on the water depth.

CALM WATER

Marine-based storage and transfer systems operating in calm water are composed of vessels and storage devices that can operate in seas of 1 foot and in winds up to 15 knots. Vessels towing equipment should be able to transit seas up to 3 feet in winds up to 20 knots for safety. Vessels involved in calm water storage and transfer systems typically work in depths as shallow as 3 feet.

FAST WATER

Marine-based storage and transfer systems are not recommended for the fast water environment, where currents exceed 0.8 knots, because of the high probability of secondary spills and the difficult of anchoring and mooring in this environment.

BROKEN ICE

Marine-based storage and transfer systems are not recommended for the broken ice environment because of loss due to ice encounters.



Deployment Configurations

As discussed earlier, the deployment configurations for marine-based storage and transfer will be largely dictated by the site considerations and the waste type. The placement of pumps will be determined by the head or suction needed, the transfer rates required and the receiving storage devices. For long distances, multiple pumps in a series may be required. The following options are the most common configurations used during response activities.

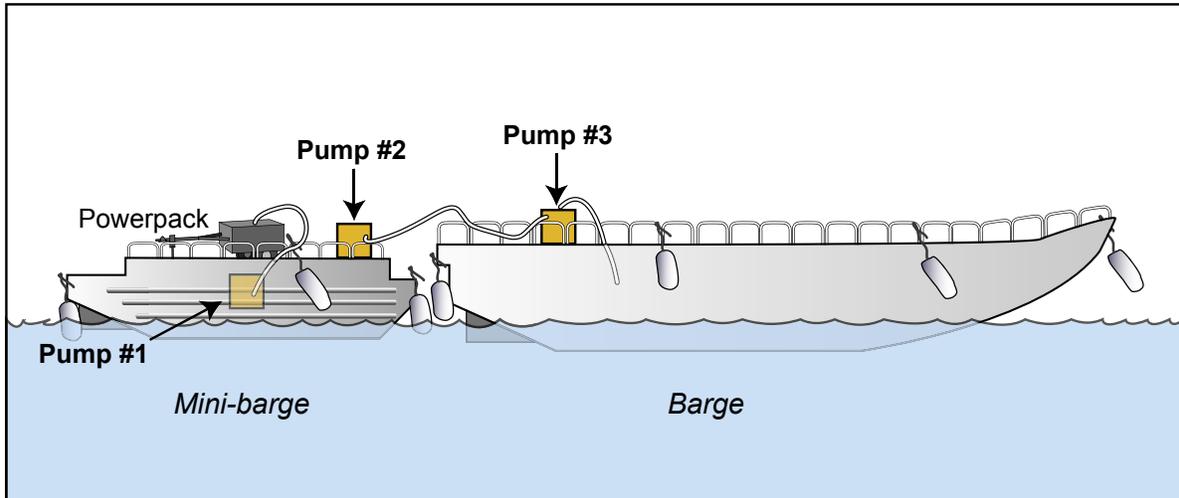


Figure MST-5. On-water marine storage and transfer. Pump position #1 is most common and requires a submersible pump with an external powerpack. #2 requires additional couplings and transfer of equipment to the smaller barge for transfer if it is not equipped. #3 requires the least amount of equipment transfers.

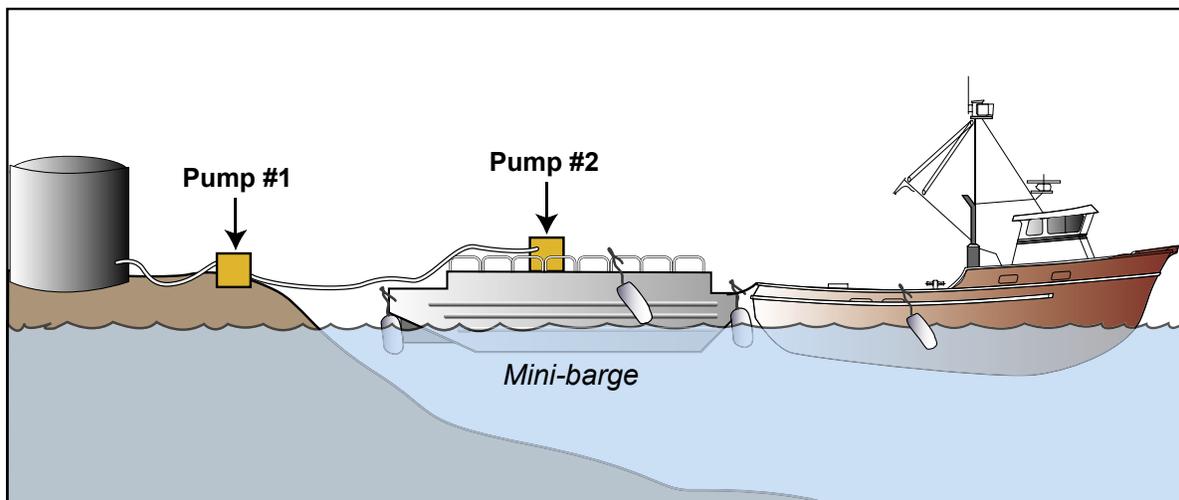


Figure MST-6. Shoreside Recovery operations transferring oily liquids to marine storage. Option #1 has the pump based on the shore. Option #2 positions the pump on the receiving barge.

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DEPLOYMENT CONSIDERATIONS AND LIMITATIONS

- + Daily fair and foul weather evaluations are recommended, and should include distance to safe harbor, transit times and exposure of vessels.
- + Mooring operations should be planned and discussed with the vessel and barge crews prior to execution. These should include emergency procedures and contingency plans.
- + Consider vessel stability when placing equipment and recovered liquids onboard any vessel.
- + Passing equipment to vessels presents significant hazards. Direct communication with the vessel masters should be maintained throughout the procedure.
- + Avoid free falling liquids, as static electricity may be produced.
- + When explosive potential is present, ground barges and equipment to dissipate static.
- + Vessel masters should have experience in the prevalent and predicted conditions and local knowledge is preferred.
- During the transfer, the pump controls and manifolds should have responsible crew with two way communication present to ensure rapid response to any spillage or changing circumstances.
- Vessel master should use extreme caution when maneuvering storage devices around submerged rocks and nearshore.
- Support and monitor hoses throughout the operation to ensure they are not under stress or chaffing.
- Secondary spill response equipment and sorbent materials should be in place.

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REFERENCES TO OTHER TACTICS

Other tactics associated with marine-based storage and transfer include:

-  • Pumping Oily Liquids
-  • Marine Recovery
-  • On-water Free-oil Recovery
-  • Shoreside Recovery

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EQUIPMENT AND PERSONNEL RESOURCES

Resources for this tactic include pumps, hoses, couplings, storage devices, tow vessels, anchoring and mooring equipment. Specific equipment requirements will be determined by site consideration described earlier and outlined in Tacit 21 Pumping Oily Liquids as well as resource availability. Resource sets will need to be refined as requirements dictate.

Open Water Marine-based Storage and Transfer System¹

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Equipment	Function	Quantity	Notes
Pump	Fluid Transfer	Site-specific	Determined by distance and lift, fluid viscosity, debris content, explosive potential.
Hoses and couplings	Fluid Transfer	Site-specific	Ensure that the pump and hoses are compatible.
Storage Device	Receives fluids from the initial storage device	Incident and site specific	Tankers, barges, floating tanks (dracones), bladders, or deck tanks.
Vessel	Function	Quantity	Notes
Class 8 or 2, 3	Maneuvering and towing of barges and tanks.	Minimum one per barge/tank	Depending on barge/tank volume, currents, and sea states.
Personnel	Function	Quantity	Notes
Field Team Leader	Supervise operations	1	May not always be on-site
Vessel Operators, Open water	Masters of tow vessels	2	Depending on number of vessels
Tankerman	Operation of the barge and director of transfer operations	1 to 2	Depends on the size of the barge
Skilled Technicians	Crews vessels and operates transfer equipment	2 to 4	Depending on number of vessels/barges
General Technicians	Work under the direction of skilled technicians or vessel operators	2 to 8	Depending on number of vessels and transfer configuration

Protected Water Marine-based Storage and Transfer System

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Equipment	Function	Quantity	Notes
Pump	Fluid Transfer	Site-specific	Determined by distance and lift, fluid viscosity, debris content, explosive potential.
Hoses and couplings	Fluid Transfer	Site-specific	Ensure that the pump and hoses are compatible.
Storage Device	Receives fluids from the initial storage device	Incident and site specific	Tankers, barges, floating tanks (dracones), bladders, or deck tanks.
Vessel	Function	Quantity	Notes
Class 8 or 2, 3, 4	Maneuvering and towing of barges and tanks.	Minimum one per barge/tank	Depending on barge/tank volume, currents, and sea states.
Personnel	Function	Quantity	Notes
Field Team Leader	Supervise operations	1	May not always be on-site
Vessel Operators, Open water	Masters of tow vessels	2	Depending on number of vessels
Tankerman	Operation of the barge and director of transfer operations	1 to 2	Depends on the size of the barge
Skilled Technicians	Crews vessels and operates transfer equipment	2 to 4	Depending on number of vessels/barges
General Technicians	Work under the direction of skilled technicians or vessel operators	2 to 8	Depending on number of vessels and transfer configuration

¹ Not recommended see Operating Environment.

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Calm Water Marine-based Storage and Transfer System

Equipment	Function	Quantity	Notes
Pump	Fluid Transfer	Site-specific	Determined by distance and lift, fluid viscosity, debris content, explosive potential.
Hoses and couplings	Fluid Transfer	Site-specific	Ensure that the pump and hoses are compatible.
Storage Device	Receives fluids from the initial storage device	Incident and site specific	Tankers, barges, floating tanks (dracones), bladders, or deck tanks.
Vessel	Function	Quantity	Notes
Class 8 or 2, 3, 4	Maneuvering and towing of barges and tanks.	Minimum one per barge/tank	Depending on barge/tank volume, currents, and sea states.
Personnel	Function	Quantity	Notes
Field Team Leader	Supervise operations	1	May not always be on-site
Vessel Operators, Open water	Masters of tow vessels	2	Depending on number of vessels
Tankerman	Operation of the barge and director of transfer operations	1 to 2	Depends on the size of the barge
Skilled Technicians	Crews vessels and operates transfer equipment	2 to 4	Depending on number of vessels/barges
General Technicians	Work under the direction of skilled technicians or vessel operators	2 to 8	Depending on number of vessels and transfer configuration

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Fast Water Marine-based Storage and Transfer System²

Equipment	Function	Quantity	Notes
Pump	Fluid Transfer	Site-specific	Determined by distance and lift, fluid viscosity, debris content, explosive potential.
Hoses and couplings	Fluid Transfer	Site-specific	Ensure that the pump and hoses are compatible.
Storage Device	Receives fluids from the initial storage device	Incident and site specific	Tankers, barges, floating tanks (dracones), bladders, or deck tanks.
Vessel	Function	Quantity	Notes
Class 8 or 2, 3, 4	Maneuvering and towing of barges and tanks.	Minimum one per barge/tank	Depending on barge/tank volume, currents, and sea states.
Personnel	Function	Quantity	Notes
Field Team Leader	Supervise operations	1	May not always be on-site
Vessel Operators, Open water	Masters of tow vessels	2	Depending on number of vessels
Tankerman	Operation of the barge and director of transfer operations	1 to 2	Depends on the size of the barge
Skilled Technicians	Crews vessels and operates transfer equipment	2 to 4	Depending on number of vessels/barges
General Technicians	Work under the direction of skilled technicians or vessel operators	2 to 8	Depending on number of vessels and transfer configuration

² Not recommended see Operating Environment.