Oil Spill Response

Containment and Recovery Field Guide

A guide to containment and recovery operations at sea

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Oil Spill Response

For more information contact us at:

SOUTHAMPTON
Lower William Street
Southampton
SO14 5QE
United Kingdom

Tel: +44(0)23 8033 1551

Fax: +44(0)23 8033 1972

Email: southampton@oilspillresponse.com

SINGAPORE
Loyang Offshore Supply Base

Loyang Cresent

Mail Box No 5105

Block 503 TOPS Avenue 3

Singapore 508988

Tel: +65 6266 1566

Fax: +65 6266 2312

Email: singapore@oilspillresponse.com

Foreword

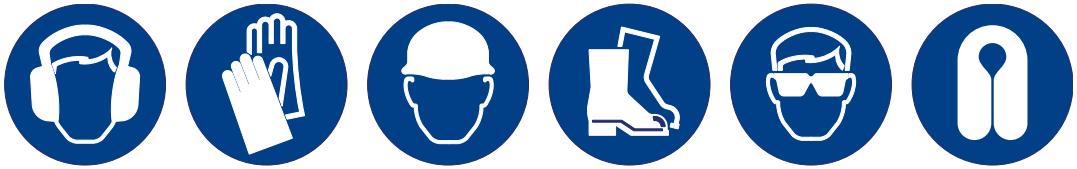
This short field guide is intended to be used by anyone undertaking containment and recovery operations to combat oil spills at sea. Included are safety considerations for the operations, a brief description of the variables involved in this type of response and advice on how to ensure the most successful outcome.

Offshore containment and recovery can be a useful response strategy and will be most successful when:

- The most suitable recovery device for the oil type and weather conditions is selected.
- The boom used is well-maintained and deployed by trained operators.
- Communications are effective amongst all parties.
- Suitable storage is available.

Contents

Safety



If the containment and recovery equipment is used correctly by following good operational procedures and using the correct Personal Protective Equipment (PPE), offshore operations should pose minimum risk to health. However, there are, as with other such activities, potential risks to responders and crew.

These risks can be minimised by:

- Identifying the risks through a comprehensive risk assessment process and implementing mitigations to reduce them where applicable.
- Communicating the risks and mitigations in place through a safety brief prior to any operations being carried out.

Minimum PPE standards:

- Overalls
- Hard hat
- Personal Flotation Devices (PFD) or lifejackets
- Gloves
- Ear defenders whilst machinery is running
- Steel toe cap boots
- Jewellery and loose clothing should not be worn

HAZARDS	IMPACTS	MITIGATION MEASURES
Man overboard. Due to entanglement in boom tow lines or unexpected ship movements.	Potentially leading to hypothermia, drowning.	When working on the back deck, personal flotation devices to be worn. Any open access to be secure unless boom deployment occurring. Boom deployments should only be carried out in suitable weather conditions.
Unsecured load. Lashing/welding equipment to the deck.	Potential crush injuries from unsecure loads.	Welding to be carried out by a competent and trained person. Equipment to be secured to the deck properly and checked by person nominated Deck In Command (IC) prior to vessel steaming.
Hydraulic hose failure.	Potential injury to eyes, skin penetration of hydraulic oil.	Ensure that equipment deployed has an adequate maintenance schedule which has been adhered to.
Noise (85-90dBA).	Danger of damage to hearing if exposed to loud machinery for prolonged periods of time.	Ear defenders to be provided and worn.
Exposure to Volatile Organic compounds (VOCs) and potentially Hydrogen Sulphide (H_2S) from the oil being recovered.	Could cause nausea and if H_2S is present, death in extreme cases. Presence of hydrocarbon vapours may also present an explosion risk.	Enforce a site entry protocol. Provide gas monitoring devices and appropriate respiratory PPE.
Manual handling.	Potential for back injuries.	Before any deployment commences, manual handling training should be given to anyone involved. Ensure that weights are clearly marked on the packages. Make sure that lifting equipment is available as appropriate.
Rotating machinery.	Potential for fractures and possible amputations.	Dangers should be highlighted in the safety brief given prior to equipment deployment. Only trained and competent personnel to use the equipment. No loose clothing or jewellery to be worn.
Slips, trips and falls.	Potential for minor injuries such as cuts, bruises or minor fractures.	Appropriate footwear to be worn. Handrails to be used. There should be an awareness of the sea conditions. Good housekeeping will also minimise the incidences of slips, trips and falls.
Use of crane for loading equipment/deploying recovery device.	Potentially leading to loss of consciousness in the worst case.	Hard hats to be worn when lifting operations are ongoing. Banksman to be used.
Vessel collision/grounding.	Potential for hypothermia, drowning or impact injuries.	Vessel crew should be trained and the vessel's navigational equipment should be in a good state of repair.
Fire onboard vessel.	Potential for minor burns, leading to death in the worst case	Alarm systems should be fitted and checked as should fire fighting equipment. Fire procedures should be included into the safety brief.
Skin contact with recovered oil.	Can lead to dermatitis.	Wear gloves/barrier cream and PPE to cover the skin.

While this table lists some of the common hazards that are likely to be present when conducting offshore containment and recovery operations, it does not constitute a risk assessment. A full site-specific risk assessment should always be conducted prior to operations commencing.

Key Steps


1
Plan and Train
!
Spill
2
Preparation
3
Contain the Oil
4
Recover the Oil
5
Store the Recovered Oil

Plan and Train

If you plan to use containment and recovery as a response strategy, key assets and personnel should be identified and/or trained prior to any incident occurring.

Oil Spill Equipment Operator

Minimum of one appointed Deck Lead required per deployment vessel during deployment.

Roles and Responsibilities:

- Ensure the successful deployment of oil recovery boom.
- Ensure the successful deployment, setup and operation of the recovery device.
- Report to Incident Command the amount of oil collected.
- Ensure the health and safety of those involved in the containment and recovery operations.
- Advise vessel crew on appropriate speed and course to maximise the oil collected.
- May be required to maintain communications with the aerial surveillance platform (this could also be conducted by the Captain).

Training Required:

- In the health and safety aspects of containment and recovery operations.
- In the deployment of containment boom and recovery devices.
- In the potential causes of boom failure.
- In the most effective way of carrying out containment and recovery operations.

Vessel Crew

Roles and Responsibilities:

- Vessel's Captain maintains absolute authority for safety of the vessel and the passengers.
- Ensure the effective and safe running of the vessel.

Training Required:

- In the health and safety aspects of containment and recovery operations.

One or more of the vessel's crew could be designated to assist with the equipment deployments as long as they have undergone the appropriate training.

A basic operator's induction course could be run covering the roles and responsibilities of the operator (designated Deck Lead) and the booming vessel.

Preparation: Organise Operations

Establishing effective methods of communication for containment and recovery operations can greatly enhance the success of the operation.

Communications Plan

In order to ensure effective communications it is important to produce a communications plan which will document:

- Who to call in the event of an emergency.
- Names of resources deployed, call signs and frequencies they are operating on.

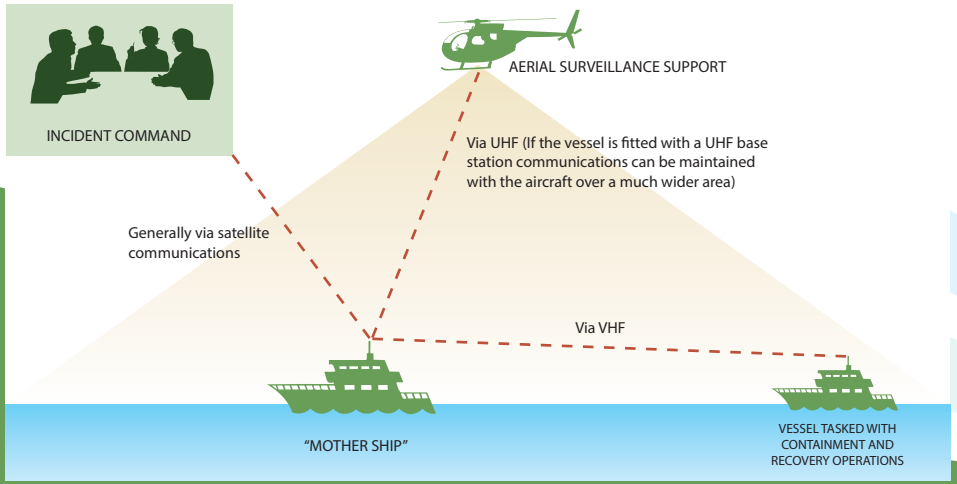
Organisation

If there are a number of vessels tasked with conducting containment and recovery operations the use of 'mother ships' may be considered to ensure that there are clear lines of communication.

The mother ship may also be useful in being able to provide additional resources to vessels conducting response operations.

Vessel Tracking

It is useful to have an Automatic Identification System (AIS) fitted on the vessels in order to track the containment and recovery operations from Incident Command and ensure the safety of the personnel on board.



Poor Communications

Ineffective communication between the command post and the vessels, the aerial surveillance support and the vessels, or between the bridge and the deck, may lead at best to the unsuccessful recovery of oil, or at worst to unsafe situations and accidents.

Preparation: Offshore Containment and Recovery Systems

The following will be required:

Offshore Boom	To increase the length of the boom and therefore the encounter, you may consider joining two (or more) booms together.
Recovery Device	There are many types of skimmers available. For more information, see 'Recover the Oil'.
Deployment Vessel	A deployment vessel should have: • Adequate deck space to load, secure and deploy the containment and recovery equipment. • A means of communicating to the tow vessel and the 'mother ship' and/or the aerial surveillance support. • Adequate berthing for crews and operations teams on board. • An open stern capable of deploying boom safely. • A crane to lift heavy equipment, such as offshore skimmers.
Tow Vessel	A tow vessel should have: • A suitable means of securing the tow line in a safe manner. • A means of communicating to the deployment vessel. • Adequate berthing for crews and operations teams on board.
Suitable Storage	Storage requirements can be estimated from the pumping capacity of your recovery device(s) and the length of time that the vessels are anticipated to be at sea. • Employing an independent vessel to shuttle supplies and storage devices to the area of operation will ensure the maximum efficiency of your recovery operations as the containment and recovery vessels are then able to stay on station. A method of separating the oil from the water on board would also be advantageous.
Aerial Surveillance Support	• To direct vessels onto the oil.

Contain the Oil: Types of Offshore Containment Boom

PASSIVE BOOM

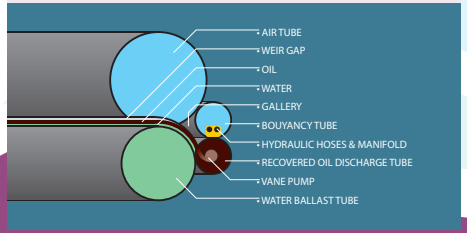
Inflation boom is generally used for offshore activities as it has better wave-following characteristics than rigid boom. There are many different makes of offshore boom however the principles are the same.

- ✓ Passive boom is relatively easy to deploy and maintain, ideally suited to spills where it may be necessary to deploy and recover the boom relatively frequently as the vessels 'chase the oil'.
- ✗ To complete the system you still need to source a suitable recovery system.

ACTIVE BOOM

Active boom systems incorporate a pump within the boom structure at the apex of the boom thus are both a containment and recovery device.

- ✓ The recovery device is incorporated into the apex of the boom so it is relatively easy to ensure the recovery device is kept in the optimum position. Active booms are generally designed with high recovery rates. They are best suited to situations such as well blowouts and pipeline failures which enable vessels to stay on station in the same area for prolonged periods of time with the boom permanently deployed.
- ✗ Active boom is more complicated to deploy, maintain and repair than passive boom.



OTHER BOOMING SYSTEMS

The 'buster' booms developed by NOFI have the advantage of being able to be towed more quickly than traditional passive inflation booms (4-5 knots as opposed to <1 knot).

- ✓ Can be towed quicker therefore has a higher encounter rate. Incorporates a separator reducing the amount of water and maximising the amount of oil that is recovered.
- ✗ A vessel dedicated to recovering from the boom is generally required as the apex is a considerable distance from the tow vessels. Buster booms are prone to collecting debris which can interfere with the ability to recover oil.

Contain the Oil: Boom Handling

DO

- Nominate one person to be in charge of the deployment on the deck.
- Ensure that equipment is correctly connected, check oil and fuel levels if relevant prior to leaving dockside.
- Signal to other vessels that you are towing, ensure that the boom and tow lines are visible in the water.
- Maintain a slow speed (~0.75 knot).
- Ensure vessel selected is able to maintain manoeuvrability at such speeds.

DON'T

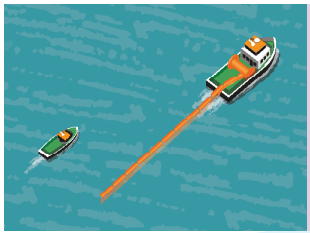
- Proceed with deployment until certain that all equipment is secured to the deck.
- Let ropes get near to propellers!
- Step over the stopper line whilst under tension.

Common Terms

1. Encounter:
The distance between the two vessels which determines the amount of oil which can be encountered and therefore contained and recovered by offshore operations. The larger the encounter, potentially the more oil recovered.

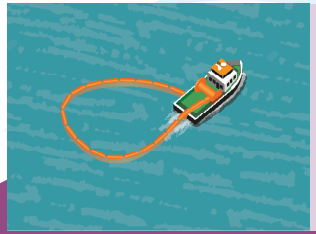
2. Apex of the Boom:
The part of the boom where the oil will collect. A recovery device should be deployed into the apex in order to recover the most amount of oil.

Boom Deployment Methods



Straight Lay:
The boom with a buoy attached to the towing line is deployed straight from boom reel. Once all of the boom is deployed the tow vessel recovers the buoy and attaches the tow line.

This is the quickest, most straightforward method of boom deployment. However, the deployment vessel has less control of the boom.



Loop Lay:
The tow line on the end of the boom is secured to the vessel. As the boom continues to be deployed it forms a 'loop' around the stern of the deployment vessel.

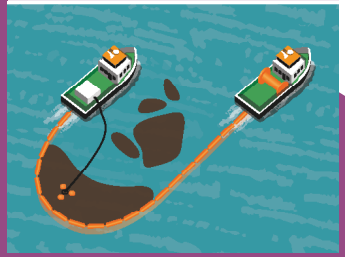
Although a slightly more complicated method this ensures that the deployment vessel has more control over the boom.

Contain the Oil: Boom Configurations

Different boom configurations can be utilised dependent upon the resources that are available for the containment and recovery operations.

J FORMATION

- ✓ Simultaneous containment and recovery is possible.
- ✗ Provides a smaller encounter.



U FORMATION

- ✓ Provides a wide encounter with oil.
- ✗ Difficult to coordinate vessels.
- ✗ Wide boom apex, making it more difficult to position the recovery device for optimum oil and minimum water recovery.
- ✗ More demand on resources and logistics.

V FORMATION

- ✓ Wide encounter with oil.
- ✓ Narrow apex, assists in maximising the amount of oil recovered.
- ✗ Difficult to coordinate vessels.
- ✗ Wide boom encounter, making it more difficult to position the recovery device for optimum oil and minimum water recovery.
- ✗ More demand on resources and logistics.

SIDE SWEEP

- ✓ Less demand on logistics as only one vessel is required.
- ✓ Quick to deploy (if side sweep system is avaliable).
- ✓ Easy to maintain configuration when manoeuvring.
- ✗ Small encounter.

Contain the Oil: Potential Causes of Boom Failures

Weather

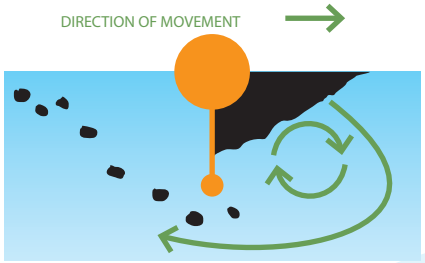
WIND	WAVES	CURRENT	BOOM PERFORMANCE
0-10 knots (0-20 km/hr)	Calm, swells	0-0.5 knots (0.25 m/s)	GOOD
>20 knots	>3-4 ft (>1 m)	>1 knot (>0.5 m/s)	BAD

Boom Saturation

If the boom fills with oil and a recovery device is not deployed the oil collected may overwhelm the boom and escape.

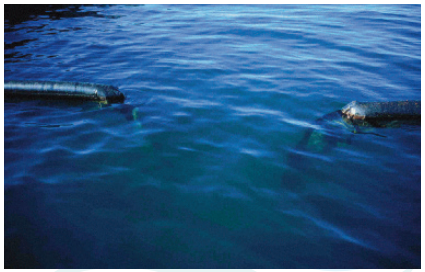
Undercutting

If the boom is towed at excessive speed or the current is running quickly then oil may undercut the boom and escape.



Boom Damage

In the event of a chamber being damaged during deployment or operations the remainder of the boom is able to stay afloat. There is the potential for oil to escape through the resultant gap, so the damaged chamber should be repaired as soon as practicably possible.



Recover the Oil

OLEOPHILIC SKIMMER

An oleophilic skimmer uses discs, drums or brushes which have oleophilic ("oil loving") properties. The oleophilic surface picks up the oil which is later removed by scrapers and pumped into storage.

- ✓ The amount of water collected is reduced compared to other types of skimmers.
- ✗ The skimmers are generally ineffective on oil that is heavily emulsified (as the high percentage of water in oil will inhibit the ability of the oil to adhere to the oleophilic surface).
- ✗ If dispersant has been used oil will not adhere to the oleophilic surface.

WEIR SKIMMER

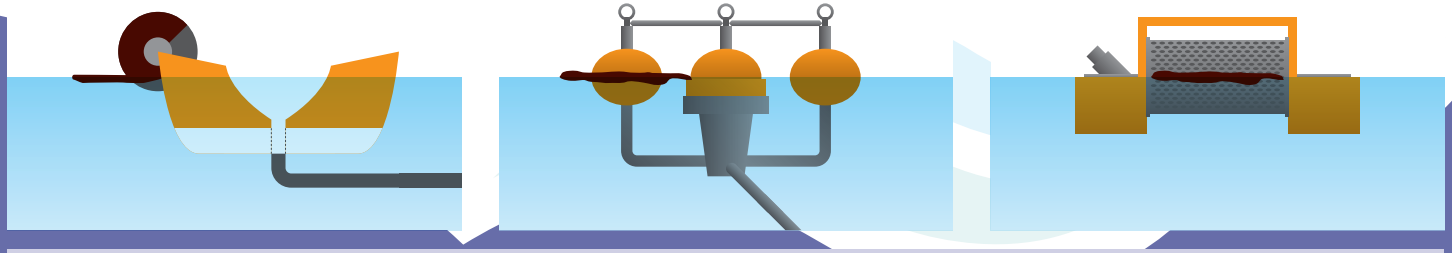
A weir skimmer sits on the oil/water interface, the oil flows into the hopper to be pumped into storage.

- ✓ Skimmer is effective on oil of a higher viscosity than the oleophilic skimmer.
- ✗ Weir skimmers are sensitive to weather conditions and tend to recover a relatively high proportion of water due to wave action. Their operation can also be negatively affected by the presence of debris in the water which may block the hopper and the pump.

MECHANICAL SKIMMER

A mechanical skimmer physically removes oil from the water's surface i.e. by the use of nets, drums or crane-operated buckets.

- ✓ Skimmer is effective on oils of a higher viscosity or weathered, emulsified oil.
- ✗ There is the potential for a high percentage of water to be recovered and a thick layer of oil is required to be effective.



! Skimmers will have a pump rating that is based on test tank conditions and does not reflect the reality of offshore recovery operations. The rated pumping volume will seldom be achieved in field conditions.

Store the Recovered Oil

Suitable types and quantities of temporary storage will be required when conducting containment and recovery operations.

Suitable storage may either be temporary in the form of:

- Inflated barges which can be towed.
- Tanks loaded onto the vessel's deck.
- Using the vessel's internal tanks or a storage barge.

It is important that a realistic volume of storage is provided prior to commencing recovery operations. It is likely that a quantity of oily water will be recovered (not purely oil). This will increase the amount of storage that will be required.

Storage could well prove to be a limiting factor for offshore containment and recovery operations if these logistics are not in place.

Ensure that local regulations are taken into consideration with respect to the discharge of oily water whilst conducting recovery operations. Some authorities will allow oily water that has settled in tanks to be discharged back into the apex of the boom to reduce the storage need and the amount of liquid that will have to be treated on return to shore.

Oil Spill Response

Tools

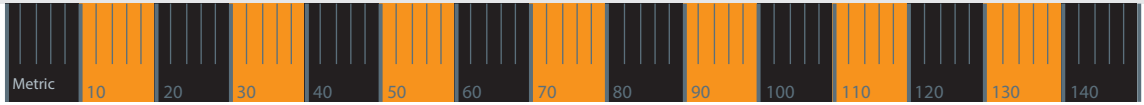
The following page contains information and tools to assist in conducting Containment and Recovery operations.

OPERATIONS ASSESSMENT FOR OIL RECOVERY OPERATIONS

VESSEL ARRANGEMENTS	YES	NO	NOTES
1. Is the vessel suited to the sea conditions in which it is to operate?			
2. Can the vessel safely accommodate the crew and response team on board?			a
- Accommodation facilities			
- Catering facilities			
- Toilet and washing facilities			
3. Does the vessel have appropriate LSA arrangements for the personnel on board?			
- Life jacket			
- Life boat/raft			
- Rescue boat			
- Fire fighting equipment			
4. Are there sufficient personnel to safely handle the vessel and the response equipment?			
5. Does the vessel have appropriate layout and adequate deck space to operate the response equipment?			b
6. Does the vessel have adequate power to operate the boom systems?			c
7. Are deck fixings suitable for operations?			
8. Is the vessel capable of low speed manoeuvring to handle booms?			d
9. Does the vessel have suitable towing arrangements to handle boom systems?			
10. Does the vessel have a crane to operate skimmers over the side? What is the capacity of the crane?			
- Lifting capacity (tonnes)			
- Reach (m)			
11. Does the vessel have suitable storage capacity for recovered oil?			e
- Capacity (m^3)			
- Heating arrangements			
- Temperature control			
- Temperature measurement			
- Tank venting arrangements			
- Tank filling arrangements			
- Tank emptying arrangements			
- Tank cleaning access			
- Can tanks be decanted?			
12. Does the vessel have adequate communications facilities?			f
- Vessel to vessel/shore			
- Bridge to deck			
- Potentially to spotter aircraft			

Notes:

a. Particularly important for remote, prolonged operations.
b. Related to the type and nature of the response operation. Open stern preferred for boom operations.
c. Towing power for boom systems particularly important. Compatibility of vessels needs to be considered when pairing vessels for boom towing operations.
d. Boom towing speeds less than one knot, need to be able to maintain steerage at low speed. Bowthruster can be valuable in this situation.
e. Particularly important with viscous oils
f. Vessel will need to be able to communicate vessel to vessel, vessel to shore and intra vessel. May need to be able to communicate with aircraft for direction.



Other Titles in the Field Guide Series

- Aerial Surveillance Field Guide
- Dispersant Application Field Guide
- Dispersant Application Monitoring Tier I Field Guide
- Dispersant Application Monitoring Tier II & III Field Guide
- Incident Management Handbook
- Offshore In-Situ Burn Operations Field Guide
- Oil Spill Response Field Guide
- Shoreline Operations Field Guide
- Vessel Dispersant Application Field Guide
- Waste Management Field Guide