

# The use of decanting during offshore oil spill recovery operations

# IPIECA

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## About this report

In response to the Deepwater Horizon incident at the Macondo Prospect off the Gulf of Mexico in April 2010, the International Association of Oil and Gas Producers (IOGP) formed the Global Industry Response Group (GIRG). This Group was tasked with identifying ways to prevent the recurrence of such an incident and to identify learning opportunities both with respect to the cause of, and response to, the incident. Part of this effort involved the formation of a subgroup on Oil Spill Response (OSR). This group was comprised of nominees from IOGP member companies, from the IPIECA Oil Spill Working Group (OSWG), from Oil Spill Response Limited (OSRL), and from other industry organizations, associations and spill response cooperatives, as appropriate.

The IOGP GIRG-OSR task force reported on its findings to both the IOGP Management Committee and the IPIECA Executive Committee at a joint session in February 2011. While certain actions recommended by the GIRG-OSR report fell within the remit of existing organizations, it was recognized that the most efficient way to execute the resultant work was for the industry to establish a limited duration Joint Industry Project (JIP), governed by the funding companies.

This report addresses Finding 17 of the IOGP Global Industry Response Group (GIRG) report which discusses the decanting of separated water from temporary floating storage devices back into the collection area.

## Introduction

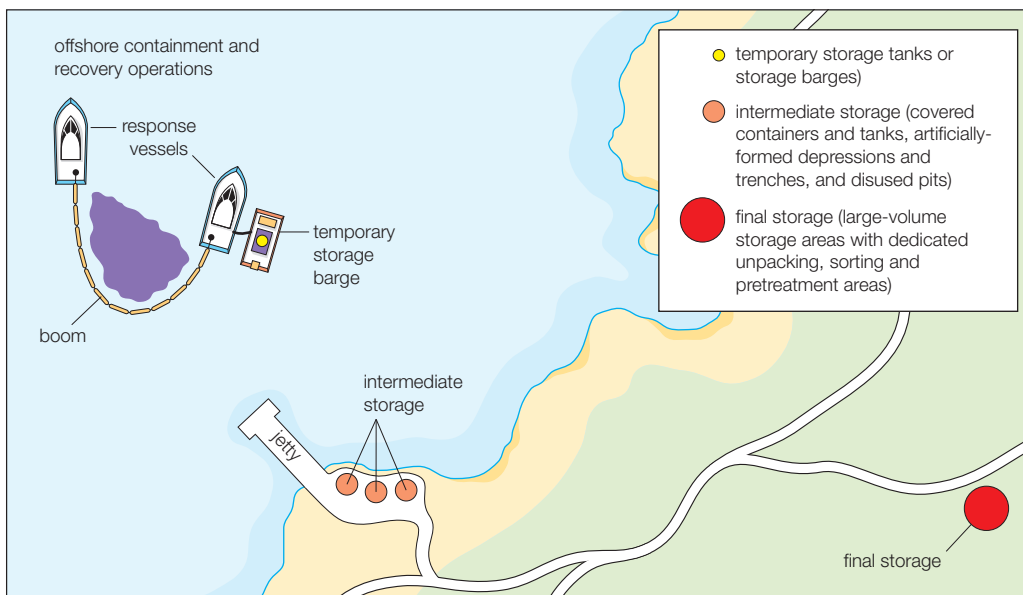
As with many oil spill response operations, offshore containment and recovery operations generate both solid waste (e.g. from contaminated flotsam, discarded personal protective equipment (PPE), etc.) and liquid waste, with liquid waste comprising the largest fraction. This liquid will consist of both oil and water, the exact percentages of which will vary with the encounter rate<sup>1</sup> and also the type of recovery device utilised. For example an oleophilic skimmer will, on average recover 10% water and 90% oil. Conversely, a weir skimmer will recover 70% water and 30% oil as a general rule. This waste is generally classified as hazardous due to its hydrocarbon content.

When planning a waste management strategy for an oil spill, it is recommended good practice to ensure that a suitable waste stream is established. The waste stream should comprise:

- **temporary storage:** in the case of offshore containment and recovery operations this may consist of inflatable barges, tanks loaded onto the deck of a vessel, a vessel's internal tanks, or a storage barge;
- **intermediate storage:** likely to be onshore storage in the form of pits or tanks;
- **final storage:** where the final processing or disposal takes place; it may be possible for the liquid waste that is generated from offshore containment and recovery operations to be reprocessed at an oil refinery or recycling plant.

If any part of the waste stream is overwhelmed, response operations may have to be suspended until sufficient capacity becomes available.

**Figure 1 Example of a waste stream, incorporating temporary, intermediate and final storage**



<sup>1</sup> The volume of spilled oil per unit of time that is actively encountered by the oil spill recovery system (e.g. booms, skimmers) and which is therefore available for containment and recovery. It is often referred to as the 'skimmer-to-oil ratio'.

## Decanting and temporary storage

Whilst the type of skimmer, the local sea and weather conditions and the fate of the oil (i.e. its degree of persistence or rate of natural dispersion) will all affect the amount of waste recovered during containment and recovery operations, it is inevitable that a certain amount of water, both in the form of free water<sup>2</sup> and water combined with the oil, will also be recovered.

If permitted under local regulations, the recovered water (both in emulsion and free) may be decanted and returned to the sea. This frees up valuable storage capacity in the temporary storage device which would otherwise have to be emptied before response operations can continue. Decanting the recovered water can serve to increase the temporary storage space available by up to 200–300% (S.L. Ross, 2005).

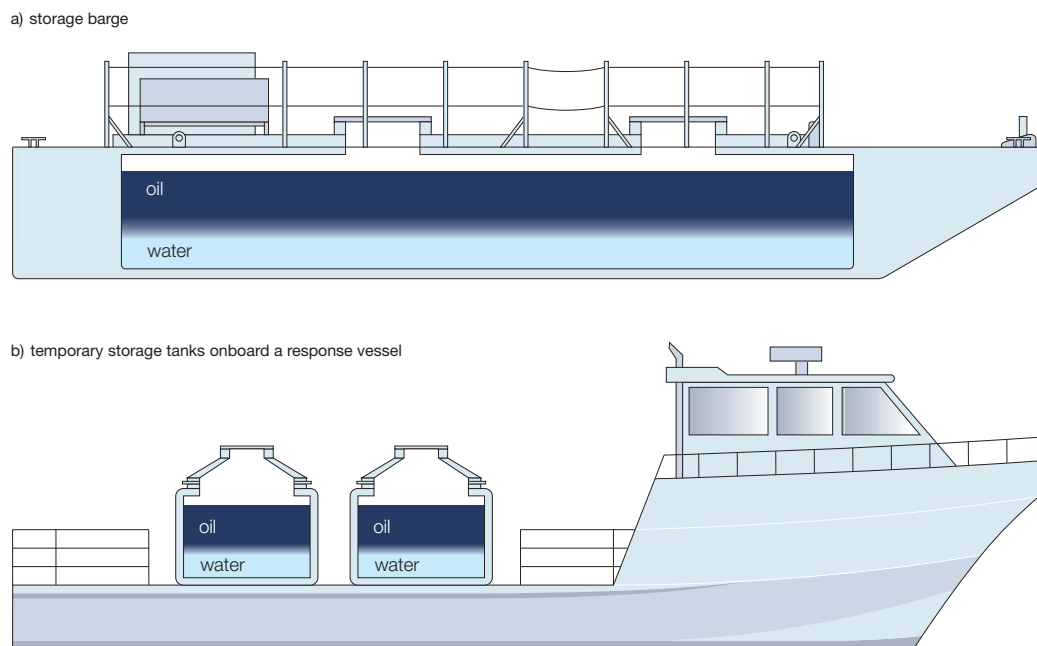
### The principles of decanting

#### Gravity separation

When contained within the relatively low-energy environment of the temporary storage device, the recovered mix of oil and water will start to separate into layers by a process of gravity separation. The use of baffles to reduce the free surface effect will help speed up separation and prevent remixing of oil and water. Once this separation has occurred it is possible to decant the bottom layer of free water, using pumps or valves, whilst retaining the recovered hydrocarbon.

**Figure 2 Examples of gravity separation in the temporary storage device**

*The recovered oil and water mix stored in the temporary storage device will separate into layers by a process of gravity separation.*



<sup>2</sup> Water that is not held in suspension as part of the oil/water mix; it may have been recovered alongside the oil/water mix, or allowed to separate from the recovered oil/water mix whilst in temporary storage.

### Optimum retention period

There is an optimum period during which the recovered oily water should be retained in the temporary storage vessel to allow adequate separation of the oil and water. When determining this 'optimum retention period', the aim is to maximize the amount of water discharged, whilst minimizing both the amount of oil released with the discharged water and the time that the temporary storage facility is effectively 'out of service' (S.L. Ross, 2005).

A study conducted at the Ohmsett facility<sup>3</sup> in New Jersey, USA in 1998 found that, for an oil in water emulsion that has not been treated with products such as emulsion breakers, this optimum retention/settling time is generally around 30 minutes, however, this was found to vary dependent on the thickness of the slick and the viscosity of the oil. For thinner slicks of less viscous oils, optimum separation generally occurred within 15–30 minutes; in these thinner slicks, higher viscosity oils provided faster separation. For thicker slicks of more viscous oils, the optimum period was 60 minutes.

Caution should be applied to this rule for thicker slicks of more viscous emulsified product. If the oil is thick and the encounter rate good, the amount of water recovered will be minimal because the skimmers will be operating at their most efficient. In this case, the water droplets will be suspended in a continuous oil phase and will take longer to reach the oil/water interface, hence there is potential for much longer separation times. Settling and rates of gravity separation in the case of thicker slicks of higher viscosity oils are therefore a function of the oils' viscosity (S.L. Ross, 1999).



*A Lancer barge being used for temporary storage*

Source: Oil Spill Response Limited

<sup>3</sup> National Oil Spill Response Research & Renewable Energy Test Facility, New Jersey, USA.

## Good practice

### Operational considerations

In order to minimize the potential for recovered product being released at the same time as the free water is decanted, the following practices are recommended:

- The temporary storage device should, prior to use, be checked to ensure that it is not contaminated with residues from any products or substances that may previously have been stored in that device, to ensure that no unauthorised discharges occur.
- Appropriate settling time should be allowed to enable gravity separation to occur prior to decanting and discharge of the free water.
- Where possible, employ the use of internal baffles in the temporary storage device to help speed up separation and prevent remixing of the oil and water.
- Free water should be discharged either into a secondary storage container or within the apex of containment booms in the path of the recovery device (so that any accidentally discharged oil can be contained and recovered).
- Visual monitoring should be undertaken at the discharge site whilst decanting to ensure that only water is released. If possible, the oil/water interface in the storage device should also be monitored to ensure that the discharge hose is only drawing from the layer of free water at the bottom.
- Dependent upon the environmental and socio-economic sensitivity of the area affected by the spill, and any other response activities that are taking place, it may be useful to identify an appropriate area for carrying out decanting operations.

### Record keeping

- It is recommended that a record is kept of where and when decanting has taken place, together with details of the volume of water discharged.

### Health and safety

- As with all oil spill response activities it is important to ensure that the correct PPE is worn. For decanting operations, the recommended PPE is the same as that required for offshore containment and recovery operations (IPIECA/IOGP, 2012).
- Operational hazards (such as the potential for the presence of explosive or toxic gases) should be identified through a site-specific risk assessment and safety brief—and possibly monitoring—prior to operations being carried out.



## Regulation

International regulation regarding the discharge of oil from vessels is contained in Annex I of the MARPOL Convention<sup>4</sup>. The Convention prohibits the discharge into the sea of oil or oily mixtures from ships, except where:

*'the oil content of the effluent without dilution does not exceed 15 parts per million'.*

However, there is provision under the MARPOL Convention for a dispensation in the case of oil spill operations, such that the regulation shall *not* apply to:

*'the discharge into the sea of substances containing oil, approved by the Administration, when being used for the purpose of combating specific pollution incidents in order to minimize the damage from pollution. Any such discharge shall be subject to the approval of any Government in whose jurisdiction it is contemplated the discharge will occur.'*

Some countries have specific regulations and conditions which apply to decanting during oil spill operations, e.g. the EPA/USCG 'Area Contingency Plans' in the USA (S.L. Ross, 2005). Other countries may have more general regulations which do not exclude the use of decanting when planning and supervising activities related to a response operation. Local regulation and guidance should always be sought prior to carrying out any decanting operations.

## Planning

As with many other issues related to oil spill response, all of the relevant stakeholders should be consulted during the oil spill contingency planning process; agreement should be reached on whether the decanting of recovered product would be permitted in the event of an oil spill incident, and any local regulation which may apply should be identified and complied with.

Important considerations during the planning stage include:

- If decanting is permitted, who is able to authorize its use?
- Are there any locations within the area covered by the oil spill contingency plan where decanting would not be permitted (for example especially environmentally-sensitive habitats such as coral reefs) and would there be a fixed-distance exclusion zone for these areas?
- Would there be constraints on water depth?
- Would there be any requirement to take samples?

The use of pro forma permits to authorize decanting should be discussed with regulatory authorities as part of preparedness and contingency planning, so that the approval process may be expedited in the event of an oil spill response operation. Appendix 1 gives a suggested template for a pro forma permit for use when seeking pre-approval for decanting operations.

<sup>4</sup> International Convention for the Prevention of Pollution from Ships — the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.

## The use of emulsion breakers

Emulsion breakers (also known as demulsifiers) can be added to the recovered product to break down the emulsion into its constituent parts of oil and water and help gravity separation to occur. However, the use of emulsion breakers can potentially result in an increase in the release of chemical contaminants (i.e. hydrocarbons and the emulsion breaker itself) in the discharged water, and for this reason their use should be avoided during decanting operations at sea. Instead, they can be added to the temporary storage device so that they take effect whilst in transit to the reception facility.

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*Emulsion Breakers are tailor-made, complex blends of surfactants and co-surfactants, combined with solvents, co-solvents and various builders. Because they vary in their chemical composition, solubility, and toxicity, the reception facility (typically a refinery) may need to institute a programme to understand the potential effects on the wastewater treatment plant and/or the final effluent discharge.*

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In 2005, S.L. Ross Environmental Research Ltd. conducted a series of experiments to ascertain the optimum injection, mixing and settling rates when using emulsion breakers (S.L. Ross, 2005). It was found that:

- applying an emulsion breaker did not affect the optimum retention period;
- when applying an emulsion breaker the amount of free water had an effect on its efficacy—if the free water content exceeds 55–60% the action of the surfactant in the emulsion breaker is inhibited;
- increasing the turbulent energy on the initial application of the emulsion breaker increased its effectiveness (increasing the energy is possible through increasing the flow rate and/or the length of the flow path between the skimmer and the temporary storage, adding mixing energy by, for example, adding a mechanical paddle to a storage tank); and
- using emulsion breakers roughly doubled the amount of TPH (total petroleum hydrocarbon) concentrations in the discharged water, and a large fraction of the emulsion breakers themselves ended up in the decanted free water.

The increased separation of oil and water that may be achieved by using emulsion breakers can make it easier to offload the recovered product upon arrival at the intermediate storage facility, and can also provide the added benefit of helping to derive a more accurate oil mass budget. The degree of improvement in separation will depend, inter alia, on the oil type and environmental conditions.

## Conclusions and recommendations

- The use of decanting is an effective way to deal with recovered water during oil spill operations and has benefits in terms of efficiency and safety (enabling less handling and more time spent recovering oil from the waters' surface rather than transiting to and from the intermediate waste handling facility).
- It is recommended that dialogue on the use of decanting is entered into with regulators and stakeholders at the earliest opportunity.
- It is also recommended that the use of pro forma permits for pre-approval of decanting operations (following discussion with, and approval by, regulators) and the incorporation of these permissions and conditions of use into the contingency plan should be considered; this can significantly improve the speed and efficiency of response operations.
- The use of emulsion breakers should be limited to application during transit to the intermediate/final storage facility, rather than during operations at sea.

## Appendix: example pro forma authorization form for decanting operations

Proforma permit — request for pre-approval for decanting operations	
Name of Incident	
Name of organization requesting authorisation to decant	
Name of representative of the organization requesting authorisation to decant	
Position of representative requesting authorisation to decant	
Date approval requested	
State reasons for requiring decanting	
State the location and description of proposed decanting operations	
Outline the measures that will be taken to minimize the risk of recovered oil being released back into the environment	
Signature of representative of the organization requesting authorisation to decant	
Signature of person authorising the permit	

## References

IPIECA/IOGP (2012). *Oil spill responder health and safety*. IOGP Report 480. London, UK.

S.L. Ross (1999). *Testing at Ohmsett to Determine Optimum Times to Decant Simple Temporary Storage Devices*. S.L. Ross Environmental Research Ltd., Ontario, Canada.

S.L. Ross (2005). *Transfer of decanting technology research to oil spill response organizations and regulators*. S.L. Ross Environmental Research Ltd., Ontario, Canada.

# IPIECA

IPIECA is the global oil and gas industry association for environmental and social issues. It develops, shares and promotes good practices and knowledge to help the industry improve its environmental and social performance; and is the industry's principal channel of communication with the United Nations. Through its member led working groups and executive leadership, IPIECA brings together the collective expertise of oil and gas companies and associations. Its unique position within the industry enables its members to respond effectively to key environmental and social issues.

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IOGP represents the upstream oil and gas industry before international organizations including the International Maritime Organization, the United Nations Environment Programme (UNEP) Regional Seas Conventions and other groups under the UN umbrella. At the regional level, IOGP is the industry representative to the European Commission and Parliament and the OSPAR Commission for the North East Atlantic. Equally important is IOGP's role in promulgating best practices, particularly in the areas of health, safety, the environment and social responsibility.

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