Tiered Oil Spill Response Scenarios using the BioBind concept

The concept of tiered response was developed by the oil spill response industry and aims to build a structured approach for preparedness and response mechanisms based on the spatial character of the spill and the spatial organization of stationed response gear and personnel.

Three different spill scenarios have been evolved. Based on these boundary conditions, the most important elements of a response operation using the BioBind technology are described. The scale of the scenarios is based on the concept of tiered response and the corresponding three levels for local, regional/national and international spill response operations. These scenarios only provide a general outline for the use of the BioBind Concept. To bring it into actual application, it is needed to integrate valid contact details of the implementing institutions in the relevant countries.

Scenario 1 Local spill (Tier 1)

A small spill occurred during bunkering operations in a harbor in the South Baltic area. Less than 1 m³ (6 bbl) of oil is spilled in an enclosed area which is not significantly affected by currents. The BioBind spill response gear is hosted on site for immediate response.

Relevant Stakeholders: On-site staff is responsible for first response. This includes personnel from the company that carries out bunkering operations as well as personnel from the operator of the facility (Shipping Company, oil terminal, port authority).

Components and logistics:

Surveillance: The knowledge about the spatial extension of the spill is essential for successful sorbent deployment. Surveillance by on site staff is sufficient and no modelling is needed, as long as the oil is not drifting away from the spill site.
Sorbent application: It is recommended to store the sorbents bulked in big bags. In this way they can be transported fast and easily from their on-site storage location to the location of the spill using a forklift or a lifting cart. In small quantities, the sorbents can be applied by throwing them on the spill or pouring them out of the storage unit (e.g. BigBags).
Recovery: To remove the saturated sorbents a standard hand net can be used or they are recovered using a customized vacuum collector. The vacuum unit is equipped with a power generator to collect the sorbents. Nevertheless it is not self-propelled. It can be used on land and on water. A vessel to tow the unit on land or a small workboat to carry the unit on water is needed.

General remarks:

Waste management: The use of sorbents will create additional waste but the sorbents will not increase in volume. Thereby the collected sorbent volume is known prior to the collection process. For sorbent storage, oil proof storage units are needed regardless of the recovery method (e.g. oil proof BigBags). After the collection the sorbents can be processed in a standard waste burning facility. It is recommended to have a contracted waste burning facility at hand prior to a spill.
The sorbents may be applied directly in front of sensitive resources to avoid the contact with free floating oil. Still there will be a contamination, but the saturated sorbents are much easier to collect than free floating oil or oil mixed with floating pieces or sand. This is valid for all three scenarios.

Scenario 2 regional or national spill (Tier 2)

Two vessels collided at sea resulting in a medium sized spill of 5 m³ (32 bbl)of oil. It is assumed that it will be possible to carry out response operations a sea. Nevertheless shoreline pollution is expected.

Relevant Stakeholders: Designated and trained staff is needed for this scenario. This response operation requires staff from regional and federal agencies. The equipment (sorbents, netboom container and vacuum unit) will be stored in a centralized spill response equipment depot close to the sea. Usually operations in the air and the open sea are carried out by federal staff, whereas onshore response is carried out by regional staff. Depending on the organizational arrangements of the individual countries additional staff from civil protection agencies, the military or private companies are included in the response process.

Components and logistics:
Surveillance: Aerial surveillance becomes very important when the oil starts to drift. The application of the sorbents needs to be done directly on the spilled oil. The sorbents will drift a bit faster than the oil. Local currents may or may not be correlated with local winds. If modelling of the local conditions can be carried out in a sufficient way it might be used to determine the location for sorbent application. If that is not the case, aerial surveillance is needed directly before the application to determine the location. For aerial application the location of sorbent application must be determined accurately by the Incident Command Manager. It is not the task of the pilot to decide when and where the sorbents will be applied

Sorbent application: In bigger quantities airborne sorbent application is recommended. In this scenario it will be done by a transport helicopter able to carry external load. For the application with a helicopter it is necessary that the sorbents are stored ready for take-off in an external load box which is able to be opened while the helicopter is in the air. The sorbents can be stored close to the sea at locations of high risk, while the helicopter can be stationed at a different location. Depending on the external load box, sorbents with a volume of 5 to 10 m³ can be released with one application.
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Scenario 2 regional or national spill (Tier 2)

Recovery: Once the sorbents are applied it is recommended to recover them as soon as possible to avoid large spreading. This will increase the effort for recovery and may lead to the fact that not all sorbents can be recovered. The seaborne recovery is similar to traditional boom handling. The netboom is stored in a standard 20ft container. One vessel is needed to carry the container to the spill and prepare the use on site. A second vessel is needed to tow the boom in a U-configuration. Cod-ends are available in various sizes. In this case it should be designed to be able to collect the amount of sorbents that is applied by the helicopter within one application. A crane barge is needed to lift the filled cod-end after recovery and place it on its deck into storage containers for transporting. Small patches of sorbents can be collected with the vacuum collector mentioned in scenario 1 mounted on a small work boat. **A detailed description of the recovery process is described in the SBOIL Manual on Offshore recovery.**

To collect bigger amounts of sorbents from the shoreline a customized vacuum unit is used. It is equipped with a power generator to collect the sorbents. Nevertheless it is not self-propelled. It can be used on land and on water. A vessel to tow the unit on land or a small workboat to carry the unit on water is needed. Depending on the amount of stranded sorbents multiple big bags for temporary storage are needed. If one bag is full it can be parked immediately and transported to a collection point by another vessel. Thereby the collection process will not be interfered. For waste management see scenario 1. **A detailed description of the onshore recovery process is described in the SBOIL Manual for Onshore recovery**

Scenario 3 international spill (Tier 3)

Two vessels collided at sea resulting in a spill of 5000 m³ (31.500 bbl) of oil. It is assumed that it will be possible to carry out response operations a sea. Nevertheless shoreline pollution is expected. Based on the size of the spill a state decides to ask for an International Offer of Assistance (IOA) to support the response operations. Within this framework it is decided to use BioBind as one of several different tools to respond to a spill of this magnitude.

Relevant Stakeholders: Designated and trained staff is needed for this scenario. The staff is specifically trained for the use of the gear and will accompany the gear and its use. The equipment (sorbents, netboom container and vacuum unit) will be stored in a centralized spill response equipment depot and transported to the location of the spill via plane. This service is carried out by private companies specialized on global tier 3 response operations (e.g. OSRL) or public multinational Equipment Assistance Services (e.g. EMSA EAS).

Components and logistics:
Surveillance: Aerial surveillance becomes very important when the oil starts to drift. The application of the sorbents needs to be done directly on the spilled oil. The sorbents will drift a bit faster than the oil. Local currents may or may not be correlated with local winds. If modelling of the local conditions can be carried out in a sufficient way it might be used to determine the location for sorbent application. If that is not the case, aerial surveillance is needed directly before the application to determine the location. For aerial application the location of sorbent application must be determined accurately by the Incident Command Manager. It is not the task of the pilot to decide when and where the sorbents will be applied
Sorbent application: In bigger quantities airborne sorbent application is recommended. In this scenario it will be done with a cargo plane. The cargo plane must be able to open its hold while it is in the air. For the application with a cargo plane the sorbents needs to be loaded stacked to enable easy loading and application. Depending on the type of plane used for application up to 200 m³ of sorbents can be applied at one flight .

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Scenario 3 international spill (Tier 3)

Recovery: Once the sorbents are applied it is recommended to recover them as soon as possible to avoid large spreading. This will increase the effort for recovery and may lead to the fact that not all sorbents can be recovered. The seaborne recovery is similar to traditional boom handling. The netboom is stored in a standard 20ft container. One vessel is needed to carry the container to the spill and prepare the use on site. A second vessel is needed to tow the boom in a U-configuration. Cod-ends are available in various sizes. To ease the handling of the filled cod-end it is recommended to have a maximum load of 50 m³. Thereby four cod-ends will be needed to offer sufficent recovery capacity for the applied 200m m³ of sorbents. A crane barge is needed to lift the filled cod-end after recovery and place it on its deck into storage containers for transporting. There should be enough space on the barge to store all four cod-ends once they are filled. Small patches of sorbents can be collected with the vacuum collector mentioned in scenario 1 mounted on a small work boat. For waste management see scenario 1. **A detailed description of the recovery process is described in the SBOIL Manual on Offshore recovery**

Tiered Response – General Remarks

The concept of tiered response was developed by the oil spill response industry and aims to build a structured approach for preparedness and response mechanisms based on the spatial character of the spill and the spatial organization of stationed response gear and personnel. The latest version is based on three tiers, each with 15 different areas of response capabilities. These areas represent the most commonly measures to mitigate the consequence of an oil spill [IOGP Report 526 2015]. In the subsequent text the concept of tiered approach is applied not on a specific spill scenario but on a specific technology. This is done to emphasize the possibility of integrating the BioBind concept into existing spill response plans based on the tiered approach. A possible scenario for each tier is given to illustrate the character of the response tool. Nevertheless no staff is assigned in this description as this is strongly dependent on the actual scenario. Based on the change of perspective, the description pathway will switch from vertically (each tier for one area) to horizontally (one tier for each area). This may appear to be contradictory to the evolving model in the tiered approach, but to describe relevant aspects of one specific technology it is necessary. However, for a holistic contingency plan, scenario based evaluations needs to be done including different technologies using the initially described methodology of tiered response planning.