



Finding 3

Dispersant logistics and supply planning

FINAL REPORT



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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 (OGP) 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 OGP 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 OGP GIRG-OSR task force reported on its findings to both the OGP 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 3 of the OGP Global Industry Response Group (GIRG) report which discusses the principles of dispersant logistics and supply planning for both subsea injection and surface application of dispersants.

Introduction

The use of dispersants is one of the key response tools when dealing with oil spills. They can be applied from aircraft, providing a fast, high encounter response capability. When responding to spills from subsurface releases, dispersants can be injected directly into the oil plume and can be highly effective in helping to make the worksite safer by reducing the amount of oil and volatile organic compounds (VOCs) at the surface. Dispersants are also frequently deployed from surface vessels as part of a Tier 1 response capability. A key element of any successful dispersant operation is the ability to supply dispersants in sufficient quantities to meet the demand. The rate of use and the volume required will vary in relation to the application systems in use, and will be governed to a great extent by the nature of the release. Subsea dispersant application, for example, may require the use of dispersants over an extended period which, in turn, will require an understanding of pre-planning and the logistics of supply.

Dispersant supply requirements

Shipping incidents

A VLCC (very large crude carrier) shipping incident might, in the event of a total loss, lead to the release of up to 250,000 tonnes of spilled oil. Such a situation is highly unlikely to arise, but even if it did, the volume of spilled oil is a finite one and, once released, will begin to weather. The lighter oil fractions will evaporate, oil will disperse into the water column and various other processes will occur naturally to reduce the overall volume of spilled oil. However, the weathering process also increases the viscosity of the oil through evaporation and emulsification, and as the viscosity increases, the dispersability of the oil through natural processes and the application of dispersants is reduced.

It follows that, when treating spilled oil with dispersants, the dosage rate will need to be gradually increased if it is to continue to have an effect on the oil, but a point will eventually be reached where the oil will not disperse at all. There is no defined limit for this threshold as it will vary according to oil type and water temperature, but experience shows that oils with a viscosity of more than 10,000 cSt may have reduced dispersion efficiency. As the weathering process continues, the oil will spread and fragment over the sea surface as a result of the action of the wind and current. This makes it difficult to accurately target the oil with dispersant, rendering the operation increasingly ineffective from a practical perspective.

To date, the largest known application of dispersants in response to a shipping spill occurred in response to the *Sea Empress* incident in 1996, during which some 436 tonnes of dispersant were applied to a spill of 72,000 tonnes of Forties crude oil over a period of 5 days using 7 aircraft. Whilst this was indisputably a large volume of oil, the response had a finite operational life. It can therefore be seen that the operational and logistical requirements of a response to a shipping incident will generally be short-lived. This narrow window of opportunity when responding to a shipping spill emphasizes the need for rapid regulatory approval of dispersant use, and the availability of aircraft and adequate dispersant supplies at relatively short notice.

Well control incidents

Whilst responses to shipping incidents are relatively short-term operations, the same cannot be said of an incident involving a loss of well control. In this case the flow of fresh oil will continue until the well is brought back under control, either through capping or relief well drilling. When responding to such an event the strategy will evolve over time as more response resources are brought to bear. Subsurface dispersant application is now considered by the upstream industry to be a primary intervention and response tool, for both surface operational safety as well as environmental reasons. It is generally expected that continued subsurface dispersant application will reduce the requirement for surface dispersant application, though probably not eliminate it entirely.

In the event of a well control incident, where dispersant application is a viable response tool, the dispersant response strategy might evolve as per the model below. Infield support vessels would commence the initial dispersant response whilst the industry-operated aerial dispersant capability is mobilized; at the same time, clearance of debris and the mobilization of subsurface dispersant injection equipment would be carried out; as the subsurface dispersant injection comes on stream the application of dispersants from aircraft might reasonably be reduced.

For the purpose of illustration, the theoretical profile is based on four infield support craft, one aerial dispersant asset and the use of subsurface dispersant injection. Table 1 provides an illustration of the dispersant logistics requirements that might arise during such an operation.

Table 1 Indicative daily dispersant use calculations for well intervention and surface response

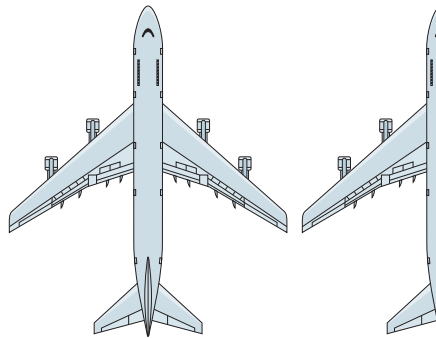
Operational period (days)	Response asset	Number of operations	Dispersant use per operation (m ³)	Daily total use (m ³)
1–4	Infield support craft	4 units	10	40
2–12	Aerial dispersant platform	3 flights per day	17	51
7–30 (capping completed by day 30)	Subsurface dispersant application*	1 unit	160	160

* Based on a subsurface dispersant injection ratio of 100:1 against a release of 100,000 bbls oil per day.

The response model above shows that the theoretical dispersant demand during the operation might peak at 211 m³ per day on days 7–12, but would be sustained at 160 m³ per day from day 7 to day 30. (This is based on the assumption that capping is completed by day 30.)

The delivery of such quantities of dispersant material is a challenging logistics operation. Depending on the source of the *approved* dispersant stock, the location of the spill and the access to freight capability, the degree of difficulty will vary. If delivery involves transport by air, stocks will need to be transported to the airport and palletized onto aviation pallets, loaded into the aircraft, flown to the destination, transported via road freight to the loading dock, loaded onto the support vessel for deployment offshore and then transferred onto the vessel carrying the injection equipment. This will

Figure 1 Daily transport volumes of dispersants—example of air transport



A daily use of 160 m³ equates to approximately one-and-a-half Boeing 747-400F plane loads of dispersant per day. In the early part of the response, this number might be exceeded.

need to be achieved on a daily basis without delays for the duration of the intervention operation, which may be up to 90–100 days if a relief well is required. The bulk transport of dispersants by ship might be considered a less difficult proposition in certain cases as it could be delivered directly to the application site. Further challenges will arise if the material is required at locations which are remote from the main logistical supply routes or where logistics support and vessel availability is restricted.

Transport documentation

Assembly of the correct documentation (e.g. consignee notes, manifests, airway bills, material safety data sheets (MSDS), etc.) is critical to ensure a rapid despatch to site. Detailed arrangements must also be made with the receiving facility to advise on ETAs, handling, transport requirements, rapid customs clearance and destinations.

Dispersant approvals

The problem of access to *approved* dispersant products is a complex one. Regulation of dispersant products varies from country to country. In some cases the regulators maintain approved lists of dispersants that meet agreed effectiveness and toxicity criteria. In others, approved product lists are adopted from other countries. The lists are not universally consistent, and in some cases there is a strong desire for a country to promote the use of domestically manufactured and registered product that might be held in limited quantities and have a limited re-supply capacity. An effective dispersant supply strategy should permit access to the widest number of approved products possible, in as many locations as possible. At present, dispersant manufacturers are required to

submit their products to the regulatory body for testing—a process which incurs a real cost to the manufacturer. However, if there is no market for the product in a particular location, the manufacturer may feel that this is an unnecessary business cost and the process is not pursued; such practice inhibits the spread of dispersant approvals for the industry.

These are real practical issues that need to be addressed in the planning stages with the country concerned, to either broaden their approved lists or to develop a protocol to permit the use of other dispersant types which may not have been specifically approved. This discussion is not one to be held during the high pressure environment of an incident response, and dispersant pre-approvals should be sought wherever possible.

Regardless of whether a particular dispersant has received specific approval for in-country use, additional permissions may be required depending on the circumstances under which it is being used (e.g. proximity to shore, water depth, etc.). Any restrictions on the use of dispersants in this regard will need to be taken into account in logistics and supply planning.

Feasibility of ‘just in time’ manufactured dispersant supply

The manufacture of dispersants is reliant upon the blending of a number of components, principally surfactants and solvents. These surfactant materials are widely used in household commercial, cleaning and pharmaceutical products, hence there is an ongoing ‘background’ demand for these products on a routine basis. Should an extraordinary demand be placed on this supply chain, such as during an oil spill, this could make it difficult for dispersant manufacturers to meet the demand for the dispersant volumes required. For example, unless provisions have been made to stockpile the raw materials required for manufacturing the dispersant product, production might be restricted, leading to a reduction in available volumes until sufficient raw material supplies are established. Some dispersant manufacturers have established core stocks of raw materials to ensure that they remain capable of generating sufficient product when the need arises; however, even if the raw materials are available, it will still take time for the dispersant manufacturers to increase production to meet the additional demand.

The estimated time to ramp up the production of dispersant products is generally assumed to be around 15 days to achieve a typical global production rate of 100 m³ per day, subject to the availability of the necessary raw materials (e.g. surfactants, solvents, etc.). One major manufacturer has estimated that the total time from order to delivery could be as long as 90 days to some locations (in non-emergency mode).

Dispersant stockpiles

Taking into account the limitations of 'just-in-time' manufacture of dispersant products described above, it can be seen that the supply of dispersant materials may not keep pace with demand in the early part of a response. The industry has therefore determined to establish stockpiles of dispersant products to act as a buffer stock for the initial period of a response. To ensure that this material can be delivered to site in an efficient manner, a detailed *logistics and transport plan* is required. Such a plan should be an integral part of any contingency or well intervention plan, and should identify all relevant options, resources and documentation requirements.

Dispersant product packaging and operational Issues

The traditional barrel

The traditional barrel is generally the most inconvenient in terms of use and shipping. Barrels need to be loaded onto pallets and require fork lift equipment to handle them properly. They also have a limited volume, which creates significant handling and waste problems where large volumes are required. For example, an aerial dispersant delivery system (ADDS) pack requires 90 bbls of dispersant to fill the system;



The traditional barrel used to be the most common form of shipping container for transporting dispersants; however, it is the least convenient in terms of use and shipping.

if dispersant stocks are supplied in barrels, the contents of each barrel would have to be individually pumped into the system, presenting a spill risk together with the attendant time penalty and the need to remove all empty barrels from the airfield ramp. Due to their bulk and shape, barrels do not lend themselves to packing onto standard 88 x 125-inch aircraft pallets. Barrels made of metal or plastic will deteriorate over time if not properly cared for, and shippers will, quite reasonably, refuse to handle materials that present a spill or safety hazard.

Intermediate bulk container (IBC)

The most widely used container for the transport of industrial liquids is the intermediate bulk container, also known as the IBC. This has a capacity of 1 m³, and is of plastic construction with a metal space frame built around it for protection. It has an integral pallet with fork pockets, making the units easy to handle with a fork lift. They can be stacked up to three high, and their uniform size makes them easy to store. The plastic tank has a life restriction of five years, which must be observed when shipping.



The intermediate bulk container (IBC) is widely used in the support of aerial dispersant operations due to its ease of stacking, storing and handling using fork lift equipment.

From an operational standpoint, these containers are highly versatile and they are commonly used in the support of aerial dispersant operations. Although the IBC has a relatively limited volume, its convenient form makes it an ideal solution for transporting dispersants on to the desired location (e.g. to an airfield for loading onto aircraft used in dispersant spraying operations, or to ports and docks for vessel transport offshore). When used onboard aircraft during dispersant spraying operations, the spray equipment can be easily topped up from the IBCs whilst dispersant operations are being conducted.

ISO tank container (isotainer)

The ISO tank container (a container built to ISO standards—sometimes referred to as an ‘isotainer’) is the most useful solution offshore. It is also the most likely to be used for transporting large volumes of dispersants in the early part of a well intervention operation. These tanks are certified for lifting and handling and have volumes of up to 20 m³. They can easily be moved by

land and sea but if shipped by air they require specialist cargo aircraft as shown on page 3. The ISO tank container will most likely be the last link in the deployment chain as these containers (in addition to ships’ bulk storage tanks) are the only type of transportable container that offers sufficient storage volumes to meet the daily demand levels.

Where isotainers are being used, it is likely that a transfer station will need to be established to transfer

dispersant product from the incoming IBCs into the isotainers at the loading port or airfield before onward shipment to the spill site. This will require that the relevant transfer equipment and fire safety/spill response arrangements are in place.

A potential use of 60 m³ of dispersant per day would require three isotainers per day, and it is important that a replenishment system is established which is capable of meeting the demand. This may involve the use of offshore crane lifts to load containers onto transfer vessels, and ship-to-ship transfer operations in the field.

Bulk ship tankage

The best way to ship the dispersant to an offshore site in large volumes is by the use of ships’ tanks. Although this mode of transport is the slowest, there are benefits in reducing the number of links in the logistics chain to a minimum. This reduces safety and handling risks and has the potential to significantly reduce costs. The use of internal supply vessel tankage and pump transfer systems will allow the replenishment of dispersant material at the injection site in large volumes. Only severe weather conditions will reduce this capability, but in such cases all other types of operations will also be limited.

The ISO tank container is the most useful solution offshore, and the most likely to be used for transporting large volumes of dispersants in the early part of a well intervention.



Planning is the key

The most fundamental requirement is to establish a detailed plan to deliver the dispersant to site to meet the requirements of any operational use that is envisaged.

The key areas of focus should be:

- **Dispersant approvals/pre-approvals:** Identify the types of dispersant approved by the regulator. Identify potential locations of any additional dispersant stocks. Seek approvals to permit the use of non-approved dispersants, together with any local permissions that may be required.
- **Dispersant requirements:** Make an assessment of likely dispersant demand based on the operational risk and the planned response strategies. Identify potential sources and location of approved dispersant material to meet the demand. Ensure access to these sources is agreed, documented and approved.
- **Operational logistics:** Identify the principal operational areas, i.e. airfields for aerial operations, port locations for at-sea operations. Establish detailed tactical plans to support the operation. These will include: safety, materials handling and transfer arrangements; berthing or aircraft parking arrangements; security clearances; secure fuel supplies; and weather information. Airfields and port facilities should be prearranged, documented and tested through exercise.
- **Transport logistics:** Identify the optimum dispersant transport routes using point-to-point principles, and determine the optimum logistics solution to provide adequate dispersant supplies to meet demand. Evaluate the capacity and time components of the transport solution to ensure a robust plan. Identify and test each interface point in the plan, to ensure that all elements of the plan will work as expected. Engage with all service providers in the logistics chain to ensure that a reliable system of response is in place.
- **Documentation:** Develop the dispersant delivery plan documentation, including associated manifests, MSDS, dispersant approval documentation, etc.
- **Test the plan:** Conduct a test of the plan to ensure its integrity (spill drills, deployments, table-top exercises, etc.); refine as required.



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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OGP 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, OGP is the industry representative to the European Commission and Parliament and the OSPAR Commission for the North East Atlantic. Equally important is OGP's role in promulgating best practices, particularly in the areas of health, safety, the environment and social responsibility.

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