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REGIONAL ASSOCIATION OF OIL AND NATURAL GAS COMPANIES IN LATIN AMERICA AND THE CARIBBEAN

Guideline for the Use of Dispersants on Oil Spills

ARPEL ENVIRONMENTAL GUIDELINE

Guideline for the Use of Dispersants on Oil Spills

Prepared by:
ARPEL Emergency Response Planning Working Group

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The Objectives of the ARPEL Emergency Response Planning Working Group are:

- To develop appropriate strategies to support industry's efforts to ensure a cost-effective response to emergencies both at the local and regional level.
- To promote the development of bilateral and regional cooperative agreements on emergency planning through joint government/industry cooperation.
- To provide guidance to assist industry's efforts in being proactive in the prevention of oil spills.

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1. INTRODUCTION AND PURPOSE

Dispersants have been used to combat oil spills for many years. Today's dispersants are formulated to quickly and safely mitigate the potential damage to the environment a large oil spill poses. In fact dispersants are considered as one of the many first option countermeasure tools available to responders. Keep in mind, though, not all spills should or need to be treated with dispersants.

When used properly, dispersants can rapidly reduce the oil on the water surface and accelerate the natural bioremediation process. Dispersion can shorten the response time to an oil spill, thus reducing the chances the oil will threaten sensitive areas. For dispersants to work, though, many questions need to be answered such as:

- Is the spilled oil dispersible?
- Is the dispersant that is available the right dispersant for the oil?
- Is the weather conducive to applying dispersants?
- Is the proper application equipment readily available?
- Have response personnel been properly trained in the application of dispersants?
- Is the use of dispersants allowed by the appropriate authorities?
- Have any tradeoffs been contemplated?

This Guideline is designed to assist the decision makers – both responders and government agencies - in answering these questions and thus putting them in a position to make an informed decision quickly that is based on fact and not conjecture.

The Guideline consists of five parts and a number of appendices. The five parts are:

1. Introduction and Purpose
2. What are Dispersants
3. Making the Decision to Either Use or Not Use Dispersants
4. Using Dispersants
5. Safety and Health Considerations

These five parts are designed to give general information on dispersants and the steps in making the "use/not use" decision. These parts are also meant to be used by government agencies, non-government organizations, the media, etc. in gaining a better understanding of the benefits dispersants can provide when used properly and under the right circumstances.

Appendices 1, 2, 3 and 4 contain the technical information and tools (such as checklists) needed by the decision-makers – both responder and appropriate government agencies - to make these decisions. A summary of the status on the regulatory/policy aspects in Latin America and the Caribbean related to the use of dispersants during oil spills is also included in Appendix 5.

These Guidelines do NOT discuss the approval process for getting the various dispersants approved for use within a Country. This is a decision lying exclusively with the appropriate Governmental agencies in each Country. Industry associations such as ARPEL can provide the agencies with background information and testing results that can assist the agencies in their decisions, but the final decision rests solely with Government.

Before proceeding it is important to note there is a vast amount of information available regarding dispersants. When reviewing this information it is important to keep to those documents that are based upon the most current facts such as the American Petroleum Institute's (API) *"A Decision-Maker's Guide to Dispersants"* and the International Petroleum Industry Environmental Conservation Association (IPIECA) Report Series Volume 5, *"Dispersants and Their Role in Oil Spill Response".*

2. WHAT ARE DISPERSANTS?

When oil is spilled upon the water it will, in most cases, float on top of the water. As the oil sits on the water the lighter ends of the oil will naturally evaporate. Of the oil remaining on the water, some will, depending on various elements such as waves, temperature, and wind, mix into the water column. This is natural dispersion. The majority of the spilled oil, though, will remain on the surface where it will continue to weather (evaporate, emulsify, etc.) Eventually many oils will develop a stable emulsion of water and oil, commonly called "chocolate mouse". Spilled oil and emulsified oil are serious threats to the environment, especially when it enters near shore areas or strands on shorelines and contaminates habitats such as mangroves, marshes, beaches and other wildlife habitat (such as for birds and marine mammals). Dispersants aid the natural dispersion process by making it easier for the oil to break up and disperse into the water column before the oil can emulsify and/or threaten sensitive sites. Very small oil droplets are formed and dispersion of the oil into the water column is possible in a matter of minutes. In other words, chemical dispersants function to aid the environment to do what will eventually occur without treatment, but to do it much faster and effectively.

The key components of chemical dispersants are surface active agents (surfactants) which are molecules that have both water-soluble (hydrophilic) and oil-soluble (hydrophobic) ends. These molecules, when applied to an oil spill, orient themselves at the oil/water interface such that the hydrophilic ends of the molecules are in the water and the hydrophobic ends are in the oil. The result is a reduction of interfacial tension between the oil and water. This action reduces the cohesiveness of the oil slick and, with agitation, finely dispersed oil droplets (ranging in size, depending on the effectiveness of the surfactant formulation, from about 10 microns to 0.5 millimeters in diameter) are formed in the near-surface water. These droplets are mixed into and sustained as part of the water column by waves and currents. Hydrophilic surfactants also prevent droplet re-coalescence.

Today's dispersants are more effective and less toxic than the dispersants available in the late 1970's. In fact, studies have shown the acute lethal toxicity of dispersants is usually lower than crude oils and refined products. To better understand how dispersants work and what their effects on the environment can be it is suggested the IPIECA Report Series Volume 5, *"Dispersants and Their Role in Oil Spill Response"* be consulted. This document can be found on the IPIECA website at: www.ipieca.org.

3. MAKING THE DECISION TO EITHER USE OR NOT USE DISPERSANTS

The key to making the right decision as to what the best response strategy is for responding to an oil spill is pre-planning. Without pre-planning timely decisions will not be made, the oil will continue to spread, threatening to strand on sensitive shorelines and wildlife habitats, and potential damage to the overall environment will escalate. In fact, without a proper and well planned response this damage can have long lasting effects. The key is to pre-plan (Oil Spill Response Contingency Plans).

In regards to dispersants, the pre-planning needs to begin with the appropriate government agencies. Potential users of dispersants must have a clear understanding of applicable laws and regulations – know when and where the government will allow the use of dispersants, which dispersants are approved for use, and what actions are required before permission is given to apply dispersants. Some countries are quite strict in regards to the use of dispersants while a neighboring country may only require notification prior to their use. In either case, meeting and working with the appropriate government agencies will result in a better understanding of the political and scientific issues and help create a good working relationship no matter what clean-up strategy is used.

If all appropriate government agencies indicate dispersants will be seriously considered for use on an oil spill, the next step is to ensure dispersants and the means to deliver them effectively to the spill are readily available. This could include keeping a stockpile of dispersants along with the needed application equipment on hand at the facility or a local spill response cooperative.

Before purchasing dispersants and the associated equipment it must be determined that dispersants are a bona fide response option. For example, nearly all light products such as gasoline, and aviation fuel are too light for dispersants to work on them while heavy products such as asphalt are just that, too heavy – the dispersant droplets can not penetrate the product in order to create that oil/water interface needed for dispersants to work. Dispersants work best with most crude oils and medium fuel oils.

Once it is determined the government and associated laws and regulations will support the use of dispersants and the oil that could potentially spill is dispersible a supply of dispersant and the proper application equipment needs to be established. Depending on the location, these materials could be kept at and maintained by the appropriate facility, a response cooperative, or an oil spill clean-up contractor. The decision maker must have a good estimate of the amount of time it will take to apply the dispersant on an actual slick (availability of aircraft or vessels, dispersant, trained personnel, staging area and the distance the spill is offshore).

Whatever the method used to justify the needed resources, it is important that an initial supply be close by. Most computer models of oil weathering rates indicate dispersants should be applied within hours of the spill occurring to be most effective. This is not to say dispersants will not be effective if applied later. In fact dispersants have been used with some success on spills older than a week. Of course this is very much dependent on the degree of emulsification affected by many factors including:

a) Type of oil (how waxy it is);
b) Weather conditions; and
c) Sea conditions.

The key, though, is to have a process – a plan – already in place that can be quickly activated.

There are some tools that can assist in the decision making process. These include the "Net Environmental Benefit Analysis" and a "Dispersant Decision Checklist".

3.1. Net Environmental Benefit Analysis (NEBA)

A Net Environmental Benefit Analysis, or NEBA, is a tool decision makers can use to assist in selecting the spill response option(s) having the lowest overall negative impact on the environment. There are two keys to performing a successful NEBA:

- First, base the decision on what is the best response strategy for a specific location while focusing on local and regional concerns. The data gathered to perform the NEBA needs to be concentrated on what is at stake locally.
- Secondly, the NEBA can NOT be conducted after a spill occurs as the data compilations and assessments can require some time. The NEBA must be conducted as part of the pre-planning process for responses to oil spills with the resulting findings and other information captured in the facility and/or regional response contingency plan. This can NOT be stressed strongly enough.

There are a number of steps to take in order to develop an effective NEBA. These include:

- Gather detailed information on the local environment. The term "environment" includes both natural – such as mangroves, coral reefs, bird nesting areas, various types of beaches, etc. - and man-made – such as water intakes, wharfs, tourist facilities, etc. In fact, if one has not already been produced for the area, this is a great opportunity to develop a complete sensitivity map showing ALL environmentally (natural and man-made) sensitive sites. [*NOTE: Keep in mind that sensitivity's may change depending on the season. For example, migratory birds are obviously not a high priority when they are not present (although their nesting areas may be)*].
- Identify the products that could possibly be spilled that would threaten these sites. Included in this evaluation are the predicted spread, thickness, and oil movement and deposition, including weathering and chemical composition.
- Once the above information is gathered each site needs to be prioritized as to its sensitivity and given a rating as to its recoverability. For example, mangroves may have a high sensitivity rating and a "slow" recovery rate if it is oiled while a sandy tourist beach may be relatively less sensitive and have a high recovery rate. The key here is to work very closely with –and, if possible reach consensus with- all stakeholders, especially government officials.
- Consider all response strategies that could be used to respond to a spill of the various identified products. These strategies can include:
  - ✓ Monitor spills that do not pose human or ecological threats
  - ✓ Containment and recovery by mechanical means
  - ✓ Recovery by hand (for example, rakes and shovels on a beach)
  - ✓ Dispersants
  - ✓ In-Situ burning
- Again, working with stakeholders, develop predictions of how each of the identified response strategies will affect each of the identified sensitive areas. Using a mangrove swamp as an example, one could predict the mangroves will be significantly affected should no action take place or recovery is done by hand while there may be no to little affect if the oil is dispersed before it can interact with the mangroves.

- Consider utilizing an enhanced NEBA that includes well documented economic variables, known as a NEEBA (Net Environment and Economic Benefit Analysis). With a NEEBA, decision makers will have additional information that shows the monetary cost of NOT applying dispersants, thus resulting in the possible damage of sensitive sites.
- Once all this work is completed an evaluation of each of the response strategies and their predicted effects on each of the sensitive sites is done by comparing the advantages and disadvantages to the environment.
- Finally, using all of the information gathered the most optimum response method can be identified.

As is apparent, this process can not be conducted at the spur of the moment. It needs to be completed as part of the pre-planning process with input from all the key stakeholders including applicable government agencies. By working together all parties will have a much better understanding of what is at stake should a spill incident occur and how best to respond to that spill.

Appendix 1 contains an example (and references) of a NEBA developed during the "TROPICS" field study in Panama.

3.2. Dispersant Decision Checklist

NEBA is a tool that indicates whether the use of dispersants is a viable response method for a specific area or location and is conducted as part of the pre-planning process. The Dispersant Decision Checklist is a tool that is completed when a spill incident occurs to help in the final dispersant use decision making process.

Over the years many various authorities have developed a number of different dispersant checklists that can be used. The important point is the checklist that will be used for a particular location needs to be agreed upon during the pre-planning process by all applicable parties. In fact, checklists are typically written by the responsible Government agency overseeing response to spill incidents with input from other interested parties. If done properly, the checklist should cover all the issues facing responders and give a solid "Yes" or "No" on whether or not it is feasible and appropriate to use dispersants. If all interested parties agree to abide by the outcome of the checklist this can be a powerful tool. Appendix 2 contains an example of a Dispersant Decision Checklist.

3.3. Examples of When to Use and When Not to Use Dispersants

It is really the responsibility of appropriate Government agencies to make the final decision of whether or not dispersant use will be allowed as an oil spill response method. If all the pre-planning discussed above has been completed then the decision is a fairly simple one: just follow the decision procedures. However, if the pre-planning has not been completed (or even started) and a large spill takes place, there are a few bits of information that can be used to assist responders in making an educated decision. Keep in mind, though, pre-planning, including completing a NEBA and having a Dispersant Decision Checklist in place is the best way to proceed.

First off, decision makers must keep in mind that any response strategy, including the use of dispersants, creates trade-offs. For example, an oil slick may be threatening a large mangrove swamp and thus using dispersants may be an obvious option.

However, there may be a shallow water reef in the area the dispersants will be applied thus creating an environmental trade-off: Are the dispersants used to save the mangroves and thus threaten the reef or are dispersants not used thus threatening the mangroves? The decision may not be an easy one to make and given the short time frame needed to make that decision it becomes even harder. Thus pre-planning is really the only way to go in order to make good, solid educated dispersant use decisions.

Having stated the above, here are a few questions to ask:

1. Is the timely deployment and effectiveness of available mechanical response equipment sufficient to mitigate spill impacts? If not then the following questions apply:
2. Is the spilled oil dispersible?
3. Does the spilled oil present a threat to sensitive resources/sites?
4. Does/Will the Government allow dispersant use and, if so, where will they allow it to be used?
5. Is there an adequate supply of approved dispersant available along with the proper application equipment?
6. Is the weather compatible for dispersant application?
7. How far offshore is the spill? If the spill is far enough offshore that, with given currents it does not pose a threat to the shoreline then the best response may be to just monitor the slick.
8. How deep is the water? Is it deep enough to allow the dispersed oil to properly mix with the water column? As a rule of thumb, 10 meters or 30 feet is typically used.

Appendix 3 gives some specific situations with a discussion as to the whether or not dispersant should be considered as a response strategy. Once again, though, pre-planning is the most important step to take.

4. USING DISPERSANTS

As previously stated, it is best to apply dispersants onto spilled oil as soon as possible since the oil, over time, will loose its ability to be dispersed. This does not mean dispersants are just "dumped" from a container onto the spill. To the contrary, for dispersants to be effective they must be applied as very small droplets. The size of each droplet is very important as droplets that are too small can be blown away by any wind and droplets that are too large could pass right through the oil with no effect. Therefore dispersant droplet sizes should be between 400 µm to 700 µm (pesticide spray equipment is designed to apply droplet sizes between 50 µm and 200 µm – much too small for dispersant use). Over the years, dispersant spray system manufacturers have developed dispersant application equipment that not only sprays the right droplet size but can also be used with small and large vessels, helicopters, and various aircraft.

The physics of the process is such that dispersants must be diluted in order to be sprayed from a slow-moving vessel, whereas they are applied un-diluted from aircraft. Applying un-diluted dispersants is best since, when diluted with water, dispersants may not re-partition to the oil phase and could be lost to the water column. Mixing seawater on vessels requires apportioning pumps or devices to ensure a consistent mixture of dispersant and water. There are several practical references and standards on the design and calibration of such systems.

There are certainly advantages and disadvantages to the various spray strategies. If using vessels, for instance, there is little chance of the dispersants being affected by any wind and the vessel wake can help with the mixing action. However, only very small areas can be treated at a time. Just the opposite occurs when using aircraft. Wind and wind shear can cause the dispersant to drift off-target and affect the application of the dispersant; however very large areas can be treated quickly. Many times, though, responders do not have a choice since proper aircraft, application equipment, and trained personnel are not always readily available to apply dispersants by air.

4.1. Dispersion Spray Equipment

Dispersants are applied either diluted in sea water or un-diluted. Aerial spraying, which is done from small and large fixed-wing aircraft, as well as from helicopters, is the most efficient application method. Spray systems on small aircraft used to spray pesticides on crops can be modified to spray dispersants. Such aircraft can carry about 250 to 1,000 liters (L) of dispersant and can perform many flights in one day in diverse conditions. Some spray systems and their aerial coverage's are listed in Table 1. As can be seen in Table 1, large spray systems on large aircraft are attractive from the aerial coverage point of view; however their timely availability to a specific area needs to be considered.

Spray systems for vessels vary in size depending on the size and carrying capacity of the vessel. Typically, vessel spray booms are 10 to 30 meters (m) wide while dispersant storage tanks are 1,000 to 10,000 L capacity. Vessel spray systems need to be positioned as far forward on the vessel as possible. As dispersant is almost always diluted with sea water to maintain a proper flow through the nozzle, extra equipment is required on the vessel to control dilution and application rates. About 10,000 to 100,000 L of dispersant can be applied in a day, which would cover an area of 1,000,000 m^2 or 1 km^2.

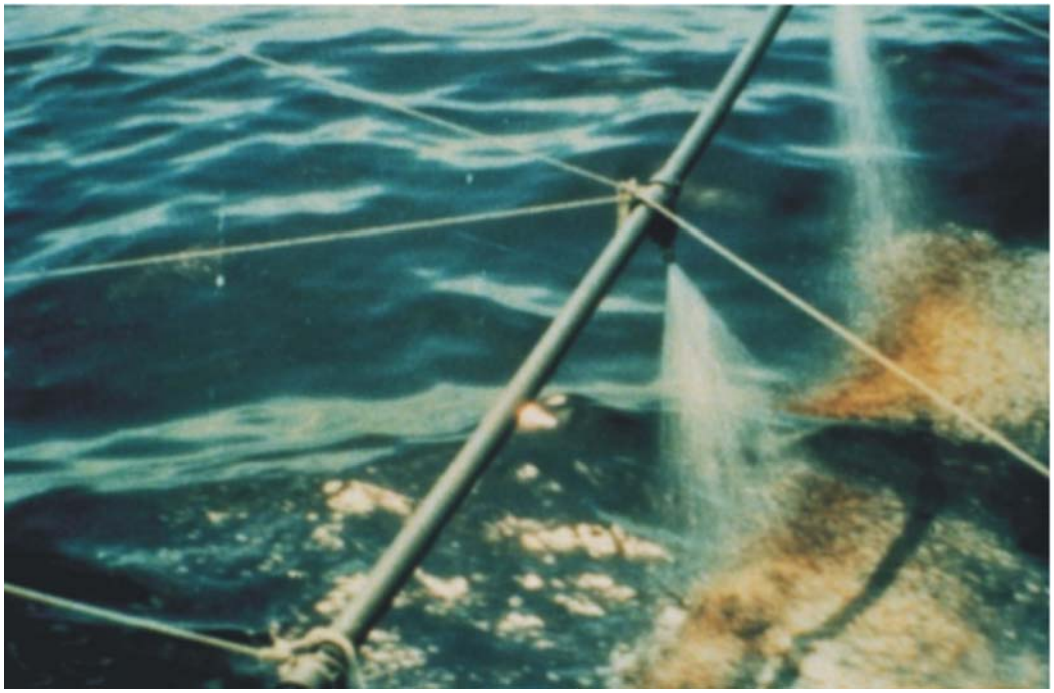
As this is substantially less than could be sprayed from a single aircraft, vessels are normally a secondary choice for use on a large offshore spill. A spray system operating from a vessel is shown in Figure 1.

Table 1: Spray Coverage and Hours for Different Spill Sizes

				Hours operation to disperse (within 24 hours time window):		
	Dispersant Load (L)	Coverage per hour (Ha)	Coverage per day (Ha)*	100 tons	1000 tons	10,000 tons
Small boat	1000	10	80	40	850	20.410
Small ship	3000	20	160	20	425	10.205
Supply ship	10,000	30	240	13.3	283	6803
Small helicopter	700	170	280	2.4	50	1201
Large helicopter	2000	280	800	1.4	30	729
Agricultural spray plane	400	170	270	2.4	50	1201
DC-3	4500	540	2400	0.7	16	378
DC-4	8000	840	4800	0.5	10	243
DC-6	11,000	1010	7330	0.4	8	202
C130 (Hercules)	13,000	1010	8670	0.4	8	202
Tones of dispersants				5	50	500
Drums of dispersants				25	250	2500
				Hours operation to disperse (within 48 hours time window):		
	Dispersant Load (L)	Coverage per hour (Ha)	Coverage per day (Ha)*	100 tons	1000 tons	10,000 tons
Small boat	1000	10	80	70	1490	35.080
Small ship	3000	20	160	35	745	17.540
Supply ship	10,000	30	240	23.3	497	11.690
Small helicopter	700	170	280	4.1	88	2060
Large helicopter	2000	280	800	2.5	53	1250
Agricultural spray plane	400	170	270	4.1	88	2060
DC-3	4500	540	2400	1.3	28	650
DC-4	8000	840	4800	0.8	18	420
DC-6	11,000	1010	7330	0.7	15	350
C130 (Hercules)	13,000	1010	8670	0.7	15	350
Tones of dispersants				5	50	500
Drums of dispersants				25	250	2500

** presuming the maximum number of hours of operation and daylight, per vehicle*

Figure 1: A spray system from a boat in operation
(Note the underlapping spray pattern)



When spraying dispersant, it is important to deliver fine droplets (400 to 700 µm) to the slick at sufficient dosage to produce results. The dispersant-to-oil ratio is generally in the 1:15 to 1:25 range. It is also essential to ensure the dispersant comes into direct contact with the oil. Droplets larger than 1,000 µm will break through the oil and cause the oil to collect in small ribbons. This can be detected by the rapid clearance of the oil in the dispersant drop zone without the formation of the usual coffee-colored plume in the water column. This is obviously a waste of the dispersant.

Other possible application tools are vessel fire monitors and fire hoses. Unless suitably modified, though, these may not produce the correct droplet sizes or quantities of dispersant per unit area. Furthermore, the high velocity of the water/dispersant mixture can herd the oil away, resulting in loss of dispersant to the water column, where it has little effect on oil floating on top of the water. To overcome this, single-point application nozzles have been developed that provide relatively good distribution of correctly sized droplets.

To ensure dispersants are applied at the proper size and rate, equipment calibration procedures should be established and followed. These procedures are:

1. Inspect the equipment and correct any defects prior to further calibration;
2. Calibrate the flow meter;
3. Calibrate the unit by catching water spray from each nozzle; and
4. Prepare a calibration curve.

Spray equipment should be maintained and periodically calibrated. Procedures and standards for design, maintenance, and calibration are given in the literature listed in Chapter 6.

4.2. Spray Aircraft

The required dispersant load and coverage obtained by the various dispersant delivery platforms are given in Table 1. As discussed, aerial spraying is done from both small and large fixed-wing aircraft as well as from helicopters.

Transport aircraft with internal tanks can carry from 4,000 to 12,000 L of dispersant. Large transport aircraft such as Hercules fitted with portable spray systems can carry about 20,000 L which could treat 400,000 L of oil at a dispersant-to-oil ratio of 1:20. At a thickness of 0.5 mm, this oil would cover about 400,000 m^2 or 0.4 km^2. This treatment could be applied in as little as an hour after loading the dispersant and as many as 8 flights could be flown in a day, depending on the distance from the airport to the spill. Figure 2 illustrates a Hercules spraying dispersant in a test over land.

Figure 2: A large aircraft applying dispersant

When using large aircraft, however, it can be difficult to obtain the required amount of dispersant. A response cooperative typically stores 100 drums or about 20,000 L of dispersant, which could be sprayed in one flyover. Further flights would have to wait for the arrival of more dispersant from other cooperatives or production sources. An entire country's supply of dispersant can easily be used up in one day if spraying with large aircraft. This emphasizes the importance of logistics/support when mounting a large scale dispersant operation.

Flying at an altitude of 15 to 30 m, the pilot of the spray aircraft cannot see the slick. To overcome this, a spotter aircraft will provide instructions to the spray aircraft for the setup of lines, when to turn the spray on and off, and small directional corrections. It is important to have good communications between the spotter aircraft and the spray aircraft.

Figure 3: A helicopter spray system ('heli-bucket') in operation

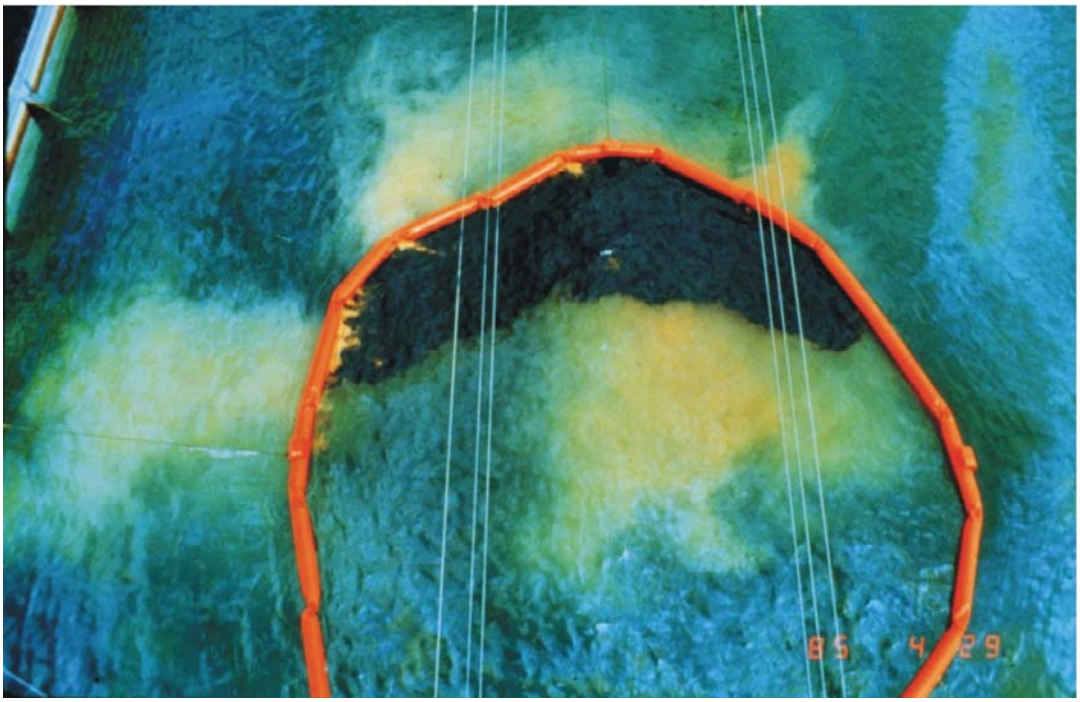
When using helicopters, spray buckets are available in many sizes from about 500 to 2,000 L. If applied at a dispersant-to-oil ratio of 1:20, 10,000 to 40,000 L of oil could be treated. If the slick is 0.5 mm thick, this would cover about 10,000 to 40,000 m^2 (or about 0.01 to 0.04 km^2). Depending on the slick distance from the staging area, it would take up to two to three hours to fill and spray each bucket over the oil. As a spill countermeasure, this rapid coverage of such a large area is appealing. Figure 3 shows a helicopter applying dispersants from a bucket.

4.3. Monitoring

A dispersant procedure should include having a monitoring protocol. The purpose of a monitoring protocol is to assist in determining the effectiveness of the dispersant applications. Dispersant effectiveness is defined as the amount of oil the dispersant puts into the water column compared to the amount of oil spilled. In the field, effectiveness often is visually indicated by the formation of a coffee-colored plume of dispersed oil in the water column which may be visible from ships and aircraft (see Figure 4). Other indicators may be necessary for naturally turbid waters or when light conditions are not optimal. Whitish to white plumes are the signal of poor or void dispersion process. This color reveals dispersant product that remains unmixed with oil in the water (dispersant-only-plume).

Dispersant effectiveness is primarily monitored by visual surveillance. When testing dispersant effectiveness in the field, it is very difficult to measure the concentration of oil in the water column over large areas and at frequent enough time periods. It is also difficult to determine how much oil is left on the water surface as there are no methods available to accurately measure the thickness of an oil slick and the oil at the subsurface often moves differently than the oil on the surface. Thus, qualitative assessments using visual indicators are the most common monitoring metric.

Figure 4: View of a dispersant test showing the yellow to coffee-colored plume from effective dispersion



Quantitative measures of dispersant effectiveness are difficult since effectiveness values depend on establishing a mass balance between oil in the water column and that left on the surface. In-situ fluorometry can be used to give an indication of the relative concentration of the oil in the water column. Some protocols to do this have been developed, e.g., SMART (Special Monitoring of Advanced Response Technologies) protocol. However, the quantitative method of measuring dispersant effectiveness in the field during an actual response operation is very difficult because of the time delays and problems in obtaining the equipment and personnel properly trained in its use. Instead, a relative measure of dispersant effectiveness is made.

Visual surveillance is the primary means of determining the effectiveness of the dispersant application. At least one experienced person should be employed in a spotter aircraft for the visual surveillance to be effective. In conducting the visual surveillance, it must be recognized there are a large number of possible false positives and negatives. These are summarized here:

➢ Visual Indications that Show More Effectiveness than Actually Occurred

The following visual indications could create the impression that dispersion has occurred when in fact there is little or no dispersion.

- Herding - This is the phenomenon whereby the oil is pushed aside by the dispersant, resulting in a clear path behind the application vehicle. A dispersant application in which the oil was herded without any apparent effectiveness is shown in Figure 5.
- Dispersant-only plume - Once in the water, dispersant forms a whitish plume until it mixes to a greater extent with the water. Such plumes could be mistaken for dispersed oil as opposed to dispersant only. Figure 6 shows a situation in which the dispersant has largely run off heavy oil. A close-up of this is shown in Figure 7.

- Herding into smaller, unseen strips - Oil is often herded into small strips that are not visible from the air.
- Spreading - Dispersants increase the tendency of the oil to spread. The surface slick may spread out to thicknesses that are not visible.
- Lacing – 'Lace' is a sheen of oil with 'holes' in it that are caused by smaller drops of dispersant leading to herding. The 'lace' is usually visible only from the surface and not from the air.

Figure 5: View of a dispersant application where herding has occurred
This photo does not show any visible effectiveness.

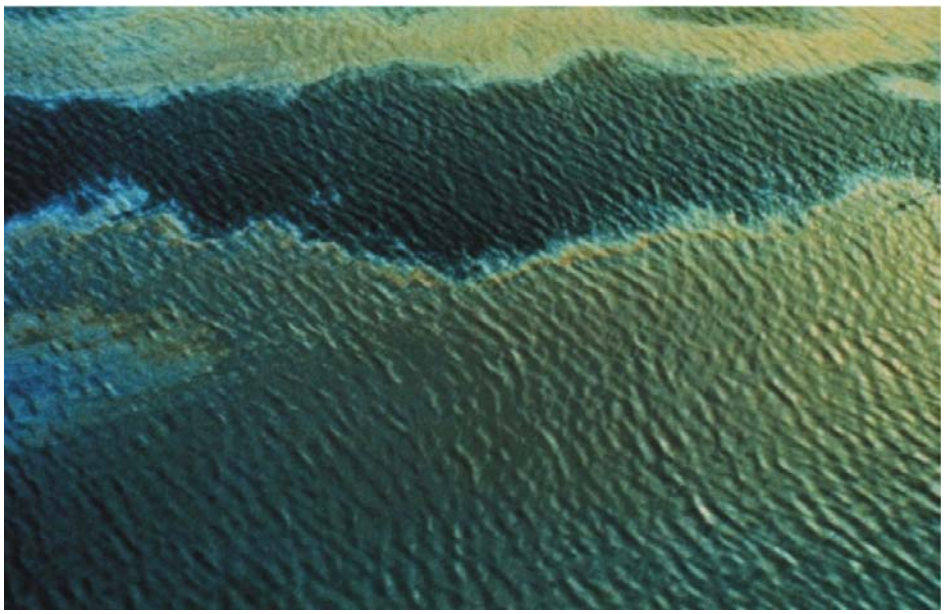


Figure 6: View of a dispersant application where dispersant-only plumes are seen
Part of this is caused by ineffectiveness on the heavy oil coming from the ship

Figure 7: Dispersant running off a heavy oil patch

Figure 8: Lacing phenomena
Courtesy from ITOPF

➢ Visual Indications that Show Less Effectiveness than Actually Occurred

The following visual indications could create the impression that little or no dispersion is occurring when in fact there is some or significant dispersion.

- Plume under remaining slick - The dispersed oil plume may move under the remaining slick.
- Plume not developed at time of observation - The dispersed oil plume can take 15 to 60 minutes to develop to a maximum.
- Poor visibility conditions - The dispersed plume is not highly visible and can be obscured by haze and fog. It is unlikely, however, that a test application would be conducted under such conditions.

4.4. Equipment Availability

A large amount of dispersant is required to mount an effective dispersant application for a large spill. Along with the required application equipment, stockpiles of dispersant must be identified during the pre-planning phase as already discussed. One source of both dispersant and equipment dedicated to the Caribbean and Latin America is the Clean Caribbean and Americas Cooperative located in Ft. Lauderdale, Florida - USA. Other possible sources include Alpina-Briggs in various locations in Brazil, the National Response Corporation, Marine Pollution Control, and Foss Environmental in USA. None of these sources, though, have aircraft with trained flight crews. However they should be able to assist in locating appropriate aircraft and crews. As already discussed, because the ideal window of opportunity to use dispersants is typically less than 48 hours, it is imperative to have these resources already identified and, if possible, agreements in place if dispersant application is a serious primary response tool. In some cases, companies are leasing application equipment along with an initial supply of dispersants and pre-deploying them in secure locations close to potential use sites. In addition, local aircraft such as helicopters and/or agricultural spray planes need to be identified.

4.5. Conducting the Operation

During the pre-planning stage, questions will arise as to whether or not a dispersant application will be effective. A simple test can be done to help answer that question. First, obtain samples of the various oils the facility may handle keeping in mind most products are not worth attempting to disperse since they will tend to evaporate quickly and the heavier crude oils are too thick to disperse. The procedure involves taking a water sample from the potential spill site and pouring about 1 L into a bottle with a narrower neck (to exaggerate the oil measurement). The bottle should be filled to the start of the neck. Using an etching tool or special marker, a line is placed at the top of the water level to indicate where the oil would start. In a separate glass container, briefly mix about 1 mL (or 5 drops) of the dispersant to be used to 10 mL of oil then pour this mixture into the test vessel containing the water. A mark is placed at the top of the oil. The test vessel is shaken vigorously for 1 minute and let stand for 10 minutes and the top of the new oil level is marked. If about half of the oil disperses then full-scale dispersant application can be commenced. For full details of this technique see ASTM 2059-00, *"Standard Test Method for Laboratory Oil Spill Dispersant Effectiveness Using the Swirling Flask"*.

When applying dispersant, the best tactic is to apply the dispersant to the thickest portions of the oil (normally the leading edge of the slick). This is generally determined visually, although infrared cameras can greatly assist by identifying the heavy parts of a slick.

Whether using vessels or aircraft it is highly recommended that spotter aircraft be in place to give the required application guidance and to monitor the dispersant effectiveness. The operation should be stopped if there is a lack of effectiveness, lack of wave energy, the weather conditions deteriorate, or any other unsafe conditions arise.

5. SAFETY AND HEALTH CONSIDERATIONS

Worker safety is the prime consideration during a dispersant operation. All personnel involved in the operation should complete an appropriate hazardous materials (Haz-Mat) course that is recognized in the relevant country. If the country does not have Haz-Mat training standards then a 40-hour Haz-Mat course should suffice.

Personnel with little to no experience on the dispersant application and monitoring processes should receive initial training in all aspects of the process including familiarization with the equipment. Experienced personnel should attend at least an annual two-day refresher course on the use of the application equipment with the second day spent practicing spray operations and any emergency procedures.

Whether utilizing aircraft, helicopters, and/or vessels to apply and/or monitor the dispersant application it is very important that all personnel be well versed in the appropriate safety equipment and procedures. This, of course, includes the pre-action safety briefing. Safety equipment should include, but is not limited to, steel toed shoes; life jackets; gloves; hardhats; NOMEX® coveralls; splash aprons, and safety glasses/goggles/shields. Personal protective equipment for personnel on-site will conform to the appropriate dispersant's Material Safety Data Sheets (MSDS).

In addition it is important that aircraft, helicopters, and vessels meet all relevant safety and inspection requirements for the country the operation is taking place in. If chartering a vessel it is suggested a survey of the vessel be conducted by a suitably qualified individual to ensure the vessel is in good condition, has adequate and appropriate safety equipment, and is suitable for the operations.

All flying operations must be carried out in accordance with a country's flight regulations. All aircraft to be used for applying dispersant should be carefully chosen to suit the required tasks. Flight plans must take into consideration all relevant weather conditions, such as wind, visibility, cloud types and height, the presence or forecasted presence of fog, precipitation, and sea state.

For helibucket operations, the helicopter must have sufficient lift capacity to carry a pilot, co-pilot, and a helibucket full of dispersant and be equipped with a cargo hook able to sling the helibucket as well as jettison it. The pilot must test the jettison mechanism before each operation. For safety reasons, twin-engine helicopters are preferred, particularly for offshore operations, as they are more powerful than single-engine machines and can gain altitude faster. In addition, helicopters should be equipped with floats should an emergency water landing become necessary. The helicopter must comply with the relevant regulations regarding helicopter maintenance and the operation being undertaken. When arranging for helicopter services, it is recommended that the performance capability of the aircraft and its suitability for its intended use be confirmed with the helicopter pilot and/or helicopter operator.

Only the pilot and co-pilot or one other person if required for the spray activation should ride in the helicopter during the helibucket operation and all should wear proper safety and lifesaving equipment. During near shore operations, updraft and downdraft winds against cliffs must be considered. In case of mechanical difficulty, emergency landing locations for the helicopter should be identified in advance through site surveillance.

The public should not be exposed to sprayed dispersant. The most common concern is exposure to overspray or drip from the nozzles during over-flight. People who may be affected by the dispersant operation, even if only remotely, should be briefed about the operation.

An important part of the safety program for a dispersant operation is establishing minimal safety zones. The safety zones established for the environmental issues should be sufficient for human populations as operations should not take place near shore. Safety zones on the sea around the dispersant operation should be on the order of 1.0 km to avoid interfering with vessel traffic and to prevent spray from landing on surface vessels or workers in the area.

Table 2: Dispersant Response Operations Safety Tips
(Source "Oil Spill Responder Safety Guide" – IPIECA Report Series – Vol. 11)

- Assess the routes of possible exposure to dispersant chemical
- Provide Personal Protective Equipment (PPE) to guard against each and every route, ensuring that all PPE is compatible and fits the wearer
- Keep decks clear and dispersant-free by regular washing
- Head spray vessels into wind where possible
- Make sure that the PPE is resistant to the dispersant in use
- Avoid uncontrolled releases of dispersant
- Always refer to the Material Safety Data Sheets

6. REFERENCES AND ADDITIONAL INFORMATION

- ADIOS 2, Automated Data Inquiry for Oil Spills, National Oceanic and Atmospheric Administration, Seattle, WA, 2004. [online]. [cited 11 December 2006] Available from Internet: ADIOS 2

- API Publication Number 4692 "A Decision-Maker's Guide to Dispersants – A Review of the Theory and Operational requirements" Washington D.C., USA, 1999. [online]. [cited 11 December 2006] Available from Internet: API Publication Number 4692

- ASTM 1413-2003, "Standard Guide for Oil Spill Dispersant Application Equipment: Boom and Nozzle Systems", American Society for Testing and Materials, Conshohocken, PA, 1999.

- ASTM 1460-2003, "Standard Practice for Calibrating Oil Spill Application Equipment: Boom and Nozzle Systems", American Society for Testing and Materials, Conshohocken, PA, 1999.

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- Bacha, B., Ward, G., Lane, C. & Schuler P. 2005. Net Environmental Benefit Analysis (NEBA) of Dispersed oil on Nearshore Tropical Ecosystems Derived from the 20 Year "TROPICS" Field Study. Proceedings of the 2005 International Oil Spill Conference, USCG, USEPA, API, IPIECA, IMO, MMS, NOAA, Miami, FL, 4 pp

- DeCola, E., "Dispersant Use in Oil Spill Response: A Worldwide Legislative and Practical Update", Aspen Law and Business, New York, NY, 314 p., 2003.

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- Fingas, M.F., "Use of Surfactants for Environmental Applications", Chapter 12, in *Surfactants: Fundamentals and Applications to the Petroleum Industry*, Laurier L. Schramm, (ed.), Cambridge University Press, pp. 461-539, 2000.

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- IMO/UNEP *Guidelines on Oil Spill Dispersant Application including Environmental Considerations* (IMO 1995)

- IPIECA, *Choosing spill response options to minimize damage - Net Environmental Benefit Analysis*, International Petroleum Industry Environmental Conservation Association, London, UK, IPIECA Report Series Volume 10, 2000.

- IPIECA, *Dispersants and their role in oil spill response*, International Petroleum Industry Environmental Conservation Association, London, UK, IPIECA Report series Volume 5, 2nd edition - 2001.

- IPIECA, *Oil Spill Responder Safety Guide,* International Petroleum Industry Environmental Conservation Association, London, UK, *IPIECA Report Series – Vol. 11, 2002*

- IPIECA/ITOPF, *International Oil Industry Spill Response Resources: Tier 3 Centres,* International Petroleum Industry Environmental Conservation Association & International Tanker Owners Pollution Federation, London, UK, A Joint IPIECA/ITOPF Briefing Paper, 1999

- List of hazardous materials and safety training courses at the Online Hazmat School [online]. [cited 11 December 2006]. Available from Internet: List of hazardous materials and safety training courses

- NAS (National Academy of Sciences), *"Using Oil Spill Dispersants on the Sea"*, Marine Board, National Research Council, National Academy Press, Washington, DC, 1989.

- References on NEBA – Please refer to Appendix 1

- RRT-6 – FOSC Dispersant Pre-approval Guidelines and Checklist. RRT-6 approved January 10, 1995 - Version 4.0, January 24, 2001. [online]. [cited 11 December 2006]. Available from Internet: Dispersant Pre-approval Guidelines and Checklist

- SMART (Special Monitoring of Applied Response Technologies) protocol @ NOAA (National Oceanic and Atmospheric Administration web site). [online]. [cited 11 December 2006] Available from Internet: SMART: A Guided Tour

APPENDIX 1 – NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA) OF DISPERSED OIL ON NEAR SHORE TROPICAL ECOSYSTEMS DERIVED FROM THE 20 YEAR "TROPICS" FIELD STUDY"[1]

In November 1984, non-treated Prudhoe Bay crude oil and dispersed Prudhoe Bay crude oil were intentionally released into two separate sites, representative of near shore mangrove, sea-grass and coral ecosystems, as part of the TRopical Oil Pollution Investigations in Coastal Systems (TROPICS) field study in Bahia de Almirante, Panama. Data on the relative effects of non-treated crude oil and dispersed crude oil on these ecosystems (compared to a reference site) were acquired and analyzed over various periods (30 days, 3 months, and 2, 6, 10, 17, 18, and 20 years).

In the short term, the oil caused mortality to invertebrate fauna, sea-grass beds, and corals at both sites. At the non-treated crude oil site, there was also significant mortality to the mangrove forest. Twenty-year observations and mangrove substrate core samples reveal the continued presence of oil and diminished mangrove repopulation, as well as substrate erosion, at the non-treated crude oil site. No oil was detected and no long-term impacts were observed at the dispersed crude oil and reference sites. These results provide baseline scientific data for developing a Net Environmental Benefit Analysis (NEBA) of dispersant use in near shore tropical systems.

Data and NEBA from the 20-year TROPICS study clearly show that the use of dispersant in the near shore environment is a sound strategy for both minimizing environmental damage to tropical ecosystems and for providing the best opportunity for recovery and repopulation in this environment. Results of this work should be applicable to similar tropical ecosystems.

The complete International Oil Spill Conference (IOSC) paper is available for review & free download in the Technical Response Documents section of the Clean Caribbean & Americas (CCA) website: www.cleancaribbean.org .

For further references on NEBA, please read:

- Addassi, Y. N. 2002. *Utilizing Net Environmental Benefit Analysis (NEBA) as a Tool for Evaluating Applied Response Technologies in Response to a Marine Oil Spill*. Office of Spill Prevention and Response, Department of Fish and Game, USA.
- CEDRE. 2005. *Using Dispersant to Treat Oil Slicks at Sea. Airborne and Shipborne Treatment*. Centre of Documentation, Research and Experimentation on Accidental Water Pollution. Editor: François Xavier Merlin. Brest, France.
- French, D. P., Schuttember, H. 1999. *Evaluation of Net Environmental Benefit Using Fates and Effects Modeling.* Proceedings of the 1999 International Oil Spill Conference. San Diego, California.
- Lunel, T., Baker, J. M. 1999. *Quantification of Net Environmental Benefit for Future Spills*. Proceedings of the 1999 International Oil Spill Conference. San Diego, California.
- Lunel, T., Rusin, J., Bailey, N., Halliwell, C., Davies, L. 1997. *The Net Environmental Benefit of a Successful Dispersant Operation at the Sea Empress Incident*. Proceedings of the 1997 International Oil Spill Conference. Fort Lauderdale, Florida.

[1] Extracted from *"Net Environmental Benefit Analysis (NEBA) of Dispersed oil on Nearshore Tropical Ecosystems Derived from the 20 Year "TROPICS" Field Study"* paper presented by Bart Bacha, Greg Ward, Christine Lane and Paul Schuler at the 2005 International Oil Spill Conference in Miami, FL (May/2005)

APPENDIX 2 - DECISION CHECKLIST

Dispersant Pre-Approval Initial Call Checklist[2]

Boxes denote essential Information

CALLER

Time of Initial Call: Date: _____/__/_____ Time: _____
Month Day Year (24 hour clock)
Name of Caller: _____
Telephone #: (__ __ __) __ __ __ - __ __ __ __

Name of Alternate Contact:
Telephone #: (__ __ __) __ __ __ - __ __ __ __

Company Name: _____
Address: _____
Street: _____
City: _____
State: _____ *Zip Code:* _____

SPILL

Initial Time of Spill: Date:_____/__/_____ Time: _____
Month Day Year (24 hour clock)
Location of Spill: LAT: _____ North or South LON: _____ West

Facility Name: _____Block Number:_____
Type of Release: [Instantaneous ( ) or Continuous Flow ( )]
Oil: Name: _____
API: _____Pour Point: _____(°C or °F)
Circle One

Amount Spilled: _____[GAL or BBLS (42 GAL/BBL)]
Circle One
Flow Rate if Continuous Flow (Estimate): _____

ON-SCENE WEATHER (Note: If not available contact local weather service)

Wind Direction From (Degrees): _____Wind Speed: _____Knots
Surface Current (Direction toward, Degrees):_____
(Speed): _____Knots
Visibility: _____Nautical Miles
Ceiling: _____Feet
Sea State (Wave height): _____Feet

[2] Adapted from "RRT-6 – FOSC Dispersant Pre-approval Guidelines and Checklist" RRT-6 approved January 10, 1995 - Version 4.0, January 24, 2001. [online].[cited 11 December 2006]. Available from Internet: FOSC Dispersants Pre-approval Guidelines and Checklist

DISPERSANT SPRAY OPERATION

Dispersant Spray Contractor or Equipment Availability
Name: _____
Address: _____
Street: _____
City: _____
State: _____ *Zip Code:* _____
Telephone: (__ __ __) __ __ __ - __ __ __ __
Dispersant: Name: _____
Quantity Available: _____
Platform: Aircraft Type: _____
Multi-Engine ( ) or Single-Engine ( )
Boat Type: _____
Other: _____
Dispersant Load Capability (Gal): _____
Time to First Drop on the oil (Hours): _____

On Scene Coordinator DISPERSANT USE CHECKLIST

(Items on the far left of this checklist are keyed to letter and numbers on the top of the boxes in the On Scene Coordinator Dispersant Use Flowchart and apply to offshore pre-approval only. INFORMATION AVAILAIBLE IN THE DISPERSANT PRE-APPROVAL INITIAL CALL CHECKLIST, AND THE TABLE ON THE OTHER SHEET ARE NECESSARY TO COMPLETE THIS CHECKLIST)

OIL SPILLED

A. On Scene Coordinator completes and evaluates DISPERSANT PRE-APPROVAL INITIAL CALL CHECKLIST.
B. Ask spiller if dispersant spray operation is on alert pending completion of pre-approval use evaluation by the On Scene Coordinator.

[1] DEPLOY MONITORING TEAM

A. Immediately Deploy a Team to the spill site if dispersant use is likely. Every attempt should be made to implement the on-water monitoring in every dispersant application. At a minimum, Tier 1 (visual) monitoring must occur during any dispersant operations approved in accordance with this Dispersant Pre-approval Guidelines and Checklist
B. Immediately notify a survey specialist contact if dispersant use is likely.

[2] PRE-APPROVED DISPERSANT OPERATIONS ACTIVATION EVALUATION

1. Do you expect the use of dispersants in this case to provide an environmental benefit? If possible, determine trajectory and environmental fate analysis.

YES ( )	GO TO SECTION 2 BELOW
NO ( )	GO TO SECTION 10 BELOW

2. Plot the position of the spill on the appropriate nautical chart, draw a circle about the spill source with a 10 nautical mile radius as a worst-case scenario for surface movement. Hash mark any area within the circle that is in waters less than 10 meters deep or 3 nautical miles from shore. What is left is considered the dispersant operational area. Is the dispersant operational area to be in offshore water that is no less than 10 meters deep and at least 3 nautical miles from the nearest shoreline?

YES ( )	GO TO SECTION 3 BELOW
NO ( )	GO TO SECTION 7 BELOW

3. Is dispersant application equipment and/or contractor available and capable of responding within a reasonable time?

YES ( )	GO TO SECTION 4 BELOW
NO ( )	GO TO SECTION 8 BELOW

4. Dispersant Platform
   Considering the amount of oil spilled, the location of the operational area, volume of available dispersants to be used, and the timeframe in which the required equipment can be on-scene, what is the most effective application platform? More than one platform type may be considered.

If Aerial	GO TO SECTION 5 BELOW
If Boat	GO TO SECTION 6 BELOW
If Other	GO TO SECTION 7 BELOW

5. Aerial Application Operational Conditions
   [A] If on-scene weather was available from the spiller on initial telephone contact use that information to complete this section and assume for planning purposes that it will remain the same during the timeframe in which this decision is operating. At the earliest opportunity, contact local weather service for detailed weather, but do not delay this decision process for the weather input (Note: All dispersant operations are carried out during daylight hours only).
   Winds less than or equal to 25 knots, and
   Visibility greater than or equal to 3 nautical miles, and
   Ceiling greater than or equal to 1,000 feet?

YES ( )	GO TO SECTION 7 BELOW
NO ( )	GO TO [B] IN THIS SECTION BELOW

[B] Notify the spiller's representative and applicable stakeholder that the dispersant use decision has been delayed until the weather improves, and that the Dispersant Spray Operation is to be placed on a standby status. When the weather is beginning to improve:

BEGIN AGAIN IN SECTION 2 ABOVE

6. Boat Application Operational Conditions

[A] If on-scene weather was available from the spiller on initial telephone contact use that information to complete this section and assume for planning purposes that it will remain the same during the timeframe in which this decision is operating. At the earliest opportunity, contact the local weather service for detailed weather, but do not delay this decision process for the weather input (Note: All dispersant operations are carried out during daylight hours only). Wave height such that the boats to be used for the dispersant application can conduct an effective and safe spray operation?

YES ( )	GO TO SECTION 7 BELOW
NO ( )	GO TO [B] IN THIS SECTION BELOW

[B] Notify the spiller's representative and applicable stakeholder that the dispersant use decision has been delayed until the sea state improves, and that the Dispersant Spray Operation is to be placed on a standby status. When the sea state is beginning to improve:

BEGIN AGAIN IN SECTION 2 ABOVE

7. Is the dispersant to be used approved by applicable government agencies and considered appropriate for existing environmental and physical conditions?

YES ( )	GO TO SECTION 9
NO ( )	GO TO SECTION 8

8. GO NO FURTHER IN THIS DISPERSANT USE CHECKLIST. The request for dispersant use does not qualify under the guidelines for pre-approval use of dispersants.

9. Dispersability

Refer to the Dispersant Pre-Approval Initial Call Checklist

Does the available technical information suggest that dispersion is likely given the spilled oil, anticipated oil weathering, and selected dispersant? Use any technical sources to make this assessment.

YES ( )	GO TO 11 BELOW
NO ( )	GO TO 10 BELOW

10. GO NO FURTHER IN THIS DISPERSANT USE CHECKLIST. In this case dispersant use is either inappropriate for this response or will probably not be considered to be effective relative to the effort required. Concentrate your efforts on Mechanical and/or in-situ burn operations Note: You may want to consider dispersant pre-approval use at a later time if the field situation changes (i.e., becomes a continuous spill or has a new instantaneous release.) In such an event, make sure the Initial Call Checklist has been updated and return to the start of this checklist (OIL SPILLED)

11. INITIATE APPLICATION OF DISPERSANTS WITHIN THESE GUIDELINES.

- Water depth ≥ 10 meters and no less than 3 nautical miles from nearest shoreline.
- The controller/observer should be over the spray site before the start of the operation. Note: The purpose of monitoring is to confirm best professional advice related to the potential success of dispersant use. Given the uncertainty involved relating to physical and environmental condition, oil weathering, and dispersant and oil interaction, we must rely on positive feedback from the monitors to continue dispersant application.
- Personal protective equipment for personnel on-site will conform to the appropriate dispersant's MSDS
- If dispersant platform is an aircraft, spray aircraft will maintain a minimum 1000-foot horizontal separation from rafting flocks of birds. Caution will be taken to avoid spraying over marine mammals and marine turtles.

- If dispersant platform is a boat:
  - If the system involves spray arms or booms that extend out over the edge of the boat and have fan type nozzles that spray a fixed pattern of dispersant, the following ASTM standards apply:
    - ASTM F 1413-92 Standard Guide for Oil Spill Dispersant Application Equipment: Boom and Nozzle Systems.
    - ASTM F 1460-93 Standard Practice for Calibrating Oil Spill Dispersant Application Equipment Boom and Nozzle Systems.
    - ASTM F 1737-96 Standard Guide for Use of Oil Spill Dispersant Application Equipment During Spill Response: Boom and Nozzle Systems.
  - If the system involves the use of a fire monitor and or fire nozzle to apply the dispersants, a straight and narrow "firestream" flow of dispersant directly into the oil is to be avoided. At this time (May 2000) there are no applicable ASTM standards for these types of systems.
- If an alternative dispersant platform is used, the Operation Plan should include dispersant application guidelines.

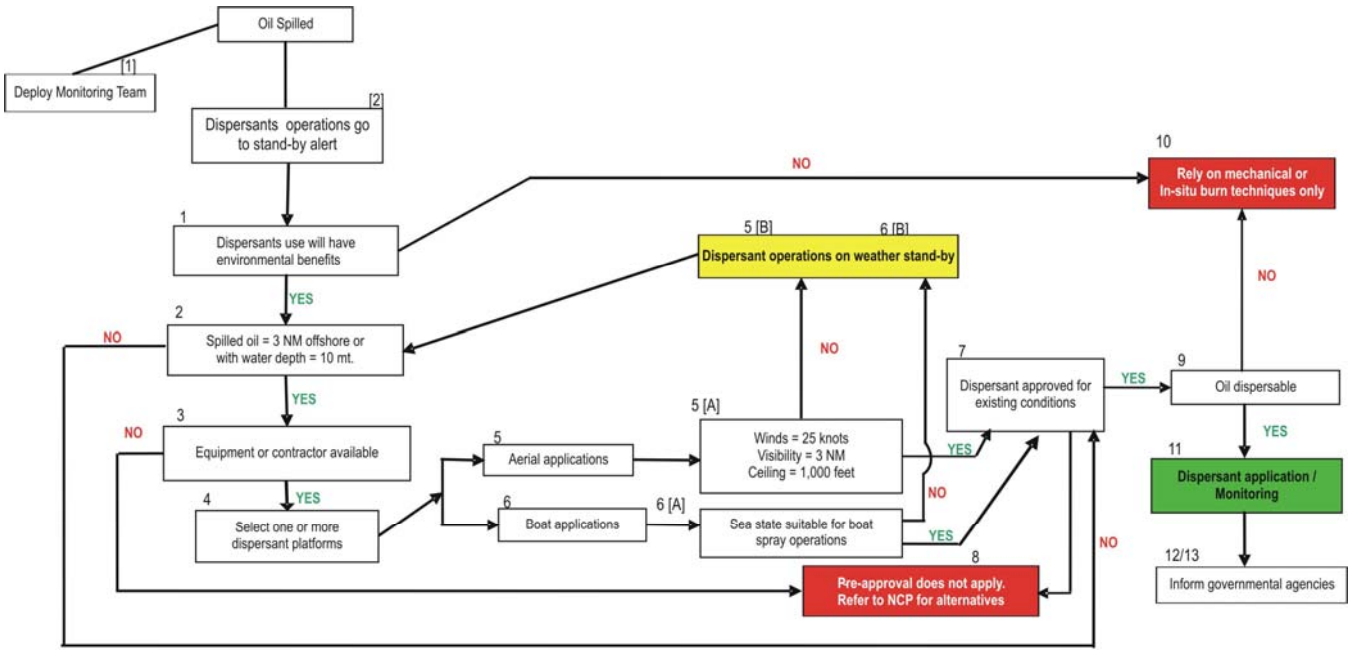
GO TO SECTION 12 BELOW

12. The appropriate governmental agencies must be kept informed on the status of the dispersant application throughout the operation. Provided the dispersant application is successful and operational results are positive, no governmental agencies approval will be required for additional sorties and passes.

GO TO SECTION 13 BELOW

13. At the completion of the dispersant operation, send the following to the appropriate governmental agencies:
    1. This completed Checklist
    2. The Dispersant Pre-Approval Initial Call Checklist
    3. A one page summary of the operation to date
    4. Other information as necessary

ON SCENE DISPERSANTS USE FLOWCHART



On Scene Coordinator DISPERSANT USE OIL TABLE

GENERAL DISPERSABILITY RELATIVE TO API GRAVITY AND POUR POINT

This table provides general guidance only. Note that specific dispersant formulations are designed to treat heavier, more viscous oils. Consult manufacturer recommendations prior to application and recommendations from monitoring team for continued use.

Probably difficult or impossible to disperse	Medium weight material. Fairly persistent. Probably difficult to disperse if Water temperature is below pour point of material.	Lightweight material. Relatively non-persistent. Probably difficult to disperse if water temperature is below pour point of material.	No need to disperse. Very light weight material. Oil will dissipate rapidly
	Medium weight material. Fairly persistent. Easily dispersed if treated promptly.	Lightweight material. Relatively non-persistent. Easily dispersed.	

API →	17	34.5	45
Gravity →	.953	.852	.802

AFTER-ACTION-REPORT REQUIREMENTS

- Incident Overview
- Oil Slick Trajectory and Behavior
- Justification for Dispersant Use
- Chronology (Date and Time) of Dispersant-Related Events
- Overview of Dispersant Operations
- Completed Dispersant Pre-Approval Initial Call Checklist and On Scene Coordinator Dispersant Use Checklist

Suggested outline for report requirements:

Incident Overview
- Description of initial report (date, time, source, etc.)
- Spill source
- Spill location
- Estimated quantity & potential quantity
- Environmental conditions

Oil Slick Trajectory and Behavior

- Expected movement of slick
- Expected weathering and behavior of product
- Observations of same

Justification for Dispersant Use

- Potential impact areas and their respective sensitivities to impact
- Within pre-approval zone for the appropriate governmental agency
- Potential for use of other recovery methods (e.g., mechanical recovery, in-situ burning)
- Weather and sea state

Chronology (Date and Time) of Dispersant-Related Events

- On Scene Coordinator notification of spill
- Reconnaissance aircraft requested
- Reconnaissance aircraft "wheels up"
- Survey specialist alerted for monitoring
- Reconnaissance aircraft on-scene and reports
- Responsible party requested use of dispersants
- Source and field sample requested by appropriate government agency
- Dispersant use approved under pre-approval guidelines
- Dispersant contractor notified
- Dispersant stock requested
- Dispersant stock en-route
- Dispersant stocks arrive at airport/dock
- Spotter aircraft "wheels up"

- Dispersant aircraft/boat "wheels up"/left dock
- Monitoring vessel launch
- Spotter aircraft on-scene
- Dispersant aircraft/boat on-scene
- Monitoring vessel on-scene
- Monitoring sampling begins
- First application
- Spotter aircraft opinion of efficacy
- Monitoring sampling results (go/no go)
- Monitoring sampling begins, again
- Second application
- Spotter aircraft opinion of efficacy
- Monitoring sampling results (go/no go)
- Additional applications, Spotter aircraft opinions, and monitoring sampling (as required)
- Termination of dispersant operation

Overview of Dispersant Operations

- Amounts and times of dispersants applied
- Any extenuating circumstances affecting the deployment of any element (spotters, dispersant, monitoring devices, etc.)
- Estimates and observations of efficacy
- Any discrepancies between estimates
- Any discrepancies between observations
- Any sightings of pelagic/migratory birds, sea turtles, or marine mammals

Completed Dispersant Pre-Approval Initial Call Checklist and On Scene Coordinator Dispersant Use Checklist

Request for Additional Information

- Parties may request additional information (e.g., pilot's logs, monitoring logs, and monitoring data) by contacting the On Scene Coordinator for the particular spill/release response activity
- Information requested will be provided within 30 to 60 days following the request.

APPENDIX 3 - SAMPLE SCENARIOS OF WHEN AND WHEN NOT TO USE DISPERSANTS

Scenario 1 Dispersion at sea	Strategy
Location: At sea Position: Offshore Proximity of Oil to Resources: A large slick of oil well away from the shore but heading to shore. Condition of Oil: The oil is light or medium crude slick and is more than 1 mm thick, fresh and not emulsified. Weather and Sea State: Seas of 0.5 to 2 m Protection Target: Birds and mammals near shore, shoreline.	General This is the absolutely ideal condition for dispersion. Verify wind and current direction to ensure that dispersing the slick will not affect people, property, or environmentally sensitive areas. As a first response, as much of the slick as possible can be dispersed. Ensure that sufficient resources are available as soon as possible to deal with at least the leading edge of the slick. If the pre-test or data show that the oil is marginally dispersible, continue operation but stop if effectiveness is not seen. Dispersant Strategy Focus attention on the thick leading portion of the slick. The slick should be approached from downwind. Monitoring Aircraft over-flights should be carried out to ensure that the slick is being dispersed and that the plume is not heading toward sensitive areas. A standby boat could be used to take water samples or conduct fluorometry. The dispersant operation should be stopped if it is seen that it is not effective.

Scenario 2 Dispersion at sea	Strategy
Location: At sea Position: Offshore Proximity of Oil to Resources: A large slick of oil well away from the shore but heading to sea (with a probability of it heading to shore in the future). Condition of Oil: The oil is light or medium crude slick and is more than 1 mm thick, fresh, and not emulsified. Weather and Sea State: Seas of 0.5 to 2 m Protection Target: Birds and mammals near shore, shoreline if the oil changes its offshore trajectory.	General This is an ideal condition for dispersion; however protecting shoreline amenities is less of a priority. Verify wind and current direction to ensure that dispersing the slick will not affect people, property, or environmentally sensitive areas. As a first response, as much of the slick as possible can be dispersed. Ensure that sufficient resources are available as soon as possible to deal with at least the leading edge of the slick. If the pre-test or data show that the oil is marginally dispersible, continue operation but stop if effectiveness is not seen. Dispersant Strategy Focus attention on the thick leading portion of the slick. The slick should be approached from downwind. Monitoring Aircraft over-flights should be carried out to ensure that the slick is being dispersed and that the plume is not heading toward sensitive areas. A standby boat could be used to take water samples or conduct fluorometry. The dispersant operation should be stopped if it is seen that it is not effective.

Scenario 3 Dispersion at sea	Strategy
Location: At sea Position: Offshore Proximity of Oil to Resources: A large slick of oil well away from the shore but heading to shore. Condition of Oil: The oil is light or medium crude slick and is more than 1 mm thick, fresh, and not emulsified. Weather and Sea State: Seas greater than 2 m but currently less than 4 m, winds >20 m/s or 40 knots. Protection Target: Birds and mammals near shore, shoreline.	General This is a marginal condition for dispersion. Verify that the operation can be done safely before proceeding. Verify wind and current direction to ensure that dispersing the slick will not affect people, property, or environmentally sensitive areas. As a first response, as much of the slick as possible can be dispersed. Ensure that sufficient resources are available as soon as possible to deal with at least the leading edge of the slick. If the pre-test or data show that the oil is marginally dispersible, continue operation but stop if effectiveness is not seen. Dispersant Strategy Focus attention on the thick leading portion of the slick. The slick should be approached from downwind. Monitoring Aircraft over-flights should be carried out to ensure that the slick is being dispersed and that the plume is not heading toward sensitive areas. The dispersant operation should be stopped if it is seen that it is not effective.

Scenario 4 Dispersion in a bay	Strategy
Location: Bay Proximity of Oil to Resources: A large slick of oil well away from the shore but heading to sea. Condition of Oil: The oil is light or medium crude slick and is more than 1 mm thick, fresh, and not emulsified. Weather and Sea State: Seas of 0.5 to 2 m Protection Target: Birds and mammals near shore, shoreline if the oil changes its offshore trajectory. Water Depth: More than 10 m (or local restriction) for at least 5 km.	General This is a marginal condition for dispersion. Verify wind and current direction to ensure that dispersing the slick will not affect people, property, or environmentally sensitive areas. Verify that the depth for at least 5 km is above 10 m or the local restriction. As a first response, as much of the slick as possible can be dispersed. Ensure that sufficient resources are available as soon as possible to deal with at least the leading edge of the slick. If the pre-test or data show that the oil is marginally dispersible, continue operation but stop if effectiveness is not seen. Dispersant Strategy Focus attention on the thick leading portion of the slick. The slick should be approached from downwind. Monitoring Aircraft over-flights should be carried out to ensure that the slick is being dispersed and that the plume is not heading toward sensitive areas. A standby boat could be used to take water samples or conduct fluorometry. The dispersant operation should be stopped if it is seen that it is not effective.

WHEN NOT TO USE DISPERSANTS

According to IMO/UNEP *"Dispersing oil where there is sufficient water or dilution has never shown toxic effects on marine and benthic biota"* (IMO, 1995). The U.S. National Research Council states *"Acute biological effects are expected to be slight in most open sea applications because the dispersed oil mixes into a relatively large volume of water, resulting in low concentrations and times of exposure"* (NAS, 1989). Having said this, there are certain conditions in which dispersants should NOT be considered as an option:

- In water with very poor circulation such as enclosed bays and harbors
- In water that is used for drinking water supplies
- In water bodies used for once-through cooling systems
- Directly over fish farms or mariculture
- On solidified oil (i.e., oil viscosity higher than 5,000 MPa.s)
- The water temperature is below the pour point of the oil
- Paraffin content is over 3%
- Light hydrocarbons (gasoline, diesel)
- Adverse atmospheric conditions (e.g., winds above 25 knots, visibility less than 3 nautical miles and ceiling less than 300 mt or 1000 ft)
- Inadequate water depth (e.g., depth less than 10 mt or 30 ft)

APPENDIX 4 - TECHNICAL INFORMATION FOR APPLYING DISPERSANTS

It is important to calculate the feasibility of performing the dispersant operation. To this end, a series of simple nomograms have been created and are provided in this Appendix. Table 4.1 shows the calculated areas, slick thickness, and viscosity with weathering for spills of 100, 1,000, and 10,000 tons.

Table 4.1

Spill size Area (sq Km) at time					
Type	Tons	1 hour	12 hours	24 hours	48 hours
Light crude	100	1	2	4	7
	1000	9	49	85	149
	10,000	312	1205	2041	3508
Medium crude	100	1	2	4	7
	1000	9	49	84	146
	10,000	302	1200	2040	3492
Heavy crude	100	1	3	4	8
	1000	7	49	84	146
	10,000	249	1144	2067	3773
Slick Thickness (mm)					
Type	Tons	1 hour	12 hours	24 hours	48 hours
Light crude	100	2,2	1	*0,7*	*0,5*
	1000	6,7	2,4	*1,7*	*1*
	10,000	12	5,1	3,6	2,4
Medium crude	100	2,2	1	*0,8*	*0,5*
	1000	6,7	2,4	*1,7*	*1*
	10,000	12	5,1	3,7	2
Heavy crude	100	2,3	1	*0,8*	*0,6*
	1000	7	2,6	*1,9*	*1,2*
	10,000	12	5,5	4	2,7
Viscosity mPa.s					
Type	Tons	1 hour	12 hours	24 hours	48 hours
Light crude	100	46	196	347	1220
	1000	28	125	226	810
	10,000	22	88	155	550
Medium crude	100	31	1300	2300	*6700*
	1000	198	830	1500	4500
	10,000	163	590	1070	*31.000*
Heavy crude	100	1460	2900	4600	*30.000*
	1000	1390	2300	3500	*220.000*
	10,000	1380	2000	2900	*170.000*

Rules of thumb	*- slick thickness should be greater than 2 mm* *- viscosity should be less than 5000 mPa.s*	*Red Italics show situations where effective dispersion is unlikely*

Figure 4.1 can be used to estimate the area of slicks at the three sizes of spills.

Figure 4.1

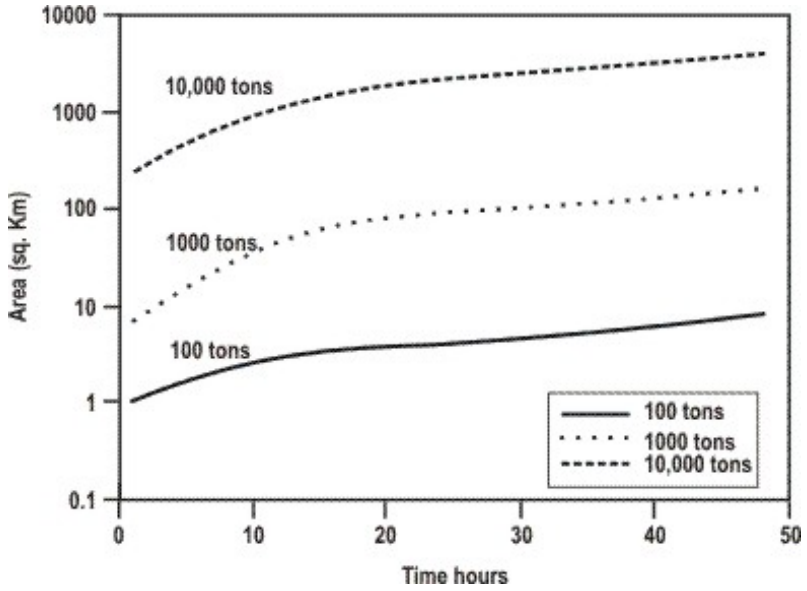


Figure 4.2 can be similarly used to calculate the thickness of the oil slick. Oil slicks less than about 1 mm thickness are too thin and will be hard to treat with dispersants.

Figure 4.2

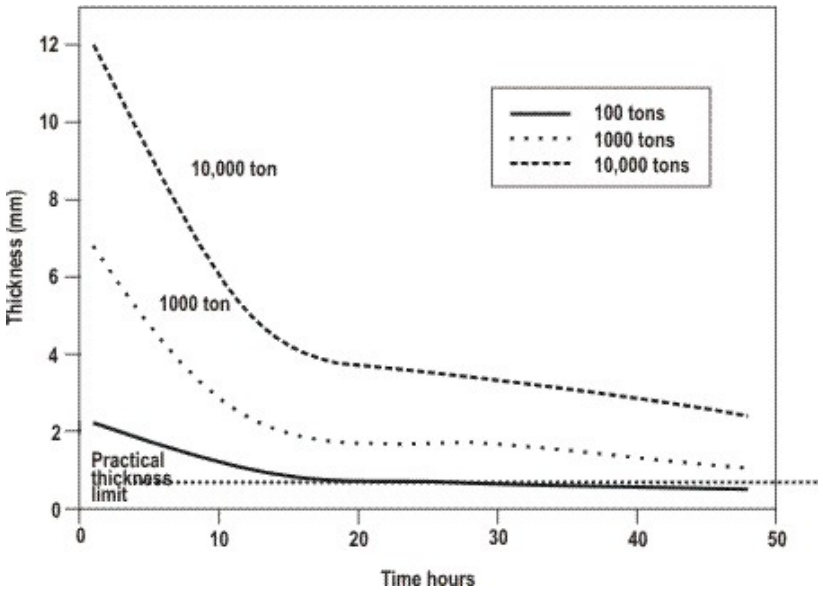
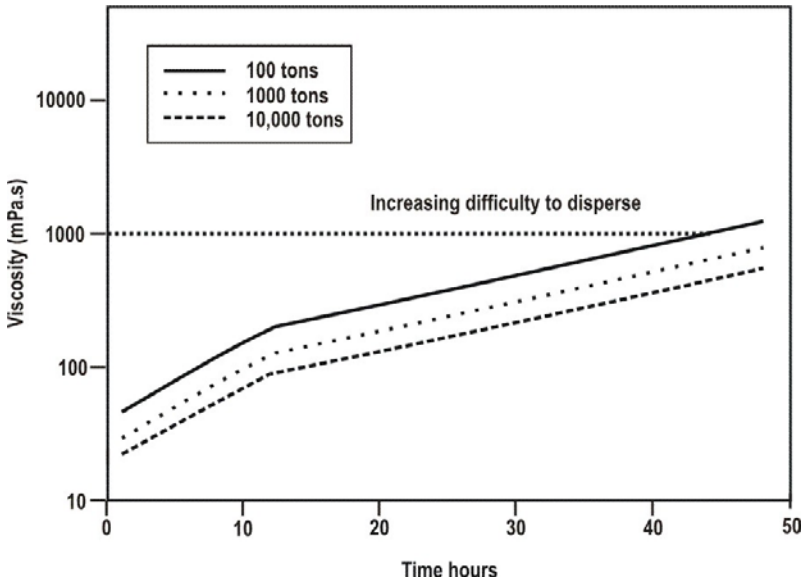


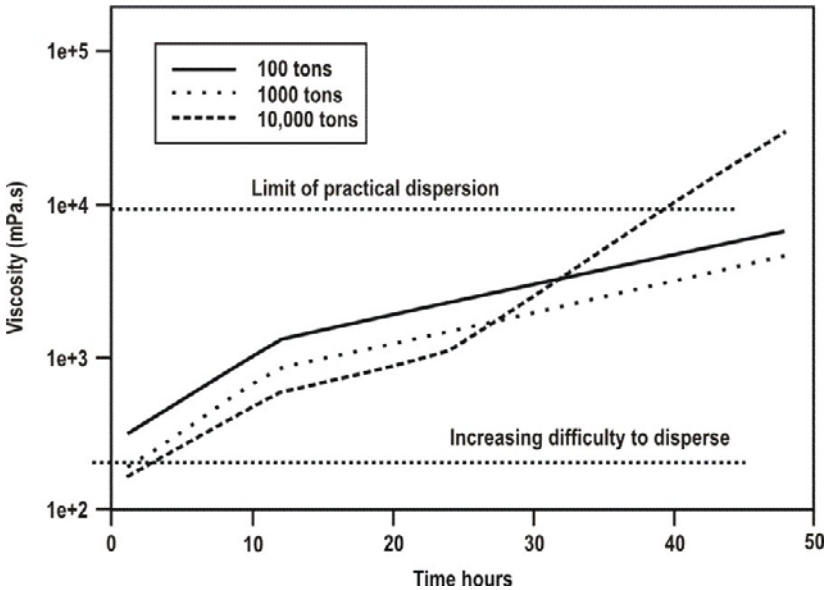
Figure 4.3 shows the increase in viscosity over time for a very light crude oil. After 48 hours, the viscosity of this light oil is such that it may not be treatable with dispersants.

Figure 4.3



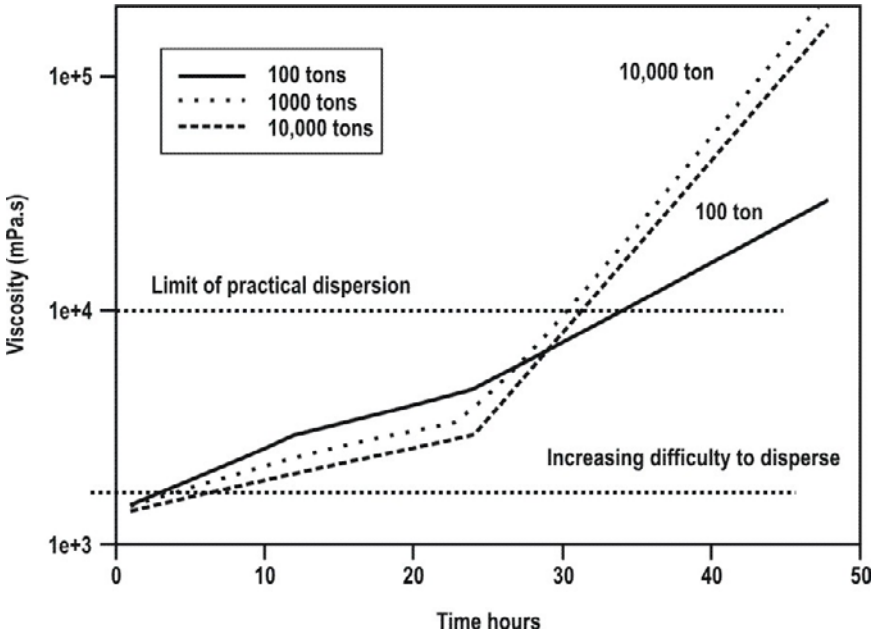
The nomogram for the increase in viscosity for a medium crude oil is shown in Figure 4.4. It can be seen that, after about 24 hours, the oil will not be amenable to dispersants.

Figure 4.4



Similarly, the nomogram for treating a heavy crude oil is shown in Figure 4.5. This figure shows that heavy oils are only amenable to treatment by dispersants in the first few hours. After the viscosity of the oil reaches 1,000 mPa.s, the oil is poorly dispersible and the upper limit at which any dispersion occurs is about 5,000 mPa.s.

Figure 4.5



APPENDIX 5 - INDIVIDUAL COUNTRY INFORMATION

- *ARGENTINA*
- *BRAZIL*
- *CARIBBEAN ISLAND STATES AND TERRITORIES*
- *CENTRAL AMERICAN COUNTRIES*
- *CHILE*
- *COLOMBIA*
- *ECUADOR*
- *MEXICO*
- *PERU*
- *SURINAME*
- *URUGUAY*
- *VENEZUELA*

ARGENTINA

(Source: General Law 18398 of the Coast Guard of Argentina)

Article 5 of Law 18398 states that that this agency is responsible "*for the rules to be adopted to prohibit the pollution of fluvial, lacustrine and maritime waters caused by hydrocarbons and other noxious or hazardous substances, and to enforce such rules;*" By Laws 24292 and 24089 which approved the International Convention for the Prevention of Pollution from Ships (MARPOL 73/98), Decree No. 1886/93 which incorporates into the REGINAVE its title 8 under the name "Prevention of Pollution from Ships," additional standards are established stating the requirements systems and chemical means are to meet to combat pollution. It also establishes that their use has to be authorized by the controlling agency.

Ordinance No. 01/98 defines Dispersant as *"Chemicals that reduce the surface tension between oil and water. Under proper usage conditions, they can facilitate the breakup of the oil slick into droplets distributed in the upper layers of the water column*. As a general rule, products designated as "dispersants" shall not be used in the following cases:

- Freshwater
- Shallow waters (depth of less than 10 meters)
- In waters used to supply potable water or for cooling towers and desalination plants.
- In areas prone to flooding, swamps, marshlands and stagnant waters.
- In gulfs, bays, inlets, lakes and/or lagoons with low rates of water renovation.
- In coastal areas or coastal or insular reserves (national, provincial or municipal) requiring special treatment and protection due to the communities and organisms they hold
- Highly sensitive areas as they are areas of reproduction of a large number of species of commercial significance, with abundant eggs, larvae and young populations, including shallow and/or low energy environments where dilution and degradation of the oil dispersed may be restricted or difficult. Also in areas of mammal reproduction and/or colonies and/or reproduction, of bird nesting and feeding.
- Areas of high benthic risk, characterized by high diversity benthic associations and biotic potential, algae and sea-grasses, banks of clams and other mollusks. It comprises special biotypes of soft and hard bottoms (sandbar, marshy lands, rocky and sandy coasts.)
- In hydrocarbons where temperature has dropped beneath its pour point.
- Those refined hydrocarbons called white oils, such as gasoline, gas oil, etc. The use of dispersants is recommended in black hydrocarbons, as for example in the case of national crudes and those refined of intermediate fuel oil such as IFO 180 and lower.

This Ordinance also establishes the chemical conditions or characteristics, biodegradability, toxicity, and efficiency test that the product must meet to be authorized by the controlling agency for use.

BRAZIL

(Source: The CONAMA (National Environment Council) issued a Resolution, CONAMA 269 from 14th September 2000, CONAMA 269 Form , deliberating on the obligatory registration of chemical dispersants in Brazil and regulating in its annexed Regulation, Annexed Regulation , the production, importation, commercialization and use of chemical dispersants in oil or derivatives spill response procedures.)

This Resolution establishes the demand to register chemical dispersant products with IBAMA (Brazilian Environment and Natural and Renewable Resources Institute), a government agency subordinate to the Ministry of Environment. It also establishes that the use of chemical dispersants on the sea must follow the criteria described on the Regulation annex to the Resolution.

The Regulation lists recommendations to support the decision on using dispersants, such as:

- Definition on the geographical area affected (direct and indirect risks);
- Definition on the distribution and seasonality of species in the ecosystems involved;
- Definition of the social and economic resources at risk;
- Definition of the coastal geomorphology and respective sensitivity to oil;
- Obtainment of meteorological data;
- Obtainment of hydrodynamic and hydrographic data;
- Obtainment of physical, social and economic cartographic data;
- Use of mathematical model on the plume drift.

According to the Regulation, dispersants can only be used during the first response, preferably on the first 24 hours after the spill. They can also be used:

- In spills that represent a threat to human life or risk of fire;
- When other response techniques are not effective;
- When the plume is farther than 2km from the coastline and drifting towards sensitive areas;
- In other areas under consent of the environmental agency.

Dispersants can not be used:

- In coastal areas with still or slow renovation waters;
- In estuaries, canals, beaches, mangroves, coral reefs and other sensitive areas;
- In regions with aquaculture or Environmental Protection Areas;
- For vessels or port cleaning;
- On highly viscous or emulsified oil;
- When the main reason is to preserve the aesthetics of the area.

Other information available on the Regulation are data tables to support the decision on the kind of dispersant to be used, the volume of oil dispersed according to volume of dispersant used and sea conditions (Beaufort scale), limit conditions for use with different application systems. The Regulation also contains application procedures for ships and airplanes.

CARIBBEAN ISLAND STATES AND TERRITORIES

(Source: Caribbean Islands OPRC Plan – RAC/REMPEITC-Carib, 2006)

Antigua & Barbuda

Antigua and Barbuda favors the combined approach of containment & recovery, chemical dispersion and manual/mechanical shoreline cleanup. The prevalence of sensitive resources (corals, mangroves, fisheries and tourism) necessitates consultation with Marine Pollution Sub-Committee (consisting of representatives from all involved parties) before the use of chemicals would be approved.

Anguilla (BWI)

The response strategy for Anguilla is based on the joint approach of recovery/containment, the use of approved chemical dispersant and manual shore clean-up. There are no local stockpiles of dispersant or application equipment. The use of dispersant needs the approval of the Marine Pollution Action Group.

Aruba

The response policy for Aruba adopts the joint approach of containment/recovery, natural dispersion, restricted use of dispersant and shoreline clean up.

Bahamas

Policies have been established to protect sensitive resources. In terms of dispersants the guidelines provided in the Caribbean plans are used. The use of dispersants is monitored closely.

Barbados

Dispersants approved by the government can be used in accordance with the Barbados National response Team's draft dispersant use policy. [A copy of this draft policy is available through RAC/REMPEITC-Carib Secretariat]

British Virgin Islands (BWI)

The Marine Pollution Action Group will authorize the use of dispersants according to criteria agreed in the Caribbean Islands OPRC Plan, unless special overriding conditions apply at the time. Only licensed and approved dispersants are permitted.

Cayman Islands (BWI)

Given the abundance of environmentally sensitive near-shore and coastal resources which forms the basis of eco-tourism, a high priority is placed on habitat protection. The use of Net Environmental Benefit Analysis is typically implemented to determine response strategy. Aerial application of oil dispersants remains a key tool in protecting sensitive shoreline and endangered species long with protective booming and other traditional response techniques.

Cuba

There does not appear to be any specific response policy although evidence from previous spills, says that dispersant application is not a primary option.

Dominica (BWI)

The response strategy for the Commonwealth of Dominica is based on the joint approach of recovery / containment, the use of dispersants and manual shore clean up. The use of dispersant needs the approval of the Environmental Pollution Committee.

Dominican Republic
Dispersants have previously been used in the ports but there is no firm policy on the use of dispersants within the many designated national parks.

French Antilles & Guyana
As in mainland France, the preferred clean-up technique is mechanical recovery but the controlled use of dispersants is also accepted as an alternative approach.

Grenada
The response strategy for Grenada is based on the joint approach of recovery/containment, the use of dispersant and manual shore clean up. There are no local stockpiles of dispersant or application equipment. The use of dispersant needs the approval of the National response Team.

Haiti
Actual information on Pollution Contingency Planning and policy on the sue of dispersants is not yet available.

Jamaica
The Jamaican economy is heavily dependent on tourism and so a very high priority is assigned to the protection and maintenance of amenity beaches. The uses of dispersants, although not ruled out, are considered a final option.

Montserrat (BWI)
A response policy has been formulated, and is based on the joint approach of containment/recovery, chemical dispersion, and manual & mechanical cleaning of contaminated tourist beaches.

Netherlands Antilles
The response policy for the Netherlands Antilles adopts the joint approach of containment/recovery, natural dispersion, restricted use of dispersant and shoreline clean up.

Puerto Rico (US)
The use of dispersants for certain areas within Puerto Rico has been pre-approved, however the use of such measures and in-situ burning may require final consultation and approval of the United States Coast Guard, Environmental Quality Board, and Caribbean Regional response Team.

St. Kitts and Nevis
There is no defined policy on dispersant use,

St. Lucia
Containment / Recovery and manual shoreline cleanup are the preferred options. As outlined in the National Plan, burning would be considered an option if other options proved inadequate and conditions were suitable. Chemical dispersion would be considered only as a last resort

St. Vincent and Grenadines
The present draft plan addresses a policy regarding spill response based on the joint approach of recovery/containment, the use of dispersant and manual shore clean up.

Trinidad & Tobago

(Source: PETROTRIN, 2006)

As of September 5, 2006, there is no government policy on dispersant use; however PETROTRIN (the state-owned oil company) has developed its own dispersant policy which is incorporated into all oil spill contingency plans.

PETROTRIN's DISPERSANT POLICY

The On-Scene Commander (OSC) may use dispersants without prior approval under the following parameters:

1. The area of application is not less than one nautical mile from any shoreline, nor closer than three nautical miles up-current from important marine fisheries.
2. The water depth should exceed 10 meters in the area in which the dispersants will be applied.
3. The method and rate of application are as recommended by the manufacturer.
4. The dispersants exhibit low toxicity and be included in the Ministry of Energy's approved list of oil spill dispersant. (Appendix 8a)
5. Potentially affected down stream industries/ ports/saltwater intake facilities notified whenever dispersant use is intended.

In terms of dispersants in waterways the governing legislation is best described in the Draft Water Pollution Rules (see www.ema.co.tt). The Ministry of Energy and Energy Industries in Trinidad & Tobago has developed a list of the chemicals that are authorized to be used in the country under their guidance. In this list there is a section for dispersants which is described below.

LIST OF CHEMICALS APPROVED FOR USE IN OPERATIONS AT PETROLEUM AND PETROCHEMICAL INDUSTRIES IN TRINIDAD & TOBAGO

The under-mentioned Chemicals are approved by this Ministry for use in the petroleum and petrochemical industries. Please note that this listing of the approved chemicals does not state the specific conditions to be observed by users of any of these chemicals.

The Ministry of Energy and Energy Industries is the sole authority for any details on the conditions for usage of chemicals. Whilst only those chemicals which have been approved for continuous use are included in this list, the Ministry of Energy and Energy Industries reserves the right to remove any chemicals, without prior notification, whenever available evidence indicates that another updated chemical analysis is needed.

EEI: 12/1/5 Vol. IX March 9, 1999

1. SHELL DISPERSANT LTX	11. SERVO CD 2000
2. SHELL DISPERSANT CONCENTRATE	12. ATPET 787
3. SHELL HERDER	13. ATPET 900
4. BP 1100 X	14. WELLAID 3315
5. TRETOLITE W1986	15. COREXIT 9554
6. COREXIT 9527	16. CRUDEX
7. COREXIT 7664	17. SHELL DISPERSANT VDC
8. COREXIT OC-5	18. COREXIT 9500
9. WELLAID 331	19. PETROCHEM 100-SD
10. SO-CHEM MH 16	20. SO-CHEM CD-2036

Turks and Caicos

The response strategy for Turks and Caicos is based on the joint approach of containment and recovery, the use of chemical dispersant and manual shore clean-up. The use of dispersants requires the approval of the Marine Pollution Action Group.

US Virgin Islands (US)

The use of dispersants for certain areas within the USVI has been pre-approved, however the use of such measures and in-situ burning may require final consultation and approval of the United States Coast Guard, the Department of Planning and Natural Resources, and the Caribbean Regional Response Team.

CENTRAL AMERICAN COUNTRIES

Belize

(Source: BELIZE OIL SPILL RESPONSE PLAN - DRAFT TWO – January 26, 2004)

All dispersant use must be approved by the Department of the Environment. Use is recommended in waters deeper than 30 ft (10 mt) to increase dilution and to prevent impact on bottom dwelling organisms. The Department of the Environment should work out beforehand a protocol for use of dispersants, as well as making contact with experts who will be available should the need arise. *("The OSC will decide on the options to be used according to the particular circumstance at the location of the discharge. For a more detailed discussion of response and clean-up options including use of dispersants and detergents, refer to NEPPOS."*).

Reference is made to the *"IMO/UNEP Guidelines on Oil Spill Dispersant Application and Environmental Considerations"* which can provide guidance. For more detailed guidance on use of dispersants, see National Emergency Preparedness Plan for Oil Spills – Belize NEPPOS."

Costa Rica

(Source: RECOPE – November/2006)

In order to obtain permits to apply dispersants in Costa Rica, dispersants must be registered with the Bureau of Registries and Controls of the Ministry of Health. With the permit, the use of dispersants must be included in the emergency response plan to be submitted annually by every company to the Bureau of Human Environment Protection. With the operation permit, the company is automatically authorized by the Ministry of Health to apply dispersants on the terms stated in the Plan (as to human protection).

An environmental statement is to be submitted to the National Technical Environmental Secretariat – SETENA, an agency attached to the Ministry of the Environment and Energy (Form D1). The agency evaluates such statement and if it considers the same to be adequate, it issues the environmental permit or feasibility. Documentation for both in-situ burning and application of dispersants may be presented in one form.

Refinadora Costarricense de Petróleo – RECOPE (state-owned oil company) has met the requirements described, both before the Ministry of Health and SETENA. Both government agencies have granted their approval for the application of dispersants and for in-situ burning. They have accepted the proposal to work together with RECOPE in the event of a contingency.

El Salvador

(Source: National Contingency Plan of El Salvador – August 16, 2004)

The use of dispersants included in the most recent listing of products called "National Contingency Plan Product Schedule," published by the Environmental Protection Agency (EPA/USA) is authorized subject to the coordination with the Ministry of the Environment and Natural Resources.

Dispersants may be exclusively used by the Ministry of the Environment, and the only company that may use it is the Refinery of Acajutla under the Ministry's supervision.

Only the use of dispersants COREXIT 9527 and 9500, and surface cleaning agents COREXIT 7664 and 9580 is authorized in the following cases:

- Spills in the mooring areas of piers during the 24 first hours of the spill.
- Spills in the open sea at depths of more than 45 m where the spills moves to mangroves or beaches with high population density (e.g., Barra de Santiago, Acajutla, Los Cóbanos, La Libertad, San Diego, La Zunganera, El Cuco, Las Tunas, Maculís, southern area of Bahía de la Unión, communities of the islands of Golfo de Fonseca).

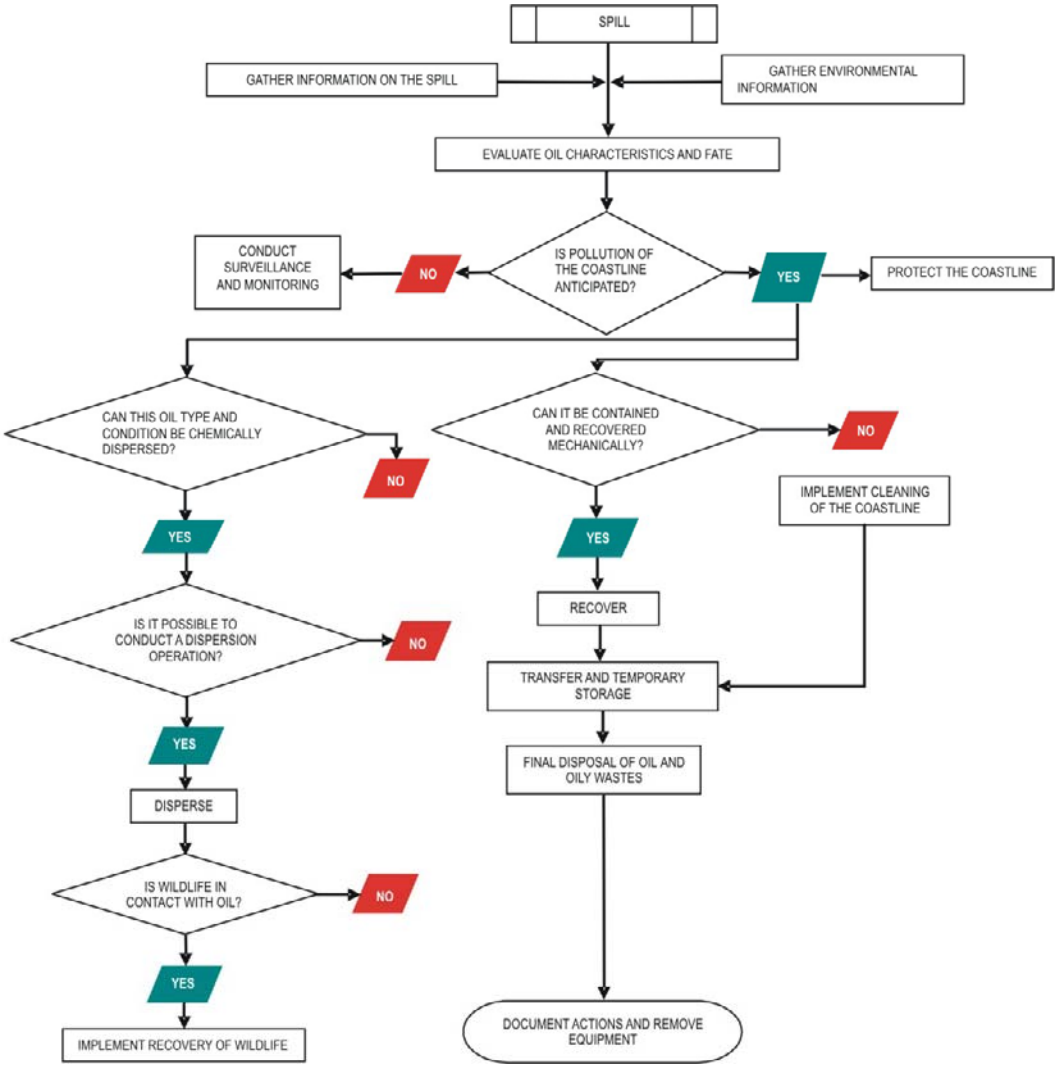
No chemical substances may be applied in the areas of rocky reefs or mangroves.

Guatemala

(Source: National Contingency Plan to combat oil spills at sea – Guatemala – December 2004)

The criteria for the use of dispersants to treat the slick are those established by the regulations of the Competent Authority. The strategies described by the contributing plans at local level are also taken into account for the use of dispersants.

The criteria for the use of dispersants are very general, although they are directed to the use of practices commonly described in several references (e.g. depths of more than 10 m, waves higher that 0.5 m, low oil viscosity, etc.)



Honduras

(Source: National Contingency Plan of Honduras – September 2004)

Annex J of the National Contingency Plan describes the "National policy regarding the use of dispersants" administered by the Environment Authority, and lists the conditions of use and appropriate locations. In general terms, the Environment Authority will approve the use of dispersants according to the criteria agreed upon in the entire Central American area, unless special considerations exist at a certain time (*"The General Policy regarding the use of dispersants shall be consistent with relevant policies of neighboring Central-American countries".)* When combating an oil spill within the country's territorial waters, the Maritime Incidents Commander is authorized by the Maritime Administration of Honduras and by the Environment Authority to use the authorized dispersants.

There are no pre-authorized locations, and the listing of authorized dispersants must be provided by the Environment Authority of Honduras.

The following directions or parameters must be followed:

1. The area of application is not less than one nautical mile from any shoreline, nor closer than three nautical miles from marine resources or coral reef ecosystems which are less than twenty feet from the water's surface;
2. The water depth should exceed thirty feet in the area where the dispersant will be applied;
3. The method of application shall be the one recommended by the manufacturer;
4. The rate to be applied shall be the one recommended by the manufacturer;
5. Dispersants to be used shall be of low toxicity; and
6. The Maritime Authority of Honduras shall notify neighboring States that will be potentially affected by an oil spill whenever it plans to use dispersants beyond Honduras' territorial waters. In the event that the Maritime Incidents Commander determines that the use of dispersants is necessary, and it is apparent that other States may be affected, then the acceptance of the referred States shall be required.

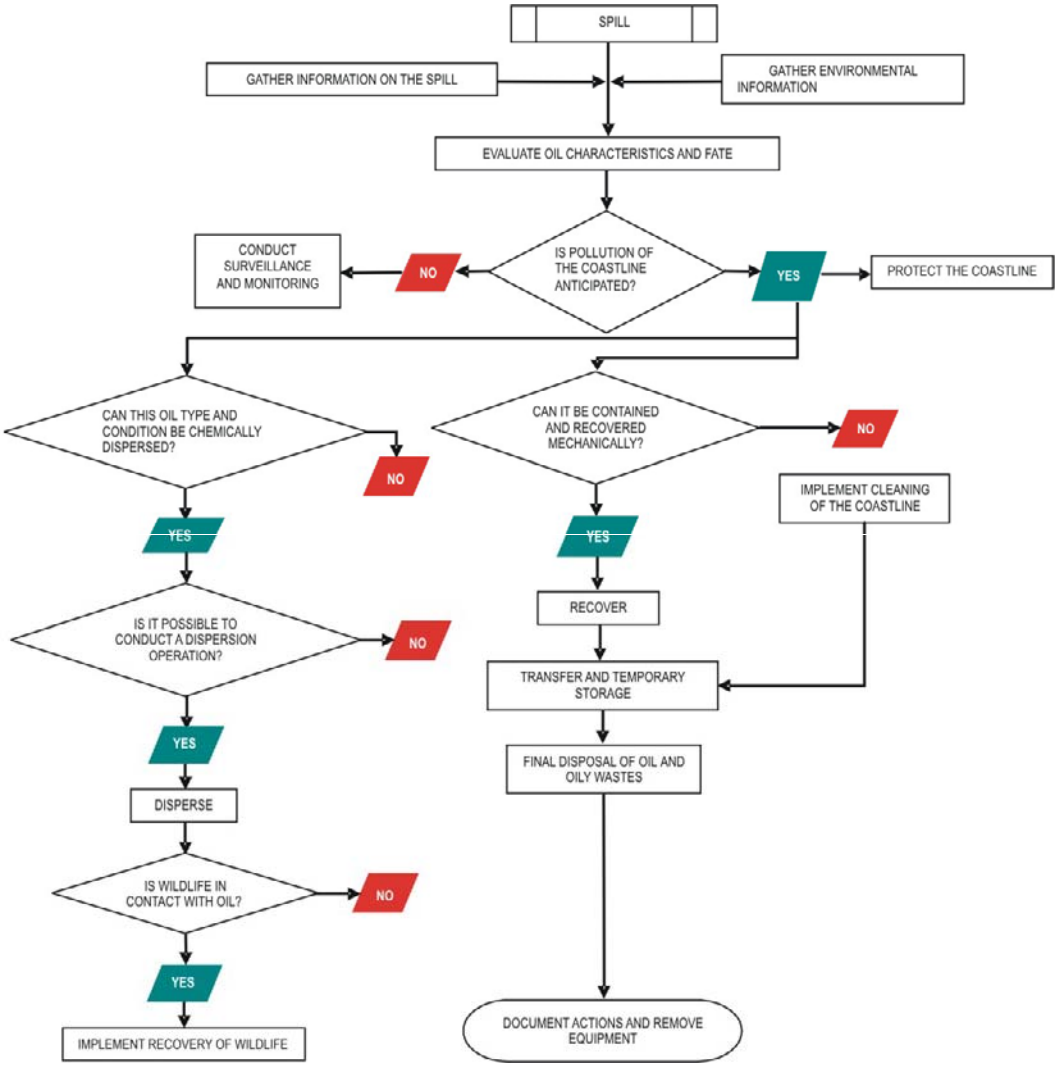
During a dispersant operation, the Maritime Incidents Commander must determine the effectiveness of the dispersant application by on-site observation or by laboratory testing. The application of dispersants must be discontinued if it is not effective.

Nicaragua

(Source: National Contingency Plan to combat oil spills at sea – December 2004)

The criteria are established in the regulations of the competent authority. The approval for use will take into account strategies described in the Local Plans.

The Plan contains a general indication of the requirements for dispersants that are directed to the use of practices commonly described in several references (e.g. depths of more than 10 m, waves higher that 0.5 m, low oil viscosity, etc.) There are no pre-authorized locations.



Panama

(Source: Republic of Panama – Maritime Authority of Panama - National Contingency Plan to control oil spills – Draft – June 2003)

The authorization for the use of these products must be obtained from the Naval Administration of Panama, and only for areas at depths of more than 20 m. It includes a list of dispersants and suppliers of dispersing additives (see table below).

NAME OF DISPERSANT	DISTRIBUTION COMPANY
Ameroid oil SIPI Dispersant / Lt	Exxon Chemical Company
Arco Chemm D-609	Arco Chem Company
Atlantic Oacufic Oil Dispersant	GFC Chemical Company
BP-1100wd	BP North America Incorporated
BP1100x	BP North America Incorporated

NAME OF DISPERSANT	DISTRIBUTION COMPANY
Conco Dispersant K	Continental Chemical
Corexit 7664	Exxon Chemical Company
Corexit 8667	Exxon Chemical Company
Corexit 9527	Exxon Chemical Company
Gold Clean	Adair Equipment Company
Gold Crew Dispersant	Ara Chem Incorporated
Proform Pollution Control Agent	Proform Products Company
Seamaster	Whale Chemical Company
Slik-A-way	MI-DEE Products Inc.

CHILE

(Source: Ordinary Resolution No. 12.600/163 VRS[3] of the General Bureau of the Marine Territory [DGTM under its acronym in Spanish] and the Merchant Marine [MM] [Valparaiso, CHILE – July 8, 2002] approving the ordinary circular a-53/001 of DGTM and MM.)

The resolution establishes preventive measures for the application of dispersants in disasters or other events causing pollution to the aquatic ecosystem or damages to the coastline of the Republic as a consequence of oil spills. The resolution states that *"The use of dispersants on oil spills constitutes one of the possible response techniques. ... If the appropriate conditions are present, the use of dispersants may play an important role to combat pollution of the sea in the presence of hydrocarbons."* The remainder of the resolution specifies thoroughly the conditions under which dispersants could -or could not- be applied, including indirect references to the Net Environmental Benefit Analysis (*e.g., "To be used only when the advantages of reducing the slick on the surface are greater than the damage it may cause, or in situations where containment or recovery of oil are not feasible,"* and other references.) The possibility of using dispersants in the coastline is also mentioned.

The application of dispersants must be approved by the DGTM and MM. However, the authorization for the use of dispersants granted by the DGTM does not mean that dispersants may be used indiscriminately in any spill situation. Therefore, the prior consent of the local Maritime Authority is required in each case for the use of dispersants; the Maritime Authority will consider the situation and decide accordingly. Annex "C" lists the dispersants authorized by the General Bureau of the Marine Territory and the Merchant Marine (as of May 20, 2002)

NAME OF PRODUCT	DISTRIBUTOR/MANUFACTURER
COREXIT 9527	EXXON
BP 1100 WD	BRITISH PETROLEUM
OC - 5 OIL COLLECTOR	
COREXIT 7664	
SLICKGONE LTD	DASIC INTERNATIONAL
HEXAPROTE 6141	
SHELL HERDER	CIA. SHELL CHILE
SHELL DISPERSANT CONCENTRATE	CIA. SHELL CHILE
SHELL DISPERSANT LTX	CIA. SHELL CHILE
COREXIT 8667 OIL DISPERSANT	
COREXIT 9550 OIL DISPERSANT	
DISPETROL II	COTACO LTDA.
SINQUI OIL SPILL REMOVER L/T	SINQUIMAR
SUPERDISPERSANT – 25	GENERAL EQUIPMENT LTDA.
GANKO OIL SPILLS 600	KOGAN INDUSTRIAL S.A.
PROSUR OIL SPILL DISPERSANT G.V.	PROSUR SOUTH OCEAN SUPPLY LTDA.
SPILL DISPERSANT N°10	GOMEZ BRETON HNOS. LTDA.
UNITOR SEACARE O.S.D.	CIA. MARITIMA UNITOR LTDA
DREW AMEROID MARINE OSD/LT	AQUATEC DE CHILE S.A. ; ASHLAND CHEMICAL CHILE
GOLD CREW DISPERSANT	IIM INGENIERIA INDUSTRIAL
DEPOSITROL SF 5100	BETZDEARBORN

[3] http://www.directemar.cl/reglamar/Directivas/A53-001.pdf

COLOMBIA

(Source: ECOPETROL, 2006)

The "National Contingency Plan Against Spills of Oil, Derivatives and Noxious Substances in Marine, Fluvial and Lacustrine Waters" of Colombia, locally known as the "National Contingency Plan" or "PNC" (under its acronym in Spanish) was approved by Decree 321 of February 17, 1999. The PNC sets forth all the policies related to planning of contingencies in Colombia for spills of oil and noxious substances in the basins and marine environment.

Paragraph 9.3.2. of the PNC refers to the role of the National Technical Committee of the National Contingency Plan -CTNPNC- and establishes that this agency *"manages all the aspects of planning, which include policies, strategies and specific studies."* Several aspects are described among the specific responsibilities of the CTNPNC, namely: *"Decide on the application of dispersants in the event of oil spills."*

Therefore, it is clear that dispersants in Colombia could be used when authorized by the CTNPNC, which is composed by the main national agencies: Ministry of the Interior, Ministry of Defense, Ministry of the Environment, Housing and Territorial Development, National Navy, among others. The Committee is chaired by the delegate of the Bureau of Disaster Prevention and Management of Colombia (DPAD)

In the event of a major spill that warrants the use of dispersants it is very difficult for the CTNPNC to meet in order to decide on the application of dispersants; therefore, the decision is made at local level by the maritime authority, through the respective Harbor Master, subject to the approval of the environmental authority.

Efforts are currently being made to put a national pre-approval policy for the use of dispersants into effect, which is based on all the studies made by the state-owned company ECOPETROL, on the experiences of other countries, and on the guides that have been published. In this regard, the environmental authority of Cartagena, CARDIQUE, has developed –together with ECOPETROL- a protocol for the application of dispersants that is currently under review. They are also interested in developing a protocol for controlled burning.

The protocol to decide on the use of dispersants considers aspects such as: initial description of the spill, prediction of behavior and inspection of sensitive areas, assessment of threat to sensitive areas (coastline assessment formats), analysis of response alternatives, "NEEBA" analysis on dispersant application, spill dispersability analysis, dispersant availability analysis, safety aspects of the application, preliminary effectiveness tests, application, follow-up and decision-making, as well as specific prohibitions and non-use recommendations.

The idea is to extrapolate the experience of Cartagena to the rest of the country, in agreement with the CTNPNC and with the support of the Ministry of the Environment and the Maritime Agency (DIMAR under its acronym in Spanish) which is ultimately the governing body in maritime matters in the country.

In summary, it is so far feasible to use dispersants as authorized by law through the PNC and its implementing Decree. There is no listing of authorized dispersants.

ECUADOR

(Source: PETROECUADOR, 2007)

The Law on "Control and prevention of oil pollution of national coasts and waters" of the Title III of the Maritime Police Code enacted by Executive Decree Nr. 945 of September 12, 1974, states as of public interest the oil pollution control in territorial waters, coasts and beach areas, as well as in rivers and navigable waters under the jurisdiction of the General Bureau of Merchant and Coastline Marine, endowing this Organization of the legal instrument allowing it for enforcing said pollution control.

The General Bureau of Merchant and Coastline Marine developed an oil spill Contingency Plan and has compelled Petroleum Terminals to develop and update the Local and Area Contingency Plans.

Regarding the use of dispersants, it is established that only those Dispersants authorized by the General Bureau of Merchant and Coastline Marine will be used.

MÉXICO

(Source: National contingency plan to combat and control oil spills and other noxious substances in the sea, 2001)

The use of dispersants should be decided based on a comparison of the damages that treated and non-treated hydrocarbons and other noxious substances may cause to the environment, and when it is clear that natural dispersion will not be sufficient to protect sensitive environments. In addition, long, medium, and short-term effects will be taken into consideration.

PERU

(Source: PETROPERU, 2006)

Contingency Plans for Oil Spills at Sea, Rivers and Lakes are basically subject to the provisions of the General Bureau of Harbormasters of Peru - Maritime Authority - who establishes the guidelines and framework for their development and implementation. In this general context, it also regulates the technical specifications and basic characteristics of dispersants, and establishes the toxicity tests and other related parameters through the Institute of the Sea, the scientific government agency in charge of marine environmental issues.

- Directorate Resolution No. 0066 – 96 / DCG. It establishes the procedures to approve the use of chemicals as Dispersants to combat oil spills at sea.
- Directorate Resolution No. 757 -2004 DCG. It specifies the provisions related to chemicals used as dispersants, sorbents or agglutinating agents to control pollution caused by hydrocarbons in the marine environment.
- Dispersants must be approved by the General Bureau of Harbormasters and Coastguard
- Dispersants must comply with the following requirements:

  - ✓ They must not cause any risk to human health.
  - ✓ They must not damage plant and marine life.
  - ✓ They must not affect recreational attractions.

- The Environmental Division of the General Bureau of Harbormasters and Coastguard is in charge of approving the use of these products and regulating their application, issuing the corresponding authorization performed by any laboratory –which has been certified- for the following tests: physical and chemical properties; biodegradation; heavy metals content; toxicity; effectiveness (ratio dispersant/oil); absence of any chlorinated compound, benzene, acids or basics compounds, phenols and others that could in any way be capable of producing cancer.
- Any change in the authorized Dispersant will force to do all the tests as a new one.
- The approval will be effective for three (3) years, and the interested party is entitled to request an extension provided evidence is supplied that the following parameters have not changed:
  - ✓ Product effectiveness
  - ✓ Product toxicity

- The use of dispersants is prohibited when sea depth is less than 20 meters. In addition, they can only be used in marine aquatic environments and not in freshwater environments.
- Dispersants will only be used when:
  - ✓ Their use lowers the risk of human losses, the risk of explosion or the risk of fire of property.
  - ✓ They prevent or substantially reduce the risks of damage to marine plants and animals.
  - ✓ Their use will diminish the risk of sensitive areas becoming endangered.
  - ✓ They reduce substantially any damage to the environment.
  - ✓ Not to change the primary use of the water.

- The corresponding Port Authority must authorize the use of dispersants before their immediate application.
  - ✓ All companies handling hydrocarbons and presenting spill risks must have a stock of dispersants that is enough to combat a spill adequately and prevent pollution.

SURINAME

(Source: Caribbean Island OPRC Plan – RAC/REMPEITC-Carib, 2006)

The response policy for Suriname adopts the joint approach of containment/recovery, natural dispersion, restricted use of dispersant and shoreline clean up.

URUGUAY

(Source: ANCAP, 2006)

No policy on dispersants is in effect in Uruguay. ANCAP (Uruguayan state-owned oil company) has submitted a proposal, but no official resolution has been made as yet. As users of dispersants, both ANCAP and the Maritime Safety Authority apply their own basic criteria (exclusive use in the open sea, at a depth of water of ten or more meters, and in the absence of “excessive" wind.)

VENEZUELA

(Source: PDVSA, 2006)

In Venezuela, the policy is that *"it is not authorized the use of any type of dispersants in the exclusive economic zone of Venezuela without the approval of the Ministry of Environment and Natural resources"*

This means that dispersants could be applied once the corresponding approval be obtained; however the response time from the Ministry does not follow the pace required to apply dispersants in the window of opportunity.

It is expected that during 2007, the technical group of INEA (National Institute of Aquatic Environments) re-start its activities to address the issue of the use of dispersants in pre-approved areas as well as in-situ burning issues.

ARPEL

Regional Association of Oil and Natural Gas Companies in Latin America and the Caribbean

Established in 1965, ARPEL is an association of 30 state owned and private oil and gas companies and institutions with operations in Latin America and the Caribbean, which represent more than 90 percent of the Region's upstream and downstream operations. Since 1976, ARPEL holds formal UN-ECOSOC special consultative status.

ARPEL works together with its members –through its various Committees and Working Groups- on issues that contribute to sustainable development in the Region:

- *Economic issues*: regional energy integration, pipelines and terminals, downstream and fuels
- *Environmental issues*: climate change, atmospheric emissions, oil spill contingency plans and best practices in environment and occupational health and safety management.
- *Social issues*: corporate social responsibility and relations with indigenous peoples

ARPEL develops a proactive attitude on issues of interest to the industry and produces documents representing the views of its members. It also promotes interaction among its members and with governments building alliances and establishing agreements with international organizations with the aim of presenting and developing a regional perspective. To accomplish its objectives, ARPEL organizes regional workshops and symposia to share information and best practices and develops technical documentation for capacity building and information exchange on the issues of interest to its members. To support its management ARPEL has an interactive Portal in which all documents developed by ARPEL Technical Committees and Working Groups are available for its Members. This tool also facilitates the virtual interaction within the ARPEL community and with those stakeholders that interrelate with it.

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