POLICY AND GUIDELINES FOR USE OF OIL SPILL DISPERSANTS (OSD) IN INDIAN WATERS

PREFACE

This guideline document has been produced as an up-to-date guide on Oil Spill Dispersants (OSDs) use on sea surface only and is intended for the use of the resource and response agencies to respond to oil spills at sea. Further, it also provides wide-ranging information on use of OSDs which may be of interest to the general readers who are broadly concerned with the marine environment protection issues and in particular the response to marine oil spills in maritime zones of India. The specifications prescribed for OSDs are arrived at, after undertaking consultations with the various Government organisations related to the marine environment protection and scientific support by the National Institute of Oceanography (NIO), Goa. More scientific information, together with supporting references, could be obtained from the NIO on this subject.

In the event of an oil spill, the floating oil may pose health risk to people, seabirds and air-breathing marine species and may drift ashore causing irreparable damage to the coastal marine ecosystem. As a matter of policy in India, the first response is to contain the oil and recover it mechanically for further disposal in an environmentally friendly manner. However, mechanical recovery may not be feasible in every case due to various factors including but not limited to operational and environmental conditions. The primary objective of dispersant application at sea in a suitable condition with reference to the depth, wave energy distribution and the environment sensitivity is to reduce the floating oil by breaking it in small droplets promoting greater dissolution in the water column and subsequent degradation by naturally occurring micro-organisms. The use of OSD can sometimes be contentious because of misunderstandings about the principle of dispersing oil and the possible side effects that it can caused. Therefore, Net Environment Benefit Analysis (NEBA) is to be mandatorily undertaken by the user prior application of OSD. A “net environmental benefit” will be achieved if the damage that might be caused to marine life by dispersed oil is less than the damage that would have been caused if the oil had come ashore or drifted near to particularly oil-sensitive resources.

A balanced and correct application requires issue of guidelines on the subject with respect to its use. Accordingly, the CG being the Central Coordinating Authority (CCA) for Oil Spill Response, had issued a document “Guidelines and Policy for use of OSD in Indian Waters” in the year 2002 which was revised in 2009. The advancements in the development of dispersants and feedback of stakeholders have further necessitated review of the 2009 document. This document incorporates the revised specifications for the new generation dispersants and also various other inputs provided by the resource and other relevant agencies.

In order to establish the necessary parameters for framing the current guidelines and policy, a committee comprising of officials from the Indian Coast Guard (ICG), NIO, National Institute of Ocean Technology (NIOT), Oil Industry Safety Directorate (OISD)/Ministry of Petroleum and Natural Gas (MoPNG), Central Board of Pollution Control (CPCB)/ Ministry of Environment, Forest and Climate Change (MoEF&CC) and Ministry of Ports, Shipping and Waterways (MoPSW) was constituted for review of the policy document 2009. ICG acknowledges the valuable contribution of all the members for providing their inputs for drafting this policy. Efforts have been made to incorporate the best practices of oil industry and international standards set by International Maritime Organisation (IMO), International Petroleum Industry Environmental Conservation Association (IPIECA), International Association of Oil and Gas Producers (IOGP), Oil Spill Response Limited (OSRL) and International Tanker Owners Pollution Federation (ITOPF) through various publications by these organisations on the subject.

On the subject of bioremediation, the committee also deliberated on the use of bioremediation agents during the discussions on review of OSD use policy. The committee were unanimous in their observation that the objective of bioremediation is to minimize the damage resulting from shoreline pollution as it is a secondary cleanup technique requiring an expert group to monitor and execute the process. The available studies and practical observation indicate that the use of bioremediation is not suitable for at sea response to bulk oil due to the extent of dilution that would occur in open system. Therefore, it was decided that ICG would not deal with the approval and use of bioremediation. It is suggested that State Governments and Ports may have a Memorandum of Understanding (MoU) or other agreements with organisations/agencies providing individual or turnkey services for bioremediation, so that the services of such agencies can be utilised on requirement basis for restoration of coastline, wetlands, marshlands, etc. For further information on the subject, guidance document by IMO, “Bioremediation in Marine Oil Spills, 2004 edition” may be referred.

The purpose of this policy is to ensure that dispersants are of requisite specifications and only used in situations where they will prevent or minimize damage to the marine environment.

Comments of the Industry, response planners and the environmentalists to improve this document may be forwarded to the Coast Guard Headquarters.

31 Jul 2024
New Delhi

Principal Director (Environment)
Coast Guard Headquarters

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INTRODUCTION

1.1 Dispersants

1.1.1 Dispersants are chemical agents that include surface active agents which are partly oil and water soluble. Dispersants change the fate of oil at sea by facilitating the breakdown of an oil slick into tiny droplets, which are suspended and disseminated in water mass, thus enhancing the penetration of oil into the water column. Dispersed oil degrades more rapidly than oil in a surface slick and present a lesser threat to the environment than floating oil. However, the environmental gains from an increase in the rate of bio-degradation may be offset by the toxicity of dispersants in some cases, making the dispersed oil available to organisms in the whole of water body a cause of concern.

1.1.2 Though mechanical response is the preferred means to combat an oil spill, a total reliance on mechanical response may not be possible in all circumstances where limitations on equipment are imposed due to factors of weather and sea conditions. The area of spill, its sensitivity and the movement of drift, spread and speed could necessitate the use of non-mechanical means like the use of OSD as one of the possible techniques for effective clean-up.

1.1.3 The use of OSD is not appropriate for all types of oil. Some oils like diesel, gas oil and other light oils usually disperse readily and, therefore, do not require any sort of treatment. Sea conditions, tides and a number of other factors are also important in determining whether treatment with OSD is the best response. In addition, there are a wide range of oil treatment products available that have different properties and may be suitable for use only on certain types of oil and under certain sea conditions. A minimum amount of wave energy is essential for successful use of OSD at sea and in very rough sea conditions, the oil may be submerged by breaking waves, preventing direct contact with the dispersant and oil thereby decreasing the efficiency of the OSD.

1.1.4 For many oil spills, the best option is to leave the oil to disperse or degrade naturally. While, planning the use of oil treatment products, the conditions and circumstances under which use is considered should be assessed with respect to other response methods, such as mechanical recovery, that may be used instead of, or in addition to OSD.

1.2 Principle

1.2.1 Dispersants being partly oil and water-soluble, reduce the interfacial tension between oil and seawater which under the influence of wind and wave energy, break up a surface oil slick into small droplets. Reduced interfacial tension increases the rate of droplet formation and inhibits coalescence of droplets. The fine droplets (less than 100 microns in diameter) under the action of mixing energy are rapidly distributed throughout the water column, thus decreasing the concentration of oil in water to background levels. However, dispersion action introduces a large amount of oil into the upper water column, which is generally a disadvantage to spill response through use of dispersants.

1.3 Role of Dispersants

1.3.1 Experience has shown that mechanical response often has distinct limitations, poor recovery rates, and inadequacy to deal with very large spills. In addition, booms and skimmers are of limited use even in moderate seas and are usually effective only at current lower than 1 knot and wave heights less than 2 meters. Even for calm conditions, it may not be feasible to use mechanical equipment alone to deal with large spills wherein oil may spread rapidly over large areas. For these reasons, use of chemical dispersants is considered a complementary option in responding to an oil spill emergency.

1.3.2 The immediate beneficial effects of dispersant are to: -

1.3.2.1 Break the oil into tiny droplets to facilitate their dissemination in water column. The dispersed oil is distributed throughout the water column and is more affected by water currents and turbulence compared to surface slick that are prone to drift due to winds and waves.

1.3.2.2 Increase water/oil interface leading to dilution of oil suspension in a larger volume of water, thus improving the natural biodegradation in the marine environment.

1.3.2.3 Suppress the formation of harmful vapours such as Hydrogen Sulphide (H_2S) and Volatile Organic Compounds (VOCs).

1.3.2.4 Inhibit formation of water in oil emulsion “chocolate mousse”, to a limited extent.

1.3.2.5 Reduces/prevents impact on shoreline as the oil is dispersed in the water column.

1.4 Types of Dispersants

1.4.1 Based on solvents used in formulation, dispersants are generally graded into four types: -

1.4.1.1 **Type I - Conventional Hydrocarbon Base**. These are normally used in undiluted (neat) form and are generally applied at a dosage ratio of one part of OSD to between 2-3 parts of oil. These products are generally of low viscosity, similar to that of kerosene, and require additional agitation to mix the OSD into the oil and consequently into the water column.

1.4.1.2 **Type II - Water Dilutable Concentrate**. These dispersants are used after dilution with sea water in the ratio of 1:10. Treatment rates are one part of dispersant to 2-3 parts of oil. (Equivalent to 1 part of concentrate dispersant to 20-30 parts of oil.

1.4.1.3 **Type III - Concentrate**. Also known as third generation dispersants are alcohol/glycol solvent-based dispersants containing higher concentrations of surface-active agents. These are primarily used in undiluted form. Diluting such products with water can reduce effectiveness. Third generation OSD are designed primarily for use from aircraft - fixed or rotary wing. Their dosage rate is much smaller, one part to 20-30 parts of oil, depending upon slick thickness. In addition, these dispersants can also be used from ships or on beaches, using appropriate spray gear.

1.4.1.4 **Type II/III Combination**. This type of dispersant manufactured both for undiluted spraying from aircraft and for sea by water dilution prior to spraying using sea going vessels. The advantage of this dispersant is that any organisation need not store type II and type III dispersant separately. When used for Type II application, dilute 1 part dispersant with 10 parts water (fresh or sea), for ‘Type III’ application, use undiluted and spray 1 part dispersant over 20 - 30 parts oil. In all cases the product should be sprayed by suitable spraying equipment.

OBJECTIVES

2.1 The objective of all oil spill response strategies should be to minimise the damage, both ecological and economic, that could be caused by an oil spill. The most obvious way to do this is to prevent the spilled oil from coming into contact with oil-sensitive resources. Most damage is done by spilled oil when it gets into shallow water or comes ashore. The objective of oil spill response actions at sea should be to prevent oil from reaching the shoreline or particularly sensitive resources at sea, so as to minimize the damage and to prevent the long-term effects that may ensue. The objectives of this document are: -

2.1.1 To develop a document to guide surface OSD usage at sea in various maritime zones of India and beyond.

2.1.2 To promulgate specifications of OSD.

2.1.3 To lay down criteria for approval of OSD by ICG.

2.1.4 To regulate the use of OSD is situations which would minimize the damage to marine environment.

POLICY ON USE OF DISPERSANT

3.1 Once oil has spilled, responders use oil spill countermeasures to try to reduce the adverse effects of spilled oil on the environment. Dispersants are one of the various response options available for oil spill clean-up. Dispersants are used to remove oil slicks from surface. The treated oil enters the water column in low concentrations as fine droplets where it is dispersed by currents and eventually subjected to natural degradation such as bio-degradation. However, the exposure to dispersed oil may have toxic effect on certain marine organisms. Thus, the policy on the use of dispersant tries to achieve a balance between the resource protection issues on the shore and environment protection issues at sea. The policy on the use of the dispersant arrived at, is as follows: -

3.1.1 Use of dispersants must be documented in the respective contingency plans and only dispersants that are on the approved list are to be used.

3.1.2 As far as practicable, all stakeholders, Ports, Oil handling and storage facilities, Shipping companies (Master/owner), Coastal refineries and Oil Exploration and Production organizations, shall recover oil from oil slick (spilled oil) by deploying physical methods/mechanical recovery equipment.

3.1.3 When physical methods or mechanical deployment of recovery equipment are not safe and practical then, approved OSD shall be used at the earliest as per allowable conditions at sea. Ships flying foreign flag and foreign oil spill response agencies whilst responding to oil spills in Indian maritime zones are to comply with these OSD Guidelines.

3.1.4 Stagnated high sea spill shall be left to degrade naturally unless it causes or likely to cause harm/damage to amenities and marine environment of a coastal area.

3.1.5 Dispersant shall be used after thorough weighing of pros and cons through NEBA including socio economic considerations and these shall be properly documented.

3.1.6 No dispersant shall be used in sensitive areas, shallow waters, low dilution capacity areas, protected bays and inlets.

3.1.7 There is no specific distance from shore or water depth criteria for their usage. However, OSD use in shallow waters results in less potential for oil dilution in the water column. Therefore, the decision to use or not to use dispersant should be based on the environmental sensitivities that will be impacted if dispersant is used versus the sensitivities that will be impacted if the dispersant is not used.

DEFINITIONS

4.1 **Approved Dispersant**. A dispersant which has been tested for toxicity, stability, biodegradability and dispersal efficiency and which, having met acceptable toxicity, stability, biodegradability and efficiency criteria, is suitable for use in Indian waters.

4.2 **Authorised Testing Agency**. A Government entity authorized by the CCA for oil spill response for conducting the tests of an OSD sample for its toxicity, efficiency, stability, determining shelf life, bio-degradability and other parameters.

4.3 **Batch**. A quantity of some commodity made in one operation or a lot.

4.4 **Chocolate Mousse**. Water–in-oil emulsions.

4.5 **Cloud Point**. The temperature at which, solid substances begin to separate from solution.

4.6 **Competent National Authority**. An organization(s)/entity(ies) which has/have been designated as the authority(ies) responsible for oil pollution preparedness and response by the Govt. of India.

4.7 **Dispersant**. Chemicals which reduce the surface tension between oil and water, and thereby facilitate the breakup and dispersal of the oil in the form of finely divided droplets throughout the water column.

4.8 **Dispersant Efficiency**. The ratio expressed as a percentage of the volume of oil dispersed to the total volume of oil treated with dispersant.

4.9 **Efficiency Index**. It is percentage by weight of the test oil which has been transferred as small droplets into the water phase under the test conditions assuming complete and even distribution at the time of sampling.

4.10 **Emulsions**. Many oils have a tendency to form water – oil emulsions (mousse) which can increase the volume of the pollutant drastically. These emulsions are often extremely viscous and stable and more difficult to clean up. Emulsions may contain as much as 75 to 90% water, which has implications for total spill volume and response decisions. (Skimming, transfer, storage and disposal).

4.11 **Flash Point**. The temperature at which, a liquid gives off sufficient vapor to flash in the presence of a naked flame.

4.12 **Net Environmental Benefit Analysis (NEBA)**. Urgent decisions need to be made about the options available for response and clean-up in order that the environmental and socio-economic impacts are kept to the minimum. Getting the correct balance is always a difficult process and conflicts inevitably arise which need to be resolved in the best practicable manner. The advantages and disadvantages of different response options need to be considered and compared, both with each other and with the advantages and disadvantages of natural recovery. This assessment process is known as NEBA.

4.13 **OSD Data Sheet**. Document prepared by the manufacturer/supplier of the OSD containing information on physical and chemical properties of the product, potential hazard and how to work safely with the product. It also contains information on usage, storage, handling and emergency procedures related to the hazard of the OSD.

4.14 **Surfactant**. A substance which has the effect of altering the interfacial tension between oil and water.

4.15 **Toxicity**. Inherent potential or capacity of a material to cause adverse effects in living organisms. Aquatic toxicity is the effect of chemicals present in the dispersant on the aquatic organisms. For the purpose of this policy, it is determined as the incipient lethal limits post determining 96-hour LC 50 test conducted by an authorized testing agency.

4.13 **Viscosity**. Viscosity of oil is its resistance to flow. Viscosities decrease with increasing temperature and hence the seawater temperature and absorption of heat from the sun are important considerations.

4.14 **Weathered Oil**. When oil is spreading and moving over the sea surface, a series of natural processes change the physical and chemical properties of the oil. This includes spreading, evaporation, dispersion, emulsification, dissolution, biodegradation, oxidation and sedimentation.

GUIDELINES ON USE OF OIL SPILL DISPERSANT IN INDIAN WATERS

5.1 Type I Conventional, Hydrocarbon-base dispersant shall not be used.

5.2 Type II water dilutable concentrate dispersant shall be used either by spraying from ships or boats in the diluted form (1 part of dispersant to 10 parts of sea water) in the ratio of 1 part of dispersant to 2-3 parts of oil (equivalent to 1 part of concentrate dispersant to 20-30 parts of oil for mainly combating offshore spills).

5.3 Type III concentrate dispersant shall be used undiluted by spraying from aircraft or other suitable vessels in the ratio of 1 part of dispersant to 20-30 parts of oil for mainly combating offshore spill.

5.4 Type II/III* (combination) concentrate type dispersant shall be used undiluted from aircraft (fixed or rotary wing) in the ratio of 1 part to 20-30 parts of oil.

5.5 Type II/III* (combination) concentrate dispersant can also be used from ships or boats using appropriate spray gear in the diluted form similar to Type II for combating mainly offshore spills.

5.6 **No OSD** shall be used in case of light distillate fuel spills.

5.7 Type II, III and Type II/III combination dispersant can be used on high spreading rate light crude oil spill.

5.8 Type III and Type II/III combination (in concentrate) dispersants can be used on low spreading rate high viscous crude, residues, emulsions, waxy crudes and water in oil emulsions. However, it should be done with utmost care and with monitoring regime in place for assessing the effectiveness of dispersant use.

5.9 **No dispersant shall be used on weathered viscous emulsions** (chocolate mousse) at sea.

5.10 Before applying OSD on spilt oil, application rate shall be calculated for effective results. For calculation refer **Annexure I**.

5.11 To achieve a good dispersant – oil contact, OSD is to be sprayed in such a way that it reaches the surface of oil and do not penetrate through the layer of floating oil. This can be achieved by combining appropriate spraying technique and suitable droplet size. Droplet size of 0.4 to 0.7 mm, resembling light rain is considered optimal for achieving the required dispersant-oil contact.

5.12 Effectiveness of the OSD is to be checked by conducting a test spray to ascertain if the OSD is working. A milky white plume will be visible if the dispersant has missed the oil or it is ineffective on the type of oil spilled. The dosage rate, droplet size and application technique may be reviewed as considered appropriate for achieving the required effectiveness of OSD before resuming the application.

Environmental Considerations

5.13 Use of dispersants has to be determined by a comparison of potential damages to the marine environment from both treated and untreated oil with consideration of both long-term and short-term effects. Though, not all aspects of the impact of dispersants on the marine environment are fully understood, however, generalisations can be made with regard to areas where dispersants can be applied. While, application in areas of a high dilution capacity and a high flushing capability i.e., open water is preferred, areas where the dispersant/oil mixture may be concentrated or have a high residency period viz. confined waters such as small bays, bottled harbours and marshes should be first assessed whether the conditions are suitable for dispersant use or not.

5.14 An important consideration for application of OSD has to be the sensitivity factor. This is the degree to which the environment will react in response to dispersants and the dispersants/oil mixture. Some environments or components thereof are so sensitive that, despite ideal dilution and flushing systems, they will be adversely affected by the toxicity of dispersants and of dispersed oil. However, in reality it is often observed that the short-term effects are much less damaging than if the environment was left exposed to untreated oil. Therefore, it is very important to identify specific sensitive resources, both sub-surface and surface in the area being considered for dispersant use.

5.15 In addition, due consideration should also be given to the prevailing wind which directly influence untreated oil and current which would more directly influence dispersed oil.

5.16 The use of dispersants is largely dependent upon balancing the consequences of response options and choosing the one that will best preserve the most highly valued resource.

5.17 The effects of dispersants on marine life depend on the conditions in which they are applied and also the type of organisms present. In shallow inshore areas and foreshore areas where scope for rapid dilution of dispersed oil is less and where more sensitive resources may be at risk, the use of dispersants may increase the damage already caused by oil. A number of factors that need to be taken into account w.r.t toxicity prior application of OSD are: -

5.17.1 The area should generally have adequate depth of water for dispersion of the oil to occur successfully.

5.17.2 The area should generally have an active water exchange rate.

5.17.3 The spilt oil must be of a type, which is appropriate for, or amenable to, dispersion.

5.17.4 No decided or pre-established methodology to calculate dispersant application relative to depth of water or proximity to coastline is available.

5.17.5 The guiding principle is that of Net Environmental Benefit which should decide a case-by-case application.

GENERAL RULES

6.1 The following are some general rules of thumb for consideration for when to use dispersants and when not to use dispersants:

6.1.1 **When to use Dispersants**.

6.1.1.1 When oil is moving towards shore and the option of containment and mechanical recovery is not viable. Refer Oil Spill Response Matrix placed at **Annexure II**.

6.1.1.2 When mechanical removal method alone is not adequate and a combination of response option is required for mitigating the threat of oil reaching shoreline.

6.1.1.3 When weather/sea conditions preclude use of mechanical recovery.

6.1.1.4 When natural dispersion is not sufficiently rapid.

6.1.1.5 When there are large numbers of birds and other faunas are at risk.

6.1.1.6 When the slick is moving towards areas of important oil-sensitive resources including harbours, mangroves, corals, areas of wildlife aggregation (e.g., birds at sea or on shore, dugong concentration areas, active turtle nesting beaches, etc.).

6.1.2 **When not to use Dispersant**.

6.1.2.1 In very shallow water with poor circulation such as protected bays and inlets where it has been assessed that the dilution of oil will not take place.

6.1.2.2 Near seawater intakes for cooling water, desalination and processing plants.

6.1.2.3 On heavy oils that are not dispersible or oils that have emulsified so badly they are no longer dispersible.

6.1.2.4 Directly above coral reef.

6.1.2.5 Near salt marshes, shellfish beds, fish farms and fish hatcheries.

6.1.2.6 On oil sheen.

6.1.3 When in doubt whether to use dispersant in a particular area or not, contact the nearest Coast Guard Regional Headquarters or District Headquarters/Station for advice and guidance.

ADVANTAGES/ DISADVANTAGES/ LIMITATIONS

7.1 In considering the use of dispersants, it is important to be aware of their specific advantages and, disadvantages/limitations.

7.1.1 **Advantages**.

7.1.1.1 Dispersants can be used under a wide range of weather and sea conditions that would not be suitable for deployment of mechanical equipment for containment and recovery.

7.1.1.2 The use of dispersants is often the quickest response for combating large oil spill.

7.1.1.3 Sea-dispersion of floating oil reduces or removes risk of shoreline contamination and harmful vapours in the vicinity of a spill.

7.1.1.4 Dispersion of floating oil reduces the possible oil contamination of birds and sea-mammals.

7.1.1.5 Dispersion potentially improves biodegradation of oil thereby enhancing the natural breakdown and assimilation into the environment.

7.1.1.6 The timely use of dispersants may inhibit formation of “chocolate mousse”.

7.1.1.7 In general, costs of treatment at sea are lower than costs of dealing with oil on the shoreline.

7.1.1.8 It prevents the generation of large volumes of waste material often associated with shoreline cleanup.

7.1.1.9 Response to remote locations can be undertaken relatively faster by aerial spray of OSD.

7.1.1.10 Dispersant use reduces exposure and safety risk to the response personnel and the public.

7.1.2 **Disadvantages**.

7.1.2.1 Dispersed oil may adversely affect marine ecology in shallow/undisturbed sea conditions especially sedentary species, fish forms, salt marshes and areas of low water exchange.

7.1.2.2 Oil is not removed but dispersed into the water column.

7.1.2.3 Dispersed oil goes to areas where it would normally not go and may adversely affect certain biota which otherwise would not be reached by surface oil.

7.1.2.4 If oil dispersion is not achieved, the effectiveness of other response options on such oil will decrease.

7.1.2.5 Dispersants are not effective for high viscosity oils as oil viscosity is a limiting factor to the efficiency of dispersants. **Annexure III** represents oil viscosity limit where dispersants are deemed to be ineffective.

7.1.2.6 There is relatively short time (OSD window) for application of dispersants which is generally the first hours/day of spill, before the oil becomes non dispersible as it becomes too viscous. This time period is generally referred as “window of opportunity” which needs to be utilized for ensuring effective use of OSD.

OSD APPROVAL BY ICG

8.1 ICG is the CCA nominated by Govt. of India for oil spill response and hence exercises its functional authority for approval of OSD which can be used in Indian waters.

8.1.1 The ICG is the designated national authority under the National Oil Spill Disaster Contingency plan (NOSDCP) for co-ordination of all types of oil pollution response which includes containment, mechanical recovery and dispersion of oil spills by application of OSD at sea.

8.1.2 ICG has two Seaboards viz. Western Seaboard and Eastern Seaboard and five Coast Guard regions: North West, West, East, North East and Andaman & Nicobar. These regions are further divided into 16 Coast Guard Districts and 42 Coast Guard Stations located along the coastline and in the island territories of Lakshadweep and Andaman & Nicobar Islands.

8.1.3 The Regional Commanders are responsible for combating oil spills in their respective areas of responsibility and have the Regional Oil Spill Disaster Contingency Plan (ROSDCP) in place. There are four pollution response teams located at Chennai, Mumbai, Vadinar and Port Blair with qualified response personnel and well-stocked inventory of response equipment.

8.1.4 OSD approved by ICG can be used by response agencies with record of NEBA undertaken to arrive at a decision to that use of OSD would be apt under the prevailing circumstances to mitigate damage to marine environment.

8.1.5 Any use of OSD should be reported to nearest ICG Spill Notification Centre as described in **Annexure IV**.

8.1.6 Though, mechanical response to an oil spill is the preferred option, various response options for oil spill, in circumstances where there is a threat to sensitive areas if the oil reaches into these locations, it is advisable to use dispersants well in advance with the “window of opportunity”.

8.1.7 The reports on OSD tested by NIO, Goa are held by ICG and evaluated w.r.t chemical and physical properties. For an OSD to be used in Indian waters, it is imperative that the product should have been tested by NIO, Goa (or any other laboratory authorized by appropriate authority of GOI to carry out test on OSD). Based on the test reports, NIO recommends the use of dispersants and further approval for use is given by the ICG. ICG will publish the list of approved products for consideration of the response agencies for stocking and use. The procedure to apply for approval of OSD by vendors is placed at **Annexure V**.

8.1.8 Any request by manufacturers or any vendor for evaluation of their product for assessment w.r.t suitability for use in Indian waters and mentioned in these guidelines may be forwarded to ICG along with test report and information as per **Annexure VI** to this document.

8.1.9 Only approved dispersants shall be used in those cases where results of NEBA indicate that failure to use dispersants will cause more severe impact on biological resources and economic facilities. The limitation of dispersant must be understood and carefully evaluated before any application.

OSD SPECIFICATIONS FOR USE IN INDIAN WATERS

9.1 Approval for use of a particular OSD will be granted after taking into consideration a number of factors such as: toxicity, effectiveness, stability, biodegradability, health hazards, the physical and chemical properties of OSD.

9.2 As a general consideration, the dispersant should comply with specification given in succeeding paragraphs.

9.3 **Phase**. The dispersant must be in liquid form and contain no solid material, suspended matter, or additional liquid phases.

9.4 **Prohibited Ingredients**. The dispersant must not contain: benzene, carbon tetrachloride or other chlorinated hydrocarbons, phenol, cresol, caustic alkali, or free mineral acid.

9.5 **Aromatic Hydrocarbons**. The dispersant, must have an upper limit of 3% total aromatic hydrocarbons as determined by gas chromatography/flame ionization detection, infrared spectroscopy, or fluorescence detection.

9.6 **Stability**. The surfactants must be wholly soluble in the solvent and must remain uniformly distributed at all temperatures from 0° to 50° C.

9.7 **Shelf Life**. The dispersant when stored according to the manufacturer's recommendations, in the original sealed containers, with ambient temperatures ranging between 0° to 50°C, should have a storage life of minimum five (5) years. Beyond five years, the use of dispersant is subject to fulfilling all specifications after re-testing. The shelf life of the product may be extended up to three years depending on the efficiency test results conducted on request of the user/buyer and recommendations of the NIO/suitable Government approved testing facility. Copy of these tests and extension of shelf life granted for the product is to be submitted to ICG for maintaining records and updating database by the organisation conducting these tests.

9.8 **Flashpoint**. The dispersants will have flash point of minimum 60°C as determined by the Pensky Marten closed cup method-D.

9.9 **Cloud Point**. The dispersant will have cloud point of 0°C (minimum). The dispersant must not separate into layers at temperatures over 0°C.

9.10 **Viscosity**. The dispersant viscosity at 0° C must be 250 Cst at a shear rate of 103/s.

9.11 **Toxicity**. Each dispersant must be tested for toxicity with the object of determining 96-hour LC 50 (Lethal concentration to 50% of test organism population) and to establish incipient lethal limits. (The testing will be carried out at NIO/or any other laboratory authorized by appropriate authority of GOI to carry out test on OSD).

9.12 **Toxicity Limit**. The toxicity criterion to be adopted for evaluation will be: -

9.12.1 Non-toxic: > 1000

9.12.2 Slightly Toxic: >10 and <100

9.12.3 Moderate Toxic: >1 and <10

9.12.4 Toxic: < 1

9.12.5 **Only non-toxic dispersants will be approved for use in Indian waters.**

9.13 **Biodegradability**. The surfactant will be tested for biodegradability and only biodegradable dispersants will be approved for use in Indian waters.

9.14 **Efficiency Index**. Percentage by weight of the test oil which has been transferred as small droplets into the water phase under the test conditions assuming complete and even distribution at the time of sampling. The efficiency criteria will be: -

Type II	50% (minimum)
Type III	60% (minimum)
Type II/III	60% (minimum for both)

9.15 **Stability Index**. The dispersant/oil emulsion should be stable/fairly stable (> 50 %).

9.16 The OSD should also be free of hydrocarbon solvents and safe for personnel handling the product and should not pose any health hazard.

9.17 The test standards/protocols for Toxicity, Efficiency, Stability and Biodegradability tests are placed at **Annexure VII** for reference. Further information on the test criteria/protocols may be obtained from NIO.

STORAGE

10.1 Dispersants are to be stored in sealed containers, preferably in shed and away from direct sunlight.

10.2 Dispersants are to be stored as per the recommendations of the manufacturer for storage and monitoring of the product.

10.3 Dispersants can be stored in the integral tanks of specialised Pollution Response Vessels for ready use.

10.3 Dispersant that are stored unopened should last for many years. However once opened, the dispersant should be tested periodically for its effectiveness. If physical parameters have significantly changed or the expiry date has been reached, a dispersant efficiency test should be conducted for extension of shelf life or the OSD can be disposed and replenished.

10.2 Dispersant should not be stored after they have been diluted with seawater.

PACKAGING

11.1 **Corrosion Resistance**. The containers used for packing the OSD shall be suitable for use in a marine environment and should not be degraded by exposure to temperatures in the range of – 30°C to + 50°C, humidity up to 100% and high levels of UV radiation.

11.2 **Corrosiveness/Human Toxicity**. The dispersant must be non-corrosive to storage containers and contain no substances that are normally considered to be toxic to humans.

11.3 **Batch Numbers**. The dispersant's batch number and year of manufacture shall be clearly marked on the side of each container.

DISPOSAL

12.1 Disposal of unusable dispersants is the responsibility of the dispersant owner.

12.2 The disposal of OSDs must be undertaken by the buyer as per the existing regulations of various States in consultation with the State Pollution Control Board. Further, a suitable arrangement in the procurement contract for buy back or disposal by the supplier may also be considered by the user.

12.3 Records of the disposal of OSD is to be maintained by the user which are to be checked during joint inspection of Tier-1 response facilities.

STOCKING CRITERIA

13.1 **Stocking Criteria**. The quantity of OSD to be stocked shall be commensurate with oil spill risk as per approved contingency plan. The general criterion is that the NIO approved OSD shall be stocked to a minimum of Tier-I size spill for ports and oil handling agencies. {e.g., Ports/Oil handling companies having a risk exposure of 700 tons should ideally stock 25-35 tons of OSD. i.e. (1: 20-30 parts of oil)}.

13.2 The minimum stock of OSD by the response agencies is to be maintained as per the Chairman NOSDCP circular 03/2018.

13.2 The Coast Guard District Headquarters, Air Enclaves, Pollution Response Vessels and Pollution Response Teams shall at all times stock the minimum quantity of OSD as per the policy and orders in vogue.

Annexure I

(Refer Para 5.10)

APPLICATION OF OSD

1. **Important Factors**.

(a) To achieve best results, dispersant application should start as soon as possible and has to be planned in the first stage of a response strategy. Choice of dispersant, method and rate of application is also important for good results.

(b) Many oils form stable water-in-oil emulsions (chocolate mousse), the viscosity of which is higher than that of the original oil. Since, chocolate mousse is very difficult to disperse; treatment with dispersants should start before the mousse formation.

(c) Dispersant application is a specialized operation that requires preparation and trained manpower.

(d) Good organization on the ground is also needed to enable spraying operation to continue for the maximum available time during day light hours. Stock piles of dispersants (as mentioned in the contingency plan) should be stocked and conveniently located in order to supply to vessels and aircraft with the minimum delay.

(e) The window of opportunity can be calculated by ADIOS package/oil spill modeling studies. The package requires certain data inputs including the life of oil and various other factors associated with weathering such as wind current, tidal range and wave height.

(f) DMP2 package of NOAA, USA software can also be used.

2. **Application Methods**.

(a) Dispersants can be applied to spilled oil in open waters by boats or aircrafts. Whichever method of application is used, the key to a successful response is the ability to target the thickest part of the oil slick within a short time and before weathering.

(b) **Vessel Spraying**. Dispersants are usually applied from boats/vessels equipped with spray arms. Spray units can be portable or permanently installed on a vessel and systems are available that deliver the dispersant either undiluted or diluted with sea water. Vessels offer certain advantages for dispersant spraying because they are usually readily available, easy to load and deploy, have cost advantages over aircraft and can apply dispersant fairly accurately to specific areas of a slick. Nevertheless, they also have serious limitations, particularly for larger spills, because of the low treatment rate which they offer and the added difficulty of locating the heaviest concentrations of oil from the bridge of a vessel. These problems can be partially overcome by controlling the operations from a spotter aircraft.

(c) **Aerial Spraying**. Aerial spraying of dispersant offers the advantage of rapid response, high treatment rates and optimum dispersant use. The aircraft should be capable of operating safely at a low altitude (typically 50 to 100 feet for larger aircraft) and at relatively low speeds (50 to 150 knots). Only concentrate dispersants are suitable for aerial spraying as they require no mixing.

3. **Application Rate**.

(a) One of the main challenges of dispersants lies in the estimation of the volume of oil to be treated and, hence, the calculation of the appropriate application rate. To achieve this, assumptions must be made concerning the average thickness and volume of an oil slick. The ratio of dispersant to oil required for effective dispersion varies between 1:3 to 1:50 depending on the type of dispersant, the type of oil and prevailing conditions. For planning purpose, the application rate can be calculated (as per the Charts 1 & 2) as follows: -

(i) Estimation of the volume of oil (in litres/hectare)

(ii) Calculation of the quantity of dispersant needed to achieve the dose required (litres) and the application rate (litres/hectare)

(b) As a general rule, most fresh oil on the sea surface will spread within a few hours to reach an average thickness of 0.1mm (10^{-4} m). At this thickness the volume of oil in one hectare (10,000 m^2) would be: -

$10^{-4}m \times 10^4 m^2 = 1m^3$ or 1,000 litres.

(c) For a dosage of 1:20, the quantity of dispersant required would be: 1000 liters/20 = **50 litres**, and the application rate would be 50 litres/hectare (10 Imp. gal/acre). The discharge rate can then be calculated by multiplying the application rate (litres/m^2) by the swath width of the spraying arm (m) and the speed of the aircraft (m/s). An illustration for 8 m spray arms is shown in Charts 1 & 2.

Chart 1: Neat (concentrated) Type III, (type II/III) Dispersant Application

8 mm Spray Arms

Vessel Speed (knots)	Neat Application Rate (Black Nozzles) Litres/Hectare	Neat Application Rate (Yellow Nozzles) Litres/Hectare	Area Treatment Rate Km^2/hr
4	430	287	0.13
6	287	191	0.20
8	215	143	0.27
10	172	115	0.33
12	143	96	0.40

Black nozzle: 90 LPM; Yellow nozzle: 48 LPM

Chart 2: Diluted (Type II), (Type II/III) Dispersant Application

8 mm Spray Arms

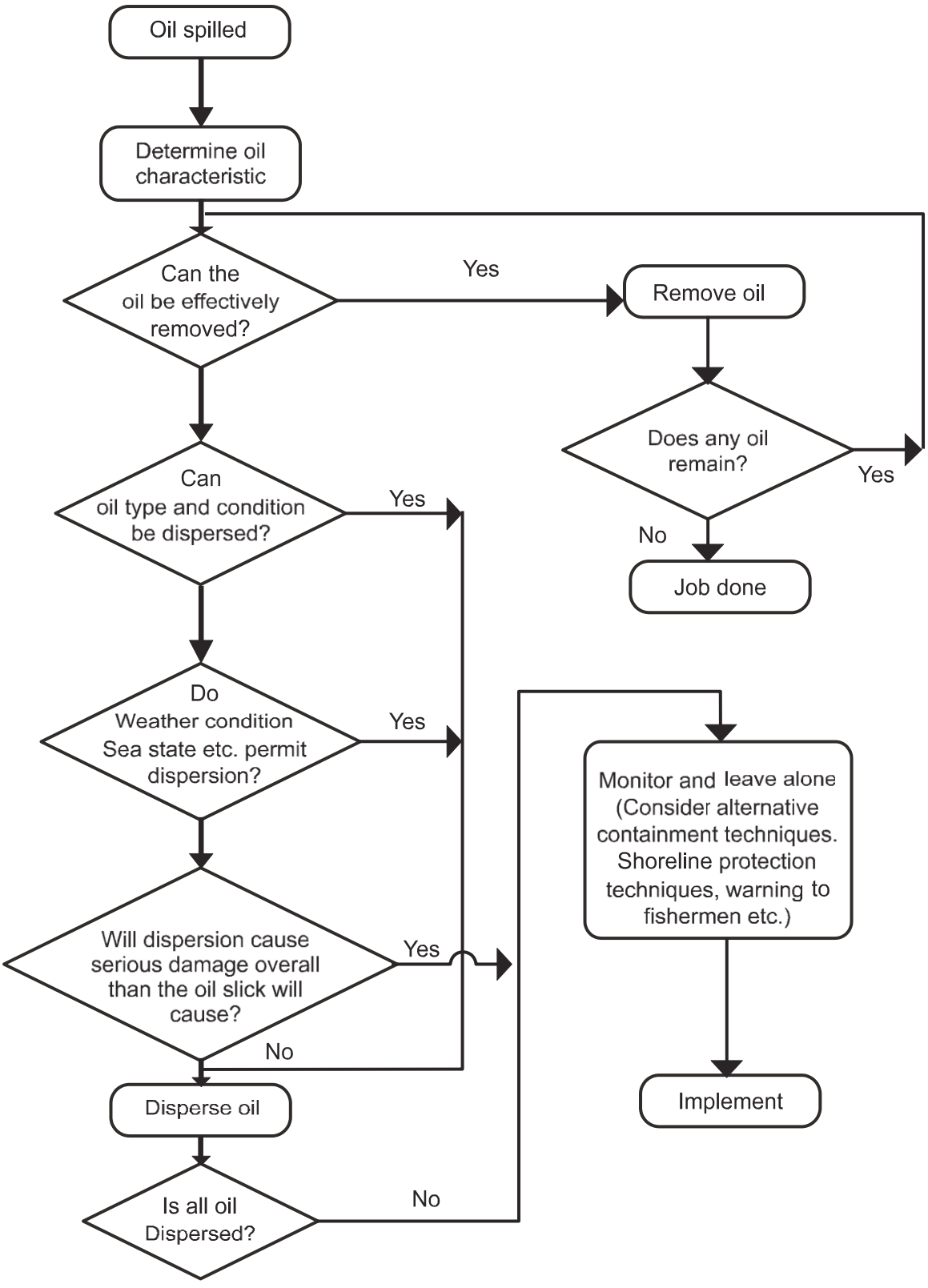
Vessel Speed (knots)	App. Rate Litres/ Hectare (10 LPM)	App. Rate Litres/ Hectare (15 LPM)	App. Rate Litres/ Hectare (20 LPM)	App. Rate Litres/Hectare (25 LPM)	App. Rate Litres/ Hectare (30 LPM)	Area Treatment Rate Km/hr
4	43	65	86	108	129	0.13
6	29	44	58	73	86	0.20
8	22	33	44	55	65	0.27
10	17	26	34	43	52	0.33
12	14	21	28	35	43	0.40

(10 LPM: 10 litres of dispersant diluted with 90 litres of sea water)

Annexure II

(Refer Para 6.1.1.1)

OIL SPILL RESPONSE MATRIX



Annexure III

(Refer Para 7.1.2.5)

EFFECTIVENESS OF OSD

1. **Impact of Oil Viscosity on Dispersant Effectiveness**. The viscosity limit beyond which dispersants are deemed to be ineffective depends on many variables like type of dispersant, nature of oil and prevailing conditions. Therefore, there is no proven data on the limit of viscosity beyond which the dispersant would not be effective. However, general guidelines on the probable effectiveness of dispersant and oil viscosity are as tabulated below: -

Oil type/viscosity	Dispersant Effectiveness
Light distillate fuels (petrol, kerosene, diesel oil)	Dispersant use not advised. These oils will evaporate and naturally disperse quite rapidly in most conditions.
Oils with viscosity up to 5,000 cSt	Dispersant use is likely to be effective.
Oils with viscosity between 5,000 and 10,000 cSt	Dispersant use might be effective.
Oils with viscosity above 10,000 cSt	Dispersant use is likely to be ineffective (though success is reported on oils with viscosity greater than 20,000 cSt).

Source: IPIECA [International Petroleum Industry Environment Conservation Association], (2015), "Dispersants: surface application"

Annexure IV

(Refer to Para 8.1.5)

SPILL NOTIFICATION POINTS

1. **Oil spill at Sea** - All oil spill incidents in maritime zones of India are to be reported to as follows:-

Ser	Area of Spill	Reporting Point
(a)	West coast of India	Maritime Rescue Coordination Centre, Mumbai mrcc-west@indiancoastguard.nic.in
(b)	East coast of India	Maritime Rescue Coordination Centre, Chennai mrcc-east@indiancoastguard.nic.in
(c)	A&N Islands	Maritime Rescue Coordination Centre, Port Blair mrcc-ptb@indiancoastguard.nic.in
(d)	Anywhere in Indian waters	(i) Regional Marine Pollution Response Centre rmprc-icg@indiancoastguard.nic.in (ii) Competent National Authority cna.india@indiancoastguard.nic.in and dte-fe@indiancoastguard.nic.in) (iii) DG Com Centre dgcommcentre-dgs@nic.in)

2. The details of coordinating agency for various area of responsibility including the contact points are enumerated below: -

SL	COORDINATING AGENCY & AREA OF RESPONSIBILITY	POINT (S) OF CONTACT	AGENCIES /NODAL POINTS IN CENTRE/STATE FOR CONVEYING THE REQUEST FOR ASSISTANCE FROM MOD	BEARING COST OF MARINE OIL SPILL DISASTER
1.	**Indian Coast Guard** **Tier -1 response** in various maritime zones except in the water of ports and within 500 mtrs of offshore exploration and production platforms, coastal refineries and associated facilities such as Single Buoy Mooring (SBM), Crude Oil Terminal (COT) and pipelines.	Competent National Authority Secretariat, Respective Coast Guard Regional Headquarters {Gujarat- RHQ(NW), Maharashtra, Goa, Karnataka, Kerala and L&M Islands – RHQ (W), Tamil Nadu, Puducherry, Andhra Pradesh - RHQ(E), Odisha, West Bengal - RHQ(NE) and A&N Islands – RHQ (A&N)}	--	The cost /damages caused due to an oil spill incident is to be claimed by agencies directly from the insurer of the polluter. DG Shipping, being the maritime administrator establishes a help desk through which all the claims are required to be settled. Following cost/damages can be claimed from an oil spill incident: (i) Costs of clean up and preventive measures. (ii) Property Damage. (iii) Economic loss in the fisheries, mariculture and fish processing sectors.
2.	**Ports** **(Major & Non-Major)** **Tier -1 response** in the water of ports (Harbour and Anchorage area) coastal refineries in port limits and associated facilities such as Single Buoy Mooring (SBM), Crude Oil Terminal (COT) and pipelines.	Respective Port Chairman/Port Officer	State/UT Administration, Ports and Oil Handling Agencies may seek assistance of MoD, when the magnitude of oil spill is beyond their response capabilities that is beyond Tier – 1. The respective heads may forward their requisition to the Director	

3.	**Oil Handling Agencies and Oil Installations** **Tier-1 response** in the water within 500 mtrs of offshore exploration and production platforms, coastal refineries and associated facilities such as Single Buoy Mooring (SBM), Crude Oil Terminal (COT) and pipelines.	Respective Offshore exploration and production platform operator	General, Secretariat, Competent National Authority, Coast Guard Headquarters, National Stadium Complex, New Delhi- 110001.	(iv) Economic loss in the tourism sector and other related businesses. (v) Other losses including costs of reasonable measures to reinstate the environment and post-spill studies.
4.	**Indian Coast Guard** **Tier – 2 Response** in maritime Zones of India	The Director General, Secretariat, Competent National Authority, Coast Guard Headquarters, National Stadium Complex, New Delhi-110001 Telefax – 011-23383196 (**24x7**), 0120-2975726, 011- 23074131 Email- cna.india@indiancoastguard.nic.in dte-fe@indiancoastguard.nic.in	--	

Annexure V
(Refers to Para 8.1.7)

PROCESS FOR APPROVAL OF OSD BY INDIAN COAST GUARD

Approvals.

1. An OSD may be approved only if the ICG is satisfied that it meets all the relevant standards and requirements. The criteria for approval of OSD is as follows:-

(a) Application for an approval must be accompanied by:-

(i) Copies of any permissions or restrictions granted or imposed by the Environmental Protection Agency of any country in respect of that OSD.

(i) The test results, supporting data and certification by NIO or equivalent agency in India.

(ii) The details of the formulation used in the preparation of the OSD, including:-

(aa) Percentage by weight of each component of the total formulation; and

(ab) Percentage of aromatics.

(ac) Chemical name (if any) of each component.

(ad) Function of each component.

(ae) Where applicable, a material safety data sheet; and

(af) Where applicable, CAS (Chemical Abstracts Service) registry number.

(ag) The details of the recommended application procedures, concentrations, and conditions for use.

(ah) The details of recommended handling and storage procedures and any precautions to be taken when using the OSD.

(aj) The name and contact details of the manufacturer of the OSD.

(ak) Warranty from the manufacturer of the OSD that each subsequent batch of the product will be the same formulation as the batch that was tested as per the requirement.

2. The ICG may require an applicant to:-

(a) Elaborate on specified information set out in the application.

(b) Supply additional specified information.

(c) Supply a sample of the OSD for testing, at the applicant's expense.

3. The applicant must supply the ICG with:-

(a) A sample of the OSD, if requested by the ICG.

(b) Instructions from the manufacturer on the use of the OSD.

(c) The applicant must, when a sample of an OSD is requested by the ICG, supply the ICG with the OSD in one or more containers that are:-

(i) Sound, clean and dry.

(ii) Suitable for the OSD.

(iii) Marked with:-

(aa) The name of the manufacturer.

(ab) The name of the OSD.

(ac) The OSD type.

(ad) The dispatch date from the supplier.

(ae) The expiry date of the OSD.

(af) Any relevant safety warnings in compliance with the labelling requirements of India.

Approval Assessment and Decision

4. Where an application is made by the applicant:-

(a) The ICG would approve an OSD if that OSD meets the assessment standards and requirements prescribed.

(b) For each approval, the ICG would publish a notice on the ICG website as soon as practicable, listing the OSD as approved product for use in Indian waters.

Standing Condition

5. The applicant must notify the ICG as soon as any of the following circumstances arise:-

(a) The OSD becomes unavailable.

(b) Where the applicant is the manufacturer of the OSD:-

(i) Where the OSD formulation has changed.

(ii) A change in the manufacturer or the manufacturer's name or address.

(iii) A change in the applicant's address.

Withdrawal of OSD Approval.

6. The ICG may withdraw an approval where the ICG is satisfied that:-

(i) Evidence from analysis of one or more samples of the OSD do not conform to the specifications or chemical formulation upon which the ICG had relied when approving the OSD.

(ii) Any requirement for permission or approval, or any restriction or control imposed, in respect of that OSD under any applicable Indian legislation is not being complied with.

(iii) The OSD, or additional specified information about the OSD, is not being supplied upon request as required.

(iv) Any of the conditions imposed relating to the OSD is not being adhered to.

(vi) The OSD is no longer manufactured or available for use in India.

7. Before deciding to withdraw an approval for any of the reasons specified above the ICG would:-

(a) Publish a notice on the ICG website.

(b) Where applicable, notify the applicant providing the reasons why the ICG is considering to withdraw the approval.

Subsequent Testing of an OSD.

8. The ICG may at any time conduct testing of an OSD to ascertain whether the OSD continues to comply with the appropriate standards and requirements.

Annexure VI

(Refer to Para 8.1.8)

OSD DATA SHEET

Product Information

Chemical Name:

Chemical Formula:

Chemical Family:

Description:

Chemical Composition

Hazardous Ingredients Information

Health Information and Protection

Nature Of Hazard

Eye Contact:

Skin Contact:

Inhalation:

Ingestion:

First Aid

Eye Contact:

Skin Contact:

Inhalation:

Ingestion:

Workplace Exposure Limits

Permissible Exposure Limits:

Limit Values:

Precautions

Personal Protection:

Ventilation:

Chronic Effects:

Fire & Explosion Hazard

General Hazard:

Fire Fighting:

Decomposition Products Under Fire Conditions:

Spill Control Procedure

Land Spill:

Water Spill:

Typical Physical & Chemical Properties

Specific Gravity (@ F):

Vapour Pressure (mmHg @ F):

Density:

Solubility in Water:

Viscosity (cST @ F):

Specific Gravity of Vapour (@ 1 atm Air + 1):

Freezing/Melting Point/Range (F):

Evaporation Rate (n-Bu Acetate =1):

Boiling Point/Range (F):

Shelf Life:

Reactivity Data

Conditions to avoid instability:

Conditions to avoid hazardous polymerisation:

Materials & conditions to avoid incompatibility:

Hazardous decomposition products:

Storing And Handling

Electrostatic Accumulation Hazard:

Storage Temperature (F):

Storage Pressure (mmHg):

Loading Temperature (F):

Loading Viscosity (cST @ F):

Annexure VII

(Refer to Para 9.17)

TEST STANDARD PROTOCOLS

The test protocols for testing of Oil Spill Dispersants are as follows:-

1. **Efficiency and Stability**. The testing methodologies followed for Efficiency and stability are those recommended by the Warren Spring Laboratory U.K. [A Specification for Oil Spill Dispersant, Appendix A to WSL Report LR448 (revised 1090)-Warren Spring Laboratory] and guidelines of Indian Coast Guard, ICG 2009.

The dispersant efficiency index is defined as the percentage by weight of the test oil which has been transferred as small droplets into water phase under the test conditions, assuming complete and even distribution at the time of sampling. The most efficient dispersant is that which produces the finest droplets.

The basis for efficiency rating of any chemical dispersant is the stability of its oil-in-water emulsion. The finer the oil droplets, greater is the stability of the dispersion. The most stable dispersant is the one which hinders fine oil droplets from coalescence and reformation of the oil film.

2. **Toxicity**. Toxicity is conducted as per EPA guidelines (Environmental Protection Guidelines) using locally available marine/estuarine species (shrimps/fishes). Firstly, the mortality rate was estimated followed by determination of lethality 96h LC50 using the Finney method 1971. Toxicity criterion will depend on various parameters like distance from the shore, sensitivity of the regions, duration of the spill, etc. LC50 values above 1000 will be considered as non-toxic and preferred.

3. **Biodegradability**. The test for OSD will be carried out following OECD guidelines (1992). Biodegradability testing can be done using either aerobic or anaerobic biodegradability methods. The aerobic biodegradability can be determined according to the OECD Guideline 306 (OECD 1992), which is the preferred method for testing biodegradability in seawater under the Paris Commission's Notification Scheme for Offshore Chemicals (PARCOM). The biodegradability (%) determined will be compared to reference substance like Sodium Benzoate. The anaerobic biodegradability potential will be assessed through following OECD Guidelines which is based on ISO 11734–anaerobic closed bottle 60-d test method.

References

(a) The Use of Dispersants in Marine Oil Spill Response, a consensus study report of the National Academies of Sciences, Engineering and Medicine. USA

(b) A Specification for Oil Spill Dispersants, Appendix A to WSL Report LR448 (revised 1090)-Warren Spring laboratory.

(c) The Approval and use of Oil Dispersants in the UK, Ministry of Agriculture, Fisheries and Food, 1997.

(d) New Zealand National Marine Oil Spill Contingency Plan, Table-1.

(e) Manual on oil Pollution, Section IV, Combating Oil Spill, IMO, Table-1.

(f) IPIECA IGOP (2015). Dispersants: surface application, good practice guidelines for incident management and emergency response personnel

(g) REMPEC (2011). Guidelines for the use of dispersants for combating oil pollution at sea in the Mediterranean region

(h) IPIECA IGOP (2014). At-sea monitoring of surface dispersant effectiveness, Final Report

(j) GESAMP (2019). GESAMP Hazard Evaluation procedure for chemicals carried by Ships

(k) ITOPF (2014). TIP