MAZAGON DOCK SHIPBUILDERS LIMITED

ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR EXTENSION OF NAVIGATIONAL CHANNEL AT MAZAGON DOCK, MUMBAI

RISK ASSESSMENT AND DISATER MANAGEMENT PLAN

वाप्कोस लिमिटेड
WAPCOS LIMITED
(भारत सरकार का उपक्रम - जल संसाधन, नदी विकास और गंगा संरक्षण मंत्रालय)
(A Government of India Undertaking - Ministry of Water Resources, River Development & Ganga Rejuvenation)

WAPCOS LIMITED

(A Government of India Undertaking)
Tel. +91-124-2397396,
Fax. +91-124-2397392
Email: environment@wapcos.co.in

November 2017

CONTENTS

1.	PROJECT DESCRIPTION	1
1.1	PROJECT BACKGROUND	1
1.2	CORE ACTIVITY	1
1.3	DREDGING REQUIREMENTS	2
1.4	SITE AREA	3
1.5	NEED OF RISK ASSESSMENT (RA) AND DISASTER MANAGEMENT PLAN (DMP)	5
1.6	BASIS OF RA AND DMP	5
1.7	DURATION OF CAPITAL DREDGING	6
1.8	INTERNATIONAL LAW	6
1.9	HUMAN RESOURCE	6
1.10	CLIMATE	7
1.11	WIND DIRECTION	7
2.	HAZARD IDENTIFICATION	7
2.1	HAZARD IDENTIFICATION	7
2.2	DREDGING HAZARDS	8
2.3	PROCESS HAZARDS	8
2.4	MAN MADE DISASTERS	10
2.5	SEISMICITY	10
2.6	OTHER HAZARDS	10
2.7	CATEGORIZATION OF HAZARDS	10
2.8	DIESEL/HSD	11
2.9	FUEL OIL	11
3.	ANALYSIS OF SCENARIOS	12
3.1	INTRODUCTION	12
3.2	LIKELY HAZARDS DURING DREDGING	13

3.3	CONSEQUENCE IN CASE OF EXPLOSIONS	14
4.	SEVERITY AND PROBABILITY	15
5.	RISK ASSESSMENT	16
6.	RISK REDUCTION	17
7.	DISASTER MANAGEMENT PLAN	1

RISK ANALYSIS AND DISASTER MANAGEMENT PLAN

1. PROJECT DESCRIPTION

1.1 PROJECT BACKGROUND

Mazagon Dock Shipbuilders Limited (MDL) is a premier leading warship building and offshore fabrication yard in India under Ministry of Defence, Government of India. The Yard was established in the 18th century, and over 200 years of its existence, has earned a reputation for quality work and established a tradition of skilled and resourceful service to the shipping world in general and the Indian Navy, Coast Guard & ONGC in particular. The Mazagaon Dock Shipbuilders Limited (MDL), Mumbai, is situated on the leeside of Salsette/Mumbai Island on the west coast of India in the state of Maharashtra. The coordinates of the site are 18°57'58" N and 72°51' 00" E in the Mumbai harbour area.

The water depth available in the proposed channel varies from 1.5 m to 2.0 m CD. A depth of about 8.0 m is required for safe navigation considering the max draft of the vessel and the clearances of a destroyer class vessel. However, maximum depth available during high tide varies from 6.0 m to 6.5 m.

The project would require dredging over an area of 250 to 350 m wide and 2.5 km long channel to make the channel navigable in all weather conditions. The total quantity of dredged material has been estimated to be about 3.0 Mm^3.

The findings of the bathymetry studies concluded that the depth at areas immediately in front of MDL is of the order of -1.8 to -2.2 m below CD whereas it is going up to an extent of -3.8 m below CD towards OCT berth. The sea bed is composed of soft marine clay / silty clay followed by compact clay and silty marine clay.

1.2 CORE ACTIVITY

The dredging process consists of four steps: excavation, vertical transport, horizontal transport and arrangement of dredged material. The project intends to overcome navigational limitations for the movement of vessels within waterfront of MDL and up to

Naval Dock, MDL proposes to establish a well demarcated navigational channel from MDL (Kasara Channel) up to OCT berth. Therefore, the project's core activity is to undertake capital dredging. The objective of capital dredging is to increase the depth of navigational channels while maintenance dredging shall be due to maintain depths.

It is proposed to deploy a Grab dredger to carry out the soil / clay dredging and a Backhoe dredger for dislodging the rocky material. The dredging process is discontinuous and cyclic.

The steps involved in grab dredging are:

- Lowering of the grab to the bottom
- Closing of the grab by pulling the hoisting wire
- Hoisting starts when the bucket is complete closed
- Swinging to the barge or hopper
- Lowering the filled bucket into the barge or hopper
- Opening the bucket by releasing the closing wire.

1.3 PROPOSED PROJECT

Extension and dredging of navigation channel is proposed considering the following reasons:

- ➢ Water depth available at low waters is only 1.5 m to 2.0 m CD which means that the maximum water depth at a tide of 4.0 m (maximum tide available) is 5.5- 6.0 m.
- ➢ Maximum draft of a fully fitted Destroyer being built at MDL would be about 6.2 m, which leaves no room for navigation even at 4.5 m tide. Approximately, 1.8 m water depth below the vessel is required for safe navigation.
- ➢ Considering the maximum draft of the vessel and the clearances, a destroyer class vessel requires approximately 8.0 m water depth for safe navigation.

1.4 SITE AREA

The site area is depicted in Figure-1. The project site is located 1 km west of the mainland (habitat).

Figure-1: Location of Proposed Project

The nearest point (North end) is 1 km from habitation and the farthest point (South End) is 2 km (approximately) from population clusters. The site layout is enclosed as Figure-2.

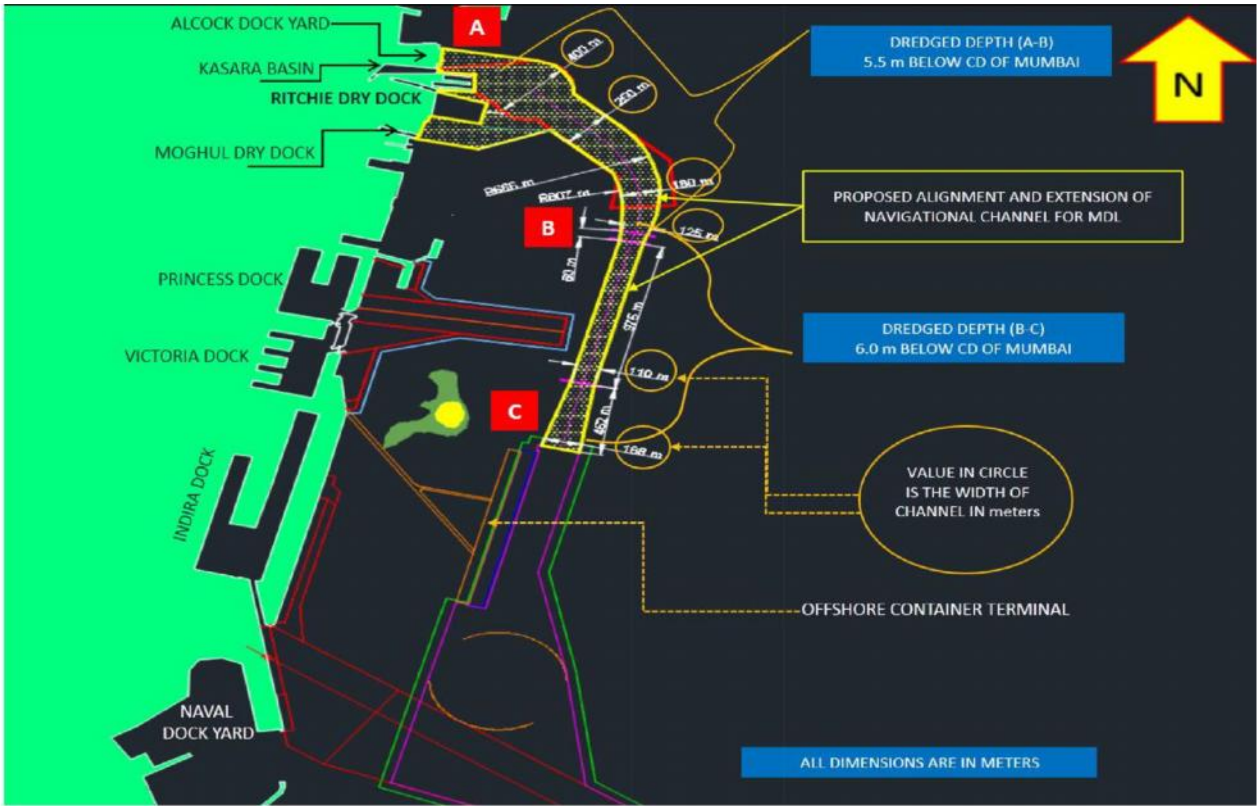

Figure-2: Layout of the proposed navigation channel

1.5 NEED OF RISK ASSESSMENT (RA) AND DISASTER MANAGEMENT PLAN (DMP)

The need for RA and DMP arises is to ensure preparedness to manage any eventuality through a scientific assessment of situations which can cause danger to the project with a potential to harm public life.

1.6 BASIS OF RA AND DMP

The ensuing RA and DMP report has been developed based on information collected from the project proponent, site visits by EIA team, socio-economic data available for the site, meteorological data, and existing risk assessment standards for similar projects along with a pro-active thought process. The report is spread out in two sections. Section-1 deals with the risk aspect of the project and Section-2 covers the Disaster Management Plan. The DMP as it is commonly referred to, also takes its reference from contingency plan. The DMP covers both natural as well as manmade hazards.

The stages involved in Risk Assessment are given in Figure-1.5.

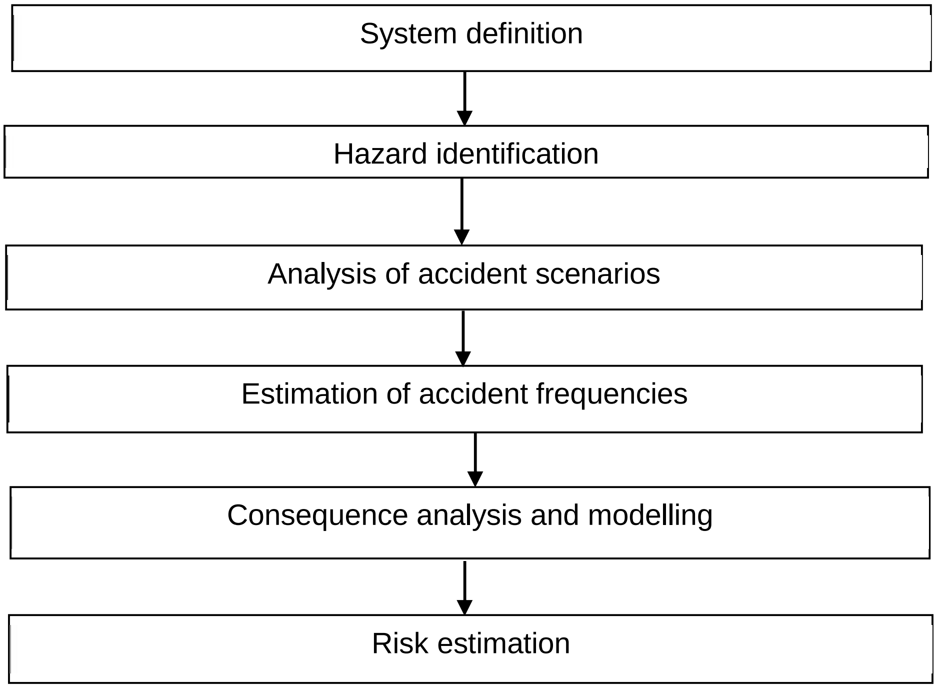

Figure-1.5: Stages in Risk Assessment

1.7 DURATION OF CAPITAL DREDGING

The tentative time schedule for the completion of dredging activity will be 8 months

1.8 INTERNATIONAL LAW

The International Convention for the Safety of Life at Sea (SOLAS) is an international maritime safety treaty. The SOLAS Convention in its successive forms is generally regarded as the most important of all international treaties concerning the safety of merchant ships (sic).

The International Ship and Port Facility Security (ISPS) Code is an amendment to the Safety of Life at Sea (SOLAS) Convention (1974/1988) on minimum security arrangements for ships, ports and government agencies. The code came into force in 2004, and prescribes responsibilities to governments, shipping companies, shipboard personnel, and port/facility personnel to "detect security threats and take preventative measures against security incidents affecting ships or port facilities used in international trade covers the execution of security on vessels" (sic).

Generally, Safety policies are divided into four categories: health and human resources, quality assessment, environment and security of vessels. All major international dredging contractors abide by the recognized standard international codes and have established systems for avoiding unnecessary risk and limiting the number of injuries and incidents. These programmes require a major effort from management and staff as well as a commitment to investments in training and workshops in order to bring complete awareness to both management and the work floor. The aim is to reduce lost-time incidents and to limit the frequency of accidents, which leads to a more efficient operation and lower risks for employees.

1.9 HUMAN RESOURCE

The total number of personnel engaged for the project would be 50 (maximum) in shifts. The minimum number of personnel employed at any given time would be 20-25 depending on work load.

1.10 CLIMATE

The climate of the project area experience a moderate temperature profile. June, July and August experience very high rainfall ranging from 300 mm to 715 mm. The minimum temperature experienced are in the months of December and January, while the maximum temperature are October to December.

1.11 WIND DIRECTION

The predominant wind direction is from East to West. About 30% wind is in the range of 3 m/s to 8 m/s.

2. HAZARD IDENTIFICATION

2.1 HAZARD IDENTIFICATION

Hazard identification is a tool identify hazards associated with a chemical for further assessment and more importantly adequate safety measures can be adopted to screen off personnel from exposure to the same.

Another aim of hazard identification is to keep the plant engineering integrity in accordance with the best design principle for safe and reliable operations. There have been many deliberations about hazard identifications by organizations such as HSE of UK, OECD, DNV, etc. In this regard selected definitions and arbitrations have been provided in succeeding paragraphs. Hazard identification can be achieved from various angles as described below:

1. First – A listing of all equipments located in an area can be done, which is called equipment inventorization and describe all the activities, which are associated with this piece of equipment, including its maintenance. If a particular piece of equipment is not in use, it may be listed in the column "Equipment currently not in use".
2. Second – A list of all on-going projects in a process/storage/handling area may be prepared and the main experimental procedures for the work could be described.
3. Third – A list of all "designated" or "day-to-day" activities performed within the battery limits of the plant can be enumerated.
4. Identification all types of hazard associated with each activity.

2.2 DREDGING HAZARDS

Hazards from dredging have been documented in several case studies. However, due to a highly customized operation, which depends on type of dredging equipment, depth conditions, channel conditions and operational requirements, the hazards can vary from case to case. However, there are common process hazards which need treatment for assessment.

As disused in earlier sections, the system operation involves a grab dredger. A Grab dredger picks up sea bed material with a clam shell bucket, which hangs from an on-board crane or a crane barge, or is carried by a hydraulic arm, or is mounted like on a drag line. The grab dredger is basically a conventional cable crane mounted on a pontoon. The bed material is excavated by the bucket of the crane and raised by the hoisting movement of a cable.

As per MIL-STD-882RevD of US, the following description are provided for Hazard and Hazardous materials.

Hazard: Any real or potential condition that can cause injury, illness, or death to personnel; damage to or loss of a system, equipment or property; or damage to the environment.

Hazardous material: Any substance that, due to its chemical, physical, or biological nature, causes safety, public health, or environmental concerns that would require an elevated level of effort to manage.

2.3 PROCESS HAZARDS

The major process hazards which can be envisaged for the proposed project are listed as below:

- Equipment failures
- Fire in fuel storage tanks
- Dredged material spills on personnel
- Fuel oil spills
- Noise hazards on board dredging vessel

2.3.1 Equipment Failure(s)

During dredging several possibilities arise on account of failure with respect to different equipments such as engine or hull failure, electrical failures due to water ingress, failure due to operator’s negligence or oversight, chain pulley failure and failure of the grab.

2.3.2 Fire in fuel storage tanks

Fire in fuel storage can occur due to faulty electrical wiring, improper insulation, static electricity, spills, operator's errors and mal practices, overheating, etc.

Photo 1: Grab Dredger

Source: Chapter-1, Introduction to Dredging Equipments, Prof.Ir. W.J.Vlasblom, 2003

2.3.3 Dredge material spills on personnel

The dredged material can accidently spill over crew due to system malfunctioning or operator's error

2.3.4 Fuel oil spills

There can be breach in fuel oil storage during loading or maintenance.

2.3.5 Noise hazards

Dredging operations generate high noise upwards 100 dB(A).

2.4 MAN MADE DISASTERS

The man-made hazards which can cause disasters are :

- Sabotage

- Terrorist attack
- Interference due to proximity of second vessel during dredging operation
- Collision with second vessel

2.5 SEISMICITY

Mumbai falls in seismic Zone III, considered moderately safe. The Mazagon Area was classified as a safe area in a study conducted by IIT Mumbai in 2011

2.6 OTHER HAZARDS

Apart from above, there can be communication failure from the dredger to the control room. Medical emergencies to the work personnel can also be considered as an incident to consider for appropriate preparedness. Operations during rough weather can also pose significant hazard. Hence, these points have been taken into account while undertaking the risk assessment.

2.7 CATEGORIZATION OF HAZARDS

The hazard identification for the proposed project (capital dredging) can be categorized as low, medium and high hazards.

2.7.1 Low Hazards

- Minor incidents due to Mechanical parts
- Slips/Trips
- Cuts/bruise due to personal negligence

2.7.2 Medium Hazards

- Loading of fuel
- Extreme weather conditions
- Noise and Vibration

2.7.3 High Hazards

- Equipment hits
- Fall in Sea
- Major electrical fault on board

2.8 DIESEL/HSD

Diesel vapors can irritate eyes, nose, throat and lungs. Excessive short-term exposure can lead to dizziness, drowsiness, loss of coordination, blood pressure elevation, headaches, nausea, asphyxiation and lung damage. Breathing diesel vapors for long periods of time can cause kidney damage and reduce the clotting ability of blood.

Diesel fuel can irritate skin and aggravate any existing skin condition. A large skin exposure can lead to severe redness, pain and chemical burn blisters. If the fuel is not cleaned from the skin quickly, it is absorbed into the blood stream where it can cause symptoms identical to inhalation exposure.

There has not been enough research to positively associate exposure to diesel fuel with cancers. However in one study, there was evidence of increased risk for lung cancer in men estimated to have had substantial exposure to diesel fuel. There was also an indication of an increased risk for cancer of the prostate in these workers.

2.9 FUEL OIL

Fuel oils are comprised of mixtures of petroleum distillate hydrocarbons. Various kinds of fuel oils are obtained by distilling crude oil, and removing different fractions. Fuel oil is any liquid petroleum product that is burned in a furnace for the generation of heat or used in an engine for generation of power, except oils having a flash point of approximately 100° F and oils burned in cotton or wool-wick burners. The oil may be a distillated fraction of crude petroleum, a residuum from refinery operations, or a blend of these.

Fuel oil numbers 1 and 2 are referred to as distillate fuels oil, while fuel oil numbers 4, 5, and 6 are labeled residual. Two major categories of fuel oil are burned by combustion sources: distillate oils and residual oils. These oils are further distinguished by grade numbers, with Nos. 1 and 2 being distillate oils; Nos. 5 and 6 being residual oils; and No. 4 either distillate oil or a mixture of distillate and residual oils]. No. 6 fuel oil is sometimes referred to as Bunker C. According to the USCG Emergency Response Notification System (1993), fuel oils are some of the top most spilled petroleum hydrocarbon products in U.S. waters, both by volume and the number of notifications. Diesel oils are among the products considered "fuel oils" in a broad sense.

3. ANALYSIS OF SCENARIOS

3.1 INTRODUCTION

This section presents analysis of scenarios enumerated in section-2. The process based scenarios are considered in this chapter.

Grab dredgers operate using a crane-mounted grab which is lowered to the seabed to capture sediment. This method may cause minimal disturbance and dilution of clays compared to the hydraulic methods employed by TSHDs and CSDs, but may cause high turbidity in loose silts.

Many dredges depend upon a workboat to transport personnel and materials between the dredge and shore

The first few scenarios which can occur relates to fuel oil. There can be a spill and fire due to the spill of oil due to various reasons such as breach of security, leakage, maintenance issues, or a fire due to ignition of the spilled oil caused by electrical faults. Fire can also happen during a welding operation on-board the dredger. Overheating of pumps and motors can also cause fires.

Accidents happen due to a series of incidents which go unchecked. The accidents or scenarios which can happen in this project are

- Spillage of oil during unloading operations
- Spillage of oil on the dredging equipment
- Dredging operations held up due to a mechanical or electrical fault
- Harm to personnel due to electrical or mechanical faults
- Severe harm to personnel due to impact with any parts of dredging
- Exposure to extreme weather conditions
- Process failures such as those of pumps, motors, arms, etc.
- Noise and vibrations hazard in operations

The Technical Services Committee of the American Institute of Marine Underwriters states the following reasons for a fire on a dredge:

- Accumulation of debris, such as oil soaked cleaning rags, dry combustible stores and bilge/waste oil accumulations.
- Inadequate maintenance of machinery or equipment.
- Inadequate or poorly maintained shielding and protection of exposed hot exhaust piping.
- Overheating electrical motors and equipment.
- Improper hot work controls for welding or torch cutting.
- Inadequate observation of and response to audible and visual alarm signals and/ or lack of proper alarms systems for unmanned engine spaces.
- Improperly maintained or inadequate fixed or portable firefighting equipment, and lack of knowledge of their proper use.

3.2 LIKELY HAZARDS DURING DREDGING

The Maritime Injury Center website provides for the following hazards during dredging operations:

Incorrect operation of dredging cranes or malfunctioning of the same can also cause injury of the workers. This can lead to a worker being injured. He or she may suffer bruises, broken bones, and cuts, lost limbs, or head or back injuries. A hit from the equipment can also cause a worker to fall overboard where the risk of drowning is very real.

Mechanical errors are another important source of cargo and crane accidents. A crane that malfunctions, due to no error on the part of the operator, can easily drop a load or swing out of control and hurt someone. A machine may malfunction because it has not been properly maintained or has not been repaired when it should have. If any part of the equipment isn't working right, the whole machine becomes dangerous to everyone around it.

Fatigue of workers may also cause accidents by making an error of judgment or even falling asleep on the job. Operator error can also come from poor communication. Snapping of radio contact with control room and/or workers make loading and unloading go smoothly and safely.

Further, scenarios which can occur due to towing and heavy weather are as follows:

Towing Related

- Failure of equipment during towing
- Loss of tow due to improper use
- Striking with overhead infrastructure such as wires, pipes, etc.

Weather

- Loss of mooring gear resulting in hull damage
- Containment of crew members during severe weather
- Damage to the system due to weather

Sinking may result from lack of proper preparation of the dredge for the potential weather event.

3.3 CONSEQUENCE IN CASE OF EXPLOSIONS

In case of explosions, a general thumb rule which apply with the increase in quantity and distance is provided below:

Quantity	Distance
X	Y
8X	2Y

The table indicates that the damage distance would only double only when there is a corresponding increase of eight fold in quantity of storage. Withers report that only 15% of the volume of drifting cloud is likely to lie within explosive limits and only this position can lead to overpressure and cause damage.

Assumptions for carrying out consequence analysis of lighter and heavier mixture fractions are as follows.

1. HSD: C10 to C12
2. SKO: C8 to C15

3. FO: C9 to C20

4. SEVERITY AND PROBABILITY

The severity matrix is provided as Table-1 and that of probability is provided as Table-2. These have been reproduced from the MIL-STD-882D. Bucket dredgers use a mechanical bucket to lift out sediments.

Table-1: Severity Matrix

Description	Category	Environmental, Safety, and Health Result Criteria
Catastrophic	4	Could result in death, permanent total disability, loss exceeding Rs. 10 lakh, or irreversible severe environmental damage that violates laws or regulations.
Critical	3	Could result in permanent partial disability, injuries or occupational illness that may result in hospitalization of at least three personnel, loss exceeding Rs. 2 lakh but less than Rs. 10 lakh, or reversible environmental damage causing a violation of laws or regulations.
Marginal	2	Could result in injury or occupational illness resulting in one or more lost work days(s), loss exceeding Rs. 1 lakh but less than Rs. 2 lakh or mitigatible environmental damage without violation of law or regulation where restoration activities can be accomplished.
Negligible	1	Could result in injury or illness not resulting in a lost work day, loss exceeding Rs. 2000 but less than Rs. 10,000, or minimal environmental damage not violating law or regulation.

Table-2: Probability Matrix

Description*	Level	Specific Individual Item	Fleet or Inventory**
Frequent	5	Likely to occur often in the life of an item, with a probability of occurrence greater than 10-1 in that life.	Continuously experienced.
Probable	4	Will occur several times in the life of an item, with a probability of occurrence less than 10-1 but greater than 10-2 in that life.	Will occur frequently.

Description*	Level	Specific Individual Item	Fleet or Inventory**
Occasional	3	Likely to occur sometime in the life of an item, with a probability of occurrence less than 10-2 but greater than 10-3 in that life.	Will occur several times.
Remote	2	Unlikely but possible to occur in the life of an item, with a probability of occurrence less than 10-3 but greater than 10-6 in that life.	Unlikely, but can reasonably be expected to occur.
Improbable	1	So unlikely, it can be assumed occurrence may not be experienced, with a probability of occurrence less than 10-6 in that life.	Unlikely to occur, but possible.

**Definitions of descriptive words may have to be modified based on quantity of items involved.*

***The expected size of the fleet or inventory should be defined prior to accomplishing an assessment of the system.*

5. RISK ASSESSMENT

The risk assessment has been carried out qualitatively for different scenarios and presented in Table-3.

Table-3: Risk Assessment Matrix for Mazagon Dredging Project

Scenario (A)	Consequence Category (B)	Probability Level (C)	Risk (D) = (B) x (C)
Oil Spill	3	2	6, Low
Dredging equipment failure	1	2	2, Very Low
Personnel risk	2	2	4, Low
Fire	1	2	2, Very Low
Noise	2	4	8, Medium
Material hazards	2	3	6, Low

Table-4 provides the risk estimation for various categories of risk probability and risk severity.

Table-4: Risk Estimation Matrix

	Risk Severity				
Risk Probability	**Catastrophic 5**	**Critical 4**	**Moderate 3**	**Minor 2**	**Negligible 1**
5 – Frequent	25	20	15	10	5

4 – Likely	20	16	12	8	4
3 - Occasional	15	12	9	6	3
2 – Seldom	10	8	6	4	2
1 – Improbable	5	4	3	2	1

The risks associated with the capital dredging project at Mazagon dock vary from low to moderate if all safe guards are in place during the project life cycle. All risks would be in acceptable level if safety regulations as prescribed by Indian and International guidelines are followed diligently.

6. RISK REDUCTION

Risk reduction measures include ALARP for the proposed dredging project at Mazagon dock.

"ALARP" is short for "as low as reasonably practicable" (Refer Figure-4)

ALARP signifies a balance between costs in general to the risk reduced by implementing safety measures.

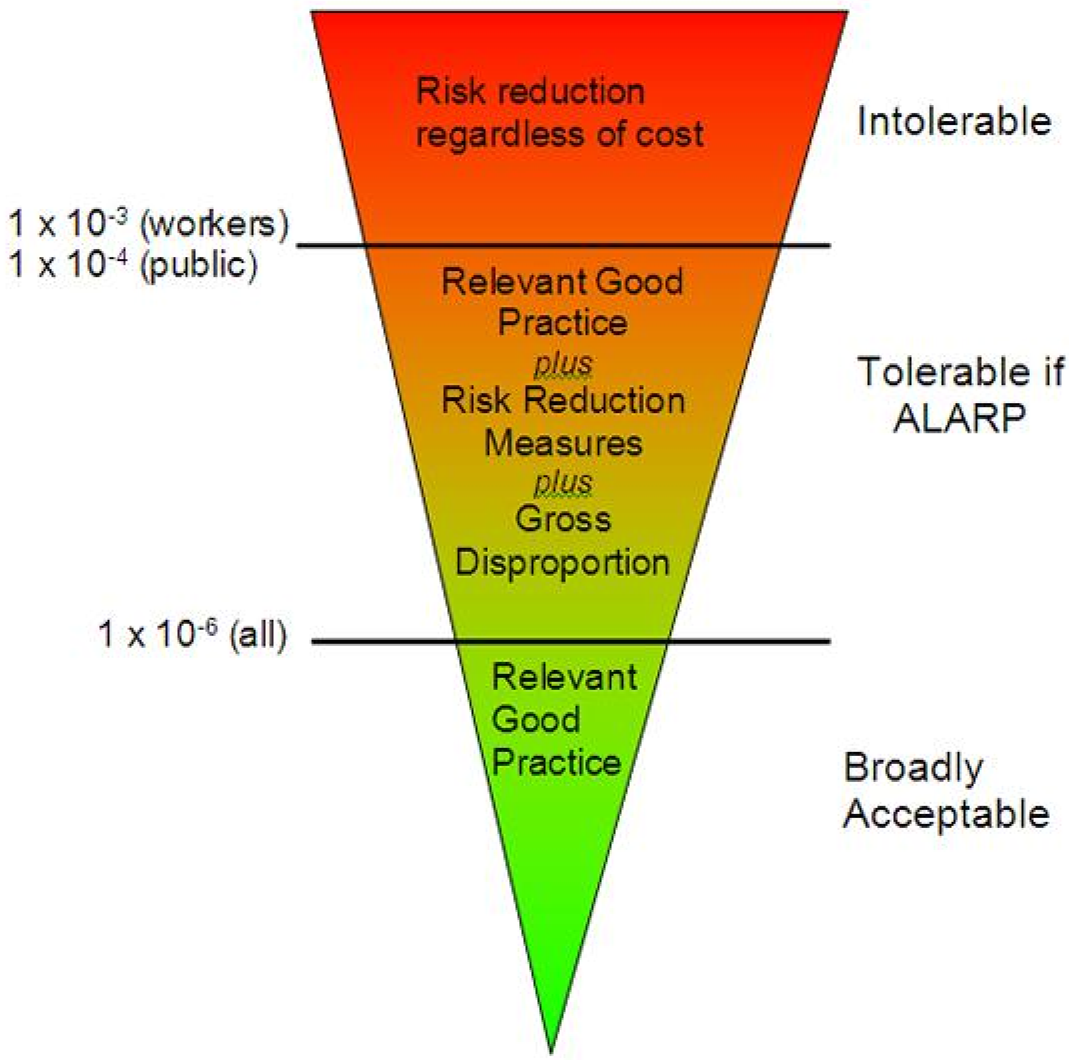

Figure-4: ALARP Triangle

The HSE UK further states that

"In essence, making sure a risk has been reduced ALARP is about weighing the risk against the sacrifice needed to further reduce it. The decision is weighted in favour of health and safety because the presumption is that the duty-holder should implement the risk reduction measure. To avoid having to make this sacrifice, the duty-holder must be able to show that it would be grossly disproportionate to the benefits of risk reduction that would be achieved. Thus, the process is not one of balancing the costs and benefits of measures but, rather, of adopting measures except where they are ruled out because they involve grossly disproportionate sacrifices (sic)."

ALARP does not mean that every measure that could possibly be taken (however theoretical) to reduce risk must be taken. Sometimes, there is more than one way of controlling a risk. These controls can be thought of as barriers that prevent the risk being realised and there is a temptation to require more and more of these protective barriers, to reduce the risk as low as possible.

7. DISASTER MANAGEMENT PLAN

Timely communication of an impending disaster may be life-saving for many people. Effective hazard communication is treated as the single most effective way of limiting losses both in terms of life and property by way of actuating preventive or remedial actions. The various aspects covered in this section are:

- Communication infrastructure
- Sounding of early warning notification
- Siren Warning Systems

i) Communication Infrastructure

It is recommended that multimodal channel of communication should be made available for effective communication in the event of any emergency:

- Telephone link(within the Dock)
- Link between Indian Meteorological Department (IMD) and the Port
- Local cable TV network for telecasting the emergency to the public at large along with what to do and what to avoid.

ii) Medical Services

- Chief Medical Officer, Mazgaon Dock
- Chief Fire Officer, Mazgaon Dock
- SHO, Police Station.

- Ambulance service at the Mazgaon Dock
- Hospital and 108 Ambulance service.
- The emergency control room telephone numbers should be pasted on Display Stands located in various strategic places within the Port and Environs to ensure that the number is available for ready use in the event of an emergency. The Display Boards should always list the following numbers for ease of dispatching the information and securing relief:
- Telephone numbers of Fire Station, Mazgaon Dock Hospitals and Dock Security Officer / Control Room.
- Installation of a Voice Paging/Public Address (PA) system is recommended. The PA system shall be such that it is capable of addressing all the harbor areas/offices, to ensure that the staff personnel and residents are informed about the ensuing emergency and preventive actions to safeguard life and property of the locality.
- All the security personnel patrolling the area should be given Wireless sets for quick communications with respect to the emergency.

iii) Communication Functionary

The communication functionary appointed for dealing with emergencies shall perform the following duties:

- Ensure that all available communication links remain functional.
- Quickly establish communication links between incident site and the control room.
- To maintain voice record of significant communication with timings “received/ passed” from the primary control room.

iv) Sounding an early warning notification

Raising an alarm holds the key to minimize the extent of damage to both life and property. The key to raise an alarm lies in the early warning for notification of an impending disaster. The Port Complex shall have a minimum of three modes of raising an alarm:

- Hoisting of a flag atop the signal room building.
- Siren/hooter
- Public address system

In addition to the said three modes of raising alarm there could be other modes of doing the same i.e. by providing the following systems:

- Break glass fire alarm.
- Blow horn speakers mounted on vehicles.
- Local Door-darshan Kendra, Local cable TV operators
- Local AIR (Radio).

The raising of alarm becomes critical for the following events:

- An impending cyclone or any natural disaster on receiving an information from the IMD or TV Channel.
- Major fire on the Dock

v) Siren warning systems

Raising the alarm is the first step in the implementation of On-site Emergency Plan/Disaster Management Plan (DMP). Essentially there would be various alarms for sounding of an emergency including fire, building collapse and flooding. The alarms are basically used to notify people of an impending disaster or an event, which is likely to snowball into a major disaster.

The various categories of alarms are as follows:

- Cyclone alarm (11 levels)
- Fire
- Flooding
- Building collapse
- All clear

Various means of communicating or raising alarm shall be in the following order:

- Raising flag on top of the signal room for indicating the severity of cyclone.
- Blowing of siren having a short blast followed by a long blast and repeating it three times for indicating evacuation from the Dock.
- Blow-horns in the vehicles being used by security people.
- Using telephone as well as fax to inform the main emergency control room of a fire.
- Establishing contact with the District Collector and requesting for help.
- Public Address System would be used to inform the public at large in the township to ensure that they do not travel in the direction of the disaster and assemble at the assembly points, as designated.

The following alarm systems may be considered or any other system, which will identify various levels of emergency:

Warning for a cyclone - the intensity level of impending cyclone as decided by the Port authority shall be made known by putting up a suitable display board or by announcements on TV or Radio as discussed earlier. Any change in cyclone level could be made known by a siren.

Similar siren may also be used for other natural disasters like floods or earthquake.

Siren – Short, intermittent.

All clear – when the Main controller considers that the accident is over and it is safe for re-entry.

Siren: - A wailing siren for 5 minutes.

vi) Temporary safe zones

In the event of an impending disaster the affected population at large will have to be transported to intermediate temporary shelter. The temporary shelters could be set up in nearby schools. The temporary shelters would greatly depend on the emergency condition and the nature of the emergency. The shelters are to be used only when there is a threat of a natural disaster.

Certain basic amenities also have to be made available before the temporary safe shelters can be decided upon which are as follows:

- Water supply
- Shelter for putting up the refugees or the affected population.
- Structure of temporary shelter need to be of concrete made in order to withstand natural disaster (earthquake) if need be. It is in this regard that schools with RCC building are ideal as sheltering spaces for the displaced population.
- Emergency shelters are also identified from the point of view of obtaining relief i.e. food supplies from the town. In the event of an impending disaster all the temporary shelters shall be provided with wireless sets.
- Provision for setting up kitchens for preparing food for the displaced population. In addition to the food supply, provision for temporary water “trailers/tankers” shall also be made.
- Prior permission will be obtained for converting schools into temporary safe shelters from educational institutions and volunteer organizations owning the same.
- The Principals of individual schools shall be appointed as record keepers before taking in the displaced population. The Principals and some of the staff members need to be trained in Disaster Management.
- The termination of emergency situations in case of the natural disasters will be decided by the District Administration i.e. the District Magistrate/ Collector.

vii) Training

Training sessions need to be provided in which personnel are briefed on their specific duties in an emergency. The concerned personnel are shown how to wear and properly use the personal protective clothing and devices. Periodic drills will be conducted to test the overall efficiency and effectiveness of the emergency response plan and emergency response capabilities.

The type of training required for emergency response personnel with responsibilities in any or all phases of the emergency is based on the type of incidents most likely to occur and the consequent response and planning activities.

The contact details of hospitals in the nearby area need to displayed at appropriate locations.

viii) Emergency control center

One Control Centre at the Port will be provided and shall be sufficiently equipped to inform the Collector, Police Department and the Coast Guard. The key characteristics of the Control Centre are as under:

- Will have an IMO web site available through Internet connection in the control room for ready reference.
- Will display a map of the whole harbor area and the population distribution in the nearby area.
- Constructed to be able to survive various manmade and natural contingencies such as, cyclone, high wind velocity, flooding, etc.
- Equipped with a diesel driven electric generator.
- Will have an automatic display of name, address and telephone numbers of any incoming call once the emergency control centre number is dialed and the same will be registered in a computer.
- Will have a Map depicting railway stations, ferry start points, bus stands and taxi stands.
- Will have a Map depicting the inter-tidal zone.
- Will have a Map depicting temporary shelters as well as food supply stores.
- Will have a list of Personal Protective Equipment (PPE), Suppliers and present availability of the same.
- Will have adequate number of flameproof searchlights.