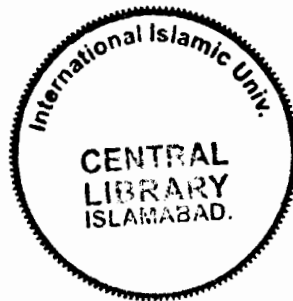


# **SHIP DISMANTLING IN PAKISTAN AND LEGAL OBLIGATIONS**

To 8000

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## **DEDICATION**

Dedicated to my husband and family whose efforts, encouragement and prayers enabled me to complete this work.

## **ABSTRACT**

Ship-recycling activities are environmental friendly due to the fact that it involves recycling of huge amount of materials used in ship's construction. But as old ships contains various hazardous materials that were not banned at the time of manufacture. If these materials are not handled carefully, these are released to the environment and can pose severe threats to environment, human health and other living organisms. A part from environmental damage, shipbreaking activities produces substantial revenues and creates a large number of jobs. So if these activities are performed in environmentally sound manner, it will not only help save our environment but also benefit countries though generation of revenue and creation of jobs.

Keeping in view of environmental problems raised from improper disposal of hazardous materials released during shipbreaking activities, a number of conventions have been organized and Pakistan have signed these conventions. Basel Convention, ILO, Stockholm Convention, Rotterdam Convention and MARPOL are some of the relevant convention ratified by Pakistan. Being a signatory of various conventions related to shipbreaking issues, it is responsibility to formulate laws, and take necessary actions to implement convention. A number of efforts have been made by the Government and it resulted in formulation of environmental laws in general but still there is lack of specific laws, guidelines and regulation relating to shipbreaking activities.

Keeping in view of environmental damage caused by improper handling of hazardous materials recovered from ships and hazardous procedures adopted we carried out a study. In the following study we identified the materials, procedures and activities harming environment and human health. The facts and figures were not only obtained from various journals, books, magazines, reports etc but also through interview of various responsible officials. The information obtained was then analyzed in view of conditions and procedures recommended by international conventions and treaties. Based on the

analysis, we are able to propose number of suggestions that can help in improvement of environmental and health conditions on shipbreaking yards of Pakistan. Environmentally sound management of shipbreaking activities also help local shipbreakers to attract more business and can result in generation of even more revenue, huge amounts of raw materials for local industry and generation of jobs.

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## LIST OF ABBREVIATIONS

Asbestos Containing Materials	ACM
Best Available Techniques	BAT
Basel Action Network	BAN
Balouchistan Environmental Protection Agency	BEPA
Balouchistan Development Authority	BDA
Chlorofluorocarbons	CFC
Correspondence Group	CG
Environment Impact Assessment	EIA
Environmental Sound Management	ESM
Food and Agriculture Organization	FAO
Hexachlorobenzene	HCB
International Chamber of Shipping	ICS
Initial Environmental Examination	IEE
International Labour Organization	ILO
International Maritime Organization	IMO
Inter-governmental Maritime Consultative Organization	IMCO
Industry Working Party on Ship Recycling	IWPSR
Light Displacement Tonnage	LDT
Marine Pollution	MARPOL
Marine Environment Protection Committee	MEPC
National Implementation Plan	NIP
No Objection Certificate	NOC
Organization for Economic Co-operation and Development	OECD
Polychlorinated Biphenyls	PCB
Persistent Organic Pollutants	POP's
Personal Protective Equipment	PPE
Polyvinyl Chloride	PVC

Tributyl Tin	TBT
Tetraethyl Lead	TEL
Tetramethyl Lead	TML
United Nations Convention on Laws of Seas	UNCLOS
United Nations Environmental Program	UNEP

## CHAPTER 1

### INTRODUCTION

#### 1.1 Shipbreaking

Shipbreaking involves the dismantling of ships to recover valuable materials such as steel and other useful materials on the ship (YPSA, 2006). A ship is sent for dismantling, after it completes its life span and is no longer in use. Ship breaking is a challenging process as it involves removal of all machinery and materials on the ship and then step wise demolition of ship structure. Although shipbreaking is actually the recycling of valuable materials but during the process a lot of hazardous materials, either present on ship or generated due to dismantling activities are released to the environment, which is a great concern (Greenpeace, 2005)..

Most of the ships which are being sent for dismantling were manufactured before ban of several hazardous materials. Therefore nearly all dismantled ships contain asbestos, heavy metals (like lead, mercury and chromium) and polychlorinated biphenyls in its structure. Other hazardous materials are generated during working of ships which contain used oils, greases, contaminated bilge and ballast water etc. During dismantling activities, if these materials are not properly handled, are released to the environment. A few hazardous materials are also generated due to improper procedures adopted during dismantling e.g burning of PVC and PCB containing materials, burning of paints during torch cutting of metal plates etc (DNV, 1999)..

Shipbreaking was not considered a threat to environment in the beginning. But as more and more ships discarded and shipbreaking became a major industry in countries like Pakistan, Bangladesh, India, China and Turkey, formulation and enforcement of specific environmental regulations became more important. Till now a lot of international conventions have covered the issue of shipbreaking. Most important are Basel convention, Stockholm convention, IMO, MARPOL, ILO, and The Hong Kong Convention.

According to a World Bank report Pakistan is among the major shipbreaking countries of the world (LITEHAUZ, 2009). Like other developing countries involved in shipbreaking activities, the working conditions in Pakistan are poor and lacking basic infrastructure for environmentally sound dismantling of ships. Although several federal and provincial organizations regulate the dismantling of ships but still there are no particular guidelines for environmentally sound dismantling of ships. There is weak enforcement of existing rules and regulations regarding working and disposal of hazardous materials. But despite of the poor situation of shipbreaking industry, the Government imposes heavy taxes on this industry.

## **1.2 Aims and Objectives**

Following are the main objectives which are aimed during current study

- To identify hazardous materials released during ship dismantling
- To study effect of these hazardous materials on Gaddani yards (air, water, soil), employed workers and population in vicinity.
- To assess the compliance with multinational environmental conventions and agreements by Pakistani shipbreaking industry and the effectiveness of regulatory authorities.
- To identify the gaps in facilities and practices for compliance with international laws.
- To determine the role of shipbreaking industry in economy of Pakistan and to suggest measures to meet international standards.
- To suggest measures to solve environmental problems, that the shipbreaking industry in currently facing.
- To assess financial capacity of shipbreaking industry required for compliance with international conventions.

## **CHAPTER 2**

### **HAZARDS ASSOCIATED WITH SHIPBREAKING ACTIVITIES**

#### **2.1 Introduction**

Shipbreaking is actually the disposal of ship involving the dismantling of ships for scrap recycling, with the hulls being discarded in ship graveyards. Most ships have a lifespan of a few decades, and ships are sent for dismantling when repairing becomes uneconomical. Ship breaking allows materials from the ship, especially steel, to be reused. Equipment on board the vessel can also be reused.

In addition to steel and other useful materials, however, ships (particularly older vessels) can contain many substances that are banned or considered dangerous. Asbestos and polychlorinated biphenyls (PCBs) are typical examples. Asbestos was used heavily in ship construction until it was finally banned in most of the developed world in 1980s (Basel Convention, 1989). Currently, the costs associated with removing asbestos, along with the potentially expensive insurance and health risks, have meant that ship-breaking in most developed countries is no longer economically viable. Removing the metal for scrap can potentially cost more than the value of the scrap metal itself. In the developing world, however, shipyards can operate without the risk of personal injury lawsuits or worker's health claims, meaning many of these shipyards may operate with high health risks. Protective equipment is sometimes absent or inadequate. Dangerous vapors and fumes from burning materials can be inhaled, and dusty asbestos-laden areas are commonplace.

Aside from the health of the yard workers, in recent years, ship breaking has also become an issue of major environmental concern. Many ship breaking yards in developing nations have no enforcement of environmental law, enabling large quantities of highly toxic materials to escape into the environment and causing serious health problems among ship breakers, the local population and biodiversity.



## **2.2 Environmental Hazards involved in shipbreaking**

Shipbreaking involves the release of large amounts of all types of pollutants. The pollutants range from gases and liquids to metals and other solid pollutants. Therefore shipbreaking activities highly affect the environment, human health and biodiversity.

Following are the important pollutants which affect human health and the environment.

### **2.2.1 Metals**

The ship is demolished to recover valuable materials including recovery of various scrap metals. Steel scrap is the largest fraction of recyclable materials recovered from ship. The scrap metal recovered from ship can be classified into two main categories, ferrous scrap, which is mainly in the form of carbon steel and some nonferrous scrap, which includes scrap metal other than iron and steel.

#### **Hazards**

The most common way to extract metal structure is torch cutting. Using torch metal pieces are cut apart for practical handling and recycling. During cutting process of metals large amounts of fumes are produced, particulates including iron, lead, chromium, nickel, manganese and debris are also produced. As torch cutting falls into "hot work" category, therefore specific conditions for working environment are required.

During cutting process a lot of emissions are evolved that are likely to contain toxic air pollutants. These pollutants can affect workers health adversely, so instead of posing a major threat to air quality, exposure of workers with these pollutants can have life threatening effect.

A number of health problems are associated with metal exposure through consumption of contaminated seafood. The workers living in nearby dismantling facilities and consuming such food are particularly exposed to this threat (Gemma, 2006).

Another highly hazardous activity is the recovery of copper wire by burning cables. The cable insulation either contains toxic substances or can produce toxic substances on burning, so burning of cables must be prevented (Sepulveda, 2010).

To protect against fouling and corrosion, anodes are connected to both ship's hull and inside tanks. These anodes are mainly alloys of aluminum and zinc, but these also contain other metals in small quantities, e.g copper, iron, and mercury. These anodes are sacrificially corroded over period of time and the amount of metals in the used anodes reflects the history of maintenance of ship. During dismantling mostly these anodes are removed and are sorted for reuse or resale but some highly corroded anodes cannot be recycled, so these should be disposed as hazardous waste. The alloys are non-toxic in their solid form and thus removal of anodes will not cause adverse effects on humans. If these anodes are not properly disposed, the environment is affected by release of heavy metals.

Lead is a toxic metal and is normally found in paints, batteries, cables, piping, some components of motors, etc. Lead is one of the most widely studied metal, for its harmful effects on human health. Children are more likely to be affected by harmful effects of lead. Long-term exposure to even trace quantities can cause mental retardation, slowing down of neurological and physical development. Particularly in adults, lead exposure can affect the peripheral nervous system and causes impairment of hearing, vision and lack of muscle co-ordination. Lead can also cause damage to kidneys, heart, reproductive system and blood vessels. Lead chromate which is present in pigment of paints is a carcinogen both to humans and other animals. It can also cause damage to embryo development and hence results in infertility. If batteries and paints containing lead are improperly disposed, it results in the release of the highly toxic metal into the environment and causes a threat to human health as well as other organisms (Patrick, 2006).

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Mercury is a highly toxic metal and it is bioaccumulative and persistent, affects the nervous system. On ships mercury is normally found in electrical switches, thermometers, luminescent lamps and other light fittings. If mercury is accidentally released to the environment, its exposure is dangerous. Another important source of exposure to mercury is through consumption of contaminated fish. Mercury falls in the category of highly toxic waste and mercury containing substances must be handled and disposed off very carefully, to avoid release of the toxic metal in to the environment (Langford, 1999).

### **2.2.2 Oil and fuel**

When a vessel reaches at the dismantling yard it normally contains considerable quantities of oil, fuel, sludge and other associated residues. Fuel oil is normally found in both integrated and free standing tanks on the ship. A variety of lubricating oils can be found on various places, depending on individual use. There is a considerable quantity of systems/lubrication oils, which are specifically located in engine room sump tanks and cylinder oils are stored in separate tanks. System oils are typically located in engine room sump tanks, whilst cylinder oils may be stored in separate purpose tanks. Often excess quantities of lubrications oils are also stored in drums. Normally when tanker arrives for dismantling, it contains oil residues; also some quantity of sludge is also present in all oil storage tanks (Perez, 2008).

### **Hazards**

Both petroleum oils and synthetic oils have adverse effects on human health, environment and biodiversity. Oils and fuels if liberated to sea may poison marine organisms and pose a sever threat to birds, fish and plants. Further more oil spills also cause damage to natural resources.

Fire and explosions are among the main dangers to workers involved in handling of fuels and oils on ships. If oils and fuels are not handled properly, it can expose workers to certain toxic hazards and can affect workers health adversely. Inhalation and

consumption of contaminated water and fish are the main routes of exposure to toxic effects of oils and fuels. Even highly refined petroleum products are hazardous and are inflammable (Perez, 2008).

### **2.2.3 Bilge and ballast water**

The lowest inner part of a ship's hull is termed as ship's bilge and bilge water is the stagnant water contained in the bilge. This bilge water contains various polluting liquids that are drained in to ship's bilge. Bilge water can be found any where on the ship and its quantity increases during dismantling of the vessel, not only due to accumulation of rain water but also due to water used during dismantling operations.

Ballast water can be either fresh water, brackish water (mixture of fresh and marine water) or marine water. Ballast water is brought on the ship to increase the stability of ship, and to maintain equilibrium under various working conditions. Ballast water can be present in huge quantities and even the empty cargo tanks of oil tankers are filled with it, to increase their weight during the course of final journey to dismantling yards. Although some modern ships have separate ballast water tanks, but during extreme weather some empty cargo compartments are filled with water. Either powered by it own engine or being towed, an empty ship would require even large quantity of ballast water for safe journey to dismantling yard. Ballast water tanks are located at various positions throughout the ship.

### **Hazards**

Bilge water is usually contaminated with oil and other cargo residues; it also can contain inorganic salts and heavy metals e.g arsenic, chromium, mercury and lead. Therefore if bilge water is released directly into the sea it can cause severe environmental effects. Further it also poses life threatening toxic effects to worker health, performing dismantling jobs in this stagnant water (Dogan, 2007).

Like bilge water ballast water may also be contaminated with certain pollutants such as cargo hold residues, residual fuel, oil, grease, other petroleum hydrocarbons, biocides, and some metals (e.g nickel, chromium etc). The ballast water filled in empty cargo tanks is heavily contaminated with oils and falls in the category of dirty ballast water.

The transport of large quantities of shallow coastal waters containing various marine organisms across natural barriers of oceans may cause introduction of invasive species of neritic marine organism. As ballast water is normally taken from estuaries and bays, therefore most ships carry a large number of species of aquatic organisms. Presence of various living species in different ballast water tanks reflects the trade history of vessel.

It is expected that any vessel arriving for dismantling will contain large quantities of ballast water. The discharge of ballast water (containing various aquatic species) directly into the coastal area of sea, can pose a potential threat to the marine environment by introduction of invasive species. Ballast water can also contain various types of viruses and bacilli, and can result in the cause of various diseases and infections in workers. In order to stop the ecological threat, caused by introduction of invasive species via ballast water, it is recommended that vessel should be de-ballasted according to international recommendations before the start of dismantling operation.

#### **2.2.4 Paints and coatings**

Vessels structure and all parts are covered with a wide variety of paints and coatings. The paints and coating are used over interior and exterior of the vessel. Some of these can be hazardous and thus required certain precautions during dismantling process. The ship's hull is painted several times during its life span, to prevent fouling. Various types of fresh paints are also found on board for maintenance purpose.

## **Hazards**

Paints can exhibit various hazardous properties, paints can contain certain toxic compounds (heavy metals such as cadmium, lead, chromium and zinc or PCB's, and pesticides). Metal containing paints are used to protect metallic surfaces from corrosion. Fouling is prevented by coating surfaces with paints containing pesticides e.g organotins and tributyl tin (TBT).

Tributyl tin (TBT) is an organometallic substance used in the antifouling paints. It is highly toxic, even in very minute quantity (nanogram/litre) in the aquatic environment. When a dismantling ship is beached, some antifouling agents are ground up. TBT is very active biocide, also it disrupts the endocrine system of marine shellfish, impair immune system. High doses even damage the nervous system and reproductive mechanism. Organotin is also bioaccumulative in marine species. Some of which are eaten by humans and ultimately they have effect on the human population. It disrupts the important functions of human immune cells. Workers in the shipbreaking yard are constantly exposed to TBT that is highly dangerous, hence use of TBT is banned by IMO in 2003 and it came into force in 2008 (Gumy, 2008).

Isocyanates are normally used in polyurethane coating and spray-painting processes and can be released during metal cutting by torch. If workers inhale fumes of isocyanates during working, it can cause asthma and other respiratory diseases. During ship dismantling processes, the exposure levels of isocyanates are unknown (Allport, 2003).

### **2.2.5 Asbestos**

Asbestos-containing material (ACM) may be found in thermal system insulation and on surfacing materials. Engine rooms usually contain the most asbestos. Some other applications may also be found. ACM is often visible, but can also be found underneath other materials that do not contain asbestos.

## **Hazards**

Asbestos is a natural mineral and it is not harmful in its natural state and therefore asbestos in its natural form does not pose any environmental and health threat. When asbestos or asbestos containing material (ACM) is disturbed and deteriorated then it breaks into very fine fibers. The most hazardous fibers are very small and not visible. These fibers can remain suspended in the air for very long periods of time and can travel a certain distance, these fibers can then easily be inhaled by workers or people living in nearby areas. If these fibers are inhaled, these can remain and may accumulate in the lungs. Working and breathing in environments having suspended asbestos fibers increases risk of lung cancer, asbestosis (lung scarring that is fatal and irreversible) and mesothelioma (a type of cancer of lungs, abdominal and heart linings). Increased exposure and inhalation of asbestos fibers leads to an increased risk of lung cancer and mesothelioma. Symptoms of such diseases remain hidden for several years after exposure. Many people with diagnosed asbestos-related diseases have connection of cause of such diseases with their work (Bartrip, 2004).

### **2.2.6 Polychlorinated Biphenyls**

Polychlorinated Biphenyls (PCBs) can be found both in liquid and solid forms in various materials and equipment onboard. It is not always easy to sample PCB's and their determination is also difficult. A list of various materials and equipment (known as Grey List), that are likely to contain PCB's has been set up. The list is as follows.

- Thermal insulation material like felt, fibreglass, cork and foam
- Felt and rubber gaskets
- Insulation of cables
- Tapes and adhesives
- Switches, voltage regulators, re-closers, electromagnets and bushes
- Transformers and capacitors (in electronic equipment)
- Oil-based paints
- Rubber isolation and foundations mounts



- Oils that are used in motors, electrical equipment, anchor windlasses and other hydraulic systems
- Surface contamination of various parts and machinery
- Caulking
- Plasticizers
- Light ballasts
- Pipe hangers

### **Hazards**

PCBs are highly toxic substances; they are persistent and bioaccumulative in the environment. PCBs can potentially cause a number of health problems including cancer. The main exposure routes of PCBs are absorption through skin, inhalation or ingestion. Although PCBs themselves are highly toxic but if they are heated or burnt are capable of producing even more toxic substances e.g polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (Liu, 2010).

#### **2.2.7 Miscellaneous waste streams**

There are small quantities of radioactive materials present on ships in smoke detectors, liquid level indicators and emergency signs. As these sources can generate low-level radioactive waste so these must be handled and disposed off in proper manner. Radioactive materials emit ionizing radiation, which are hazardous to both human health and environment. Cause of various forms of cancers and genetic mutation are well documented and have important role in causing cancers and genetic diseases. . If radioactive materials are accidentally released, it can expose local population to associated health damaging effects (McCombie, 1997).

Wood is found widely on ships in the form of furniture, doors and various other things. The surface of wood is coated with certain paints and preservative. If these substances are liberated to the environment these can pose health threats. Therefore the

wooden objects should be treated according to international regulations and should only be sold to recognized recyclers.

Polyvinyl chloride (PVC) is widely used in various products of ships, commonly found in floor coverings, cables and many plastic products. PVC products contain more than 50% chlorine and other environmentally hazardous additives. In solid form PVC is not very much toxic but when PVC products are made to burnt, then PVC produces various toxic compounds (including carbon monoxide and dioxins) depending upon availability of oxygen. This includes carbon monoxide and dioxins. As PVC contains chlorine so large quantity of hydrogen chloride; in the form of gas is also generated during burning of PVC. If fumes of hydrogen chloride are inhaled, it combines with water in the lungs to produce hydrochloric acid. Therefore burning of PVC products should be prohibited, and PVC products must be disposed according to international regulations.

Dioxins are released on burning of chlorinated products like PVC in open fire in shipbreaking yard. Dioxins are constantly released in the working environment and are inhaled. While it is highly toxic, carcinogenic and can suppress immune system, dioxins also have prenatal and postnatal effects on the nervous system of children, (neurosystem depressor also cause reproductive imbalance, skin problems e.g hyperpigmentation). It also alters the lipid metabolism; interfere with enzymatic break down etc (Rigo, 1995).

Polycyclic Aromatic Hydrocarbons (PAH's) are produced during ship dismantling activities. Such as, during torch cutting, paint smoulding and burning of various (hazardous) waste materials. Inhalation of the fumes produced during these activities cause main health hazards as mafignant tumours, affecting on lungs, stomach, intestine and skin. Also interfere with the enzymatic break down. Some 250 PAH's have been discovered, out of which 30 compounds are carcinogenic (Bosetti, 2007).

Batteries contain various heavy metals in their structure e.g Pb, Ni, Cd etc. Lead acid batteries also contain sulfuric acid, which is highly corrosive and causes severe burns. Batteries are found on board to power various electrical equipment e.g intercoms, radio communication equipment, flashlights, fire alarms, life boats and emergency start equipment. If batteries recovered from ships are in working order, these are sold for reuse. But if recovered batteries are not in working condition, then these are sold to recyclers so that valuable lead can be recovered for further applications. Undamaged batteries do not pose any environmental threat but damaged batteries should be stored, handled and disposed properly to avoid any damage to human health and the environment.

Freon is a trade name used for various chlorofluorocarbons (CFC), these compounds consists of chlorine, fluorine and carbon. Although CFCs are highly stable in troposphere and are non-flammable and non-toxic. But if CFCs are released, as these are stable, can reach stratosphere, where UV radiation of sun breaks down CFC molecules and forms highly reactive radicals. Such radicals destroy ozone molecules and results in depletion of ozone layer. CFCs are widely used as refrigerants, foam-blowing agents and solvents. It is believed that CFCs produced from ship contribute up to 10% of total global emissions (Al Jeran, 2009).

#### **2.2.8 Other chemicals**

There are various chemicals and materials that are not discussed but may require special handling. Following is a list of such chemical and materials.

- Solvent and thinners like kerosene, spirits and alcohol
- Antifreeze fluids and compounds
- Corrosion inhibitors
- Evaporator dosing and de-scaling acids
- Plastics and epoxy resins
- Various compressed gases such as acetylene, propane and butane
- Electrolyte of batteries

- Boiler and other water treatment chemicals
- Engine additives
- Flame retardants.

The chemical and materials listed above can have negative effects on the environment. A number of these are of value and therefore sold to market for reuse.

### **2.3 Hazardous work activities**

Ship breaking involves not only release of hazardous and toxic substances to the ambient environment but also involve risky tasks that can threat health and life of workers. On Asian dismantling yards (including Pakistan, India and Bangladesh), workers cut apart ships by hands, under extremely hazardous working conditions.

There are various hazards related to shipdismantling and can be broadly classified into two main categories: exposure of toxic substances, and accidents while working. The toxic substances evolved during break down of ship structure can affect adversely workers health and during working on the ship workers are also exposed to various accidents caused either by working or materials on the ship.

Explosions are one of the main causes of accidents on ships. Heavy metals plates (that are being cut) fall from heights of several meters, workers are some time crushed under such plates. Workers are also crushed sometimes by falling of steel beams. Electric shocks are another source of accidents (Hossain, 2006).

Mostly, the whole process of ship breaking is manual. Often there are few or no precautions adopted and hence worker's safety is overlooked. During ship breaking electricity is rarely used. The lifting equipment such as cranes, motorized pulleys and other lifting machinery are not tested, so often lift weight beyond their capacity. Chains and ropes that are recovered from dismantled ships are used for load bearing applications, without testing their loading capacity. Also these chains used with cranes are not labeled

for their loading capacity. Usually very heavy sheets or iron that has been cut from the ship's structure are carried by workers on their shoulders, these metals plates can be carried by using some machinery/equipment. The workers are illiterate and do not know that how much weight they are carrying and shipbreakers also ignore the legal limits of weights that can be carried by workers. The weight limit prescribed in the Factory Act and Rules, is far below than that carried by workers at ship dismantling yards.

The workers are not properly trained to perform dismantling operations with safety measures. Hence workers are unaware of any hazards, to which they are exposed. Hence workers breath in toxic atmosphere, without any respiratory equipment, this results in lung problems and other related diseases. Also ships are not properly cleaned and cleared for hot working, so some unventilated pockets and hatches of the vessel often contain inflammable or explosive gases, which results in fires and explosions during cutting operation.

As shipbreaking activities involve risky tasks, so workers must be equipped with appropriate personal protective equipment (PPE). But the shipbreakers do not provide workers with necessary PPE for various general and specialized jobs. For instance shipbreakers even do not provide the very necessary PPE e.g gumboots and helmets. Similarly the safety equipment to handle various machinery and chemicals also not available. The workers involved in metal cutting operations work day and night but they do not wear any thing to protect eyes, so their eyes are affected by welding effects. The workers do not wear proper clothing like proper work suit, boots, gloves, goggles etc. So lack of PPE often results in serious injuries from explosions and other accident hazards. The beaches of shipbreaking yards are full of hazardous and toxic substance, pieces of sharp and pointed iron pieces, which cause injuries. Workers not only do not wear gumboots but often walk on these places bare footed. Employers do not give importance to occupational health and safety. Mostly the workers, working on the yard are poor and illiterate and are not conscious about their health, occupational safety and life threatening effects of toxic chemicals (LITEHAUZ, 2009).

Following is a comprehensive list of various hazards that can effect the health of workers by causing diseases or injuries or even death.

### **Serious Accident Hazards**

- Fires and explosions cause by explosives and flammable materials
- Being struck by falling objects
- Falls from elevations either inside ship or on the ground
- Compressed between heavy objects
- Struck by moving objects
- Sharp objects
- Slipping on wet surfaces
- Being snapped by ropes, cables, chains and slings
- Deficiency of oxygen in confined spaces
- Lack of personal protective equipment and safety signs
- Housekeeping practices
- Handling heavy objects
- Poor access to various places of vessel being dismantled (stairs, floors and passage ways)

### **Hazardous Substances**

- Asbestos dust and fibers
- PVC & PCBs (and their combustion products)
- Heavy and toxic metals (lead, chromium, cadmium, mercury etc).
- Welding fumes
- Organometallic substances (tributyltin, etc.)
- Volatile organic compounds (solvents)
- Lack of hazard communication (signs, labeling and material safety data sheets)
- Inhalation in confined spaces
- Batteries, electrolytes and fire-fighting liquids

- Compressed and inflammable gas cylinders

### **Physical Hazards**

- High temperatures
- Noise
- Poor illumination
- Vibration

### **Mechanical Hazards**

- Transport vehicles (e.g trucks)
- Sharp-edged and heavy tools
- Portable and fixed ladders and scaffolding
- Cranes, hauling and hoisting equipment
- Chains, hooks and shackles
- Lack of safety guards in machinery
- Power-driven grinders, saws and other hand tools
- Lack of maintenance of machinery and equipment

### **Biological Hazards**

- Infectious diseases (malaria, dengue fever, respiratory infections, hepatitis, TB etc)
- Bites of various animals and insects
- Toxic marine organisms
- Risk of communicable diseases transmitted by rodents, insects, pests and other animals that may infest the ship

### **Ergonomic and Psychological Hazards**

- Repetitive strain injuries, working in awkward postures and excessive workload.

- Mental stress and strained human relations (aggressive behavior, alcohol and drug abuse)
- Long working hours, night work, shift work and temporary employment
- Poverty, low wages, lack of basic education and unhealthy social environment

**General Concerns**

- Lack of health and safety facilities and training
- Insufficient accident prevention procedures
- Inadequate first-aid and rescue facilities
- Poor work organization
- Inadequate sanitation and housing facilities
- Lack of medical facilities and social protection



## **CHAPTER 3**

### **LEGAL OBLIGATIONS OF SHIPBREAKING INDUSTRY**

#### **3.1 Introduction**

When shipbreaking started, there was no main issue of environmental policies and laws but as shipbreaking involves the transport and release of banned hazardous chemicals and hazardous work conditions, a lot of treaties and laws became applicable on shipbreaking industry. But with the passage of time shipbreaking evolved as a major environmental issue, so to make these treaties and laws applicable on shipbreaking industry, a number of legislation have been made under various conventions. This resulted in the formation of special committees / working groups and a lot of amendments in laws. But after a lot of discussion and sessions a lot of issues remained to be resolved. Basel convention provided complete guidelines for the full and partial dismantling of ship and at last the problem of shipbreaking resulted in Hong Kong Convention for the safe and environmentally sound recycling of ships held at Hong Kong, China in May 2009. It is expected that implementation of this convention will resolve problems associated with shipbreaking. But implementation of this convention is still to debate.

Following are the major conventions and laws, which are partially or fully applicable on shipbreaking industry.

#### **3.2 Basel Convention**

Basel convention on the control of transboundary movement of hazardous wastes and their disposal was adopted in Basel (Switzerland) in March 1989, and it became effective on 5<sup>th</sup> May 1992. The main motive of the convention is to create awareness about health and environmental hazards associated with toxic waste being dumped in the developing countries from the industrialized countries. It also promotes the necessity for sound management of hazardous wastes in the dumping countries. Convention is also useful in providing guidance about exchange of information source on control of transboundary movement of hazardous waste and other wastes within the transporting

states. The convention is highly concerned about the problem of illegal transboundary traffic of hazardous wastes and other wastes. Convention's great response is that if transboundary movement is necessary requirement, then it must be according to relevant international and national laws and recommendations.

### **Hazardous waste**

Basel convention in its Article 3 describes the national definition of hazardous waste; which are mostly explosive, flammable, poisonous, infectious, corrosive or ecotoxic. Under Basel convention toxic waste producing and exporting nations are responsible for management of toxic waste. This shifts them to cleaner production. Also they must strictly discourage the industries for using hazardous chemicals, so that minimum hazardous waste is generated at the end.

### **Notification**

Basel convention in its Article 6 and 7 describes all the obligations related to export of toxic waste. Notification is done by exporting state to importing state in written form and sends to the competent authority. In response to notification importing state or state of transit send its written consent to exporter, within 60 days of the receipt of given notification by the state of transit, export of hazardous waste is then allowed.

### **Export and Import**

Basel convention in its Article 8 describes 'a permit' to export or import is necessarily required, otherwise it is not allowed. Also toxic waste disposal must be in the environmentally sound manner; otherwise this waste is taken back into state of export without any hindrance or opposition by exporting state.

### **Basel Ban**

Greenpeace and Basel Action Network (BAN) after intensive working proposed an amendment to the Basel convention. Due to their effective suggestion, Basel convention added this amendment in its treaty in 1995. According to Basel Ban export of

hazardous waste from developed (OECD) countries to developing country is strictly prohibited if it is not done in environmentally sound manner. The Basel Ban is applied to export for any reason including recycling (Basel Convention Ban Amendment, 1995).

### **European Union**

Basel BAN amendment has not got enough ratification. So this has not got the right position, to be imposed strictly to all Basel parties. Although parties signed the amendment and considered it moral binding. However the European Union fully implemented the Basel Ban and its waste shipment regulation.

#### **3.2.1 Basel convention and ship breaking**

The practice of ship dismantling is actually export of hazardous waste from developed to developing countries, which is violation of Basel Ban amendment to the Basel convention. It also means that ship is dismantled at a green shipbreaking facility. In Basel convention it is also an obligation that ship owner have to fully decontaminate their end of life vessels prior to export. But the shipping industry prohibits the application of Basel Ban provisions for shipbreaking.

### **Environmentally sound management**

Article 2.8 of the Basel convention defines the practice of ESM of hazardous and toxic waste. It means taking all practicable steps that include storage; transport; treatment; reuse; recycling; recovery and final disposal in a manner that will protect human health and environment against the adverse effects resulting from such wastes.

Article 4.2 of Basel convention is helpful and source for drafting guidelines for environmentally sound management, according to which each party must take appropriate measures to:

- (a) Minimize their waste to such an extent that is not harmful for health and environment

- (b) Disposal facilities must be in vicinity with the site of generation
- (c) Export of hazardous waste to the developing state is prohibited strictly if they can not manage their toxic waste (according to criteria decided by the Parties at their first meeting)
- (d) State of concern must be provided with information according to Annex I

ESM also include an efficient approach for “clean” ship design practices. It include consideration of material compositions.

### **Non-transparent**

Ship in its original structure is unique and the ownership is non-transparent. Because there is no international requirements or standards relating to the condition or the original documents, that tells or indicates when the vessel destined for breaking. Consequently, a ship owner, without taking into account, onboard precautionary measures sends the ship for dismantling. Also the final destination is unknown. Hence the actual practice is illegal, simply under the Basel regime.

### **Legal Issues**

Legal issues related to the ships and their dismantling practice was debated among Basel parties in January 2002. They reached the conclusions that Basel convention is actually practically applicable to ships for scrap due to the onboard hazardous materials.

### **International Cooperation**

Due to complexity of the issue related to ship breaking, all the parties agreed that several international organizations need to cooperate, which may include IMO, London Convention and UNCLOS (United Nations Convention on the Law of Seas) (Basel Convention, 1989).

### 3.2.2 Technical Guidelines

Basel parties adopted technical guidelines in December 2002. The technical guidelines for the environmentally sound management of the full and partial dismantling of ships, provides a full documented guidelines to all those states who wish to establish facilities for dismantling. Also in Technical guidelines one can find advice on monitoring and verification of environmental performance (Technical Guidelines, 2002).

#### Environmental pollution control procedure at shipbreaking facilities

The decommissioning of ship structure into its components and parts creates the potential releases of environment. Technical guidelines provide with controlled procedure practices as described in the table 3.1.

**Table 3.1: Steps of ship decommissioning for disposal**

Actions	I	II	III
1	Inventory of onboard hazardous waste	Identifications, Quantification and location of waste	Chemical safety data sheet
2	Removal of hazardous liquid e.g oil and fuels before cutting at cleaning station facility	Waste and used solvent from cleaning station contained and properly secured	Combustible material must be removed to make vessel safe for hot work
3	Securing safe access to all areas	Ensure breathable atmospheres	Safe conditions for hot work
4	Removal of equipment	Consumable and loose equipment removed first	Reusable components removed as they become accessible e.g Fixtures chains, engine parts and propels
5	Removal of hazardous	Asbestos containing	Disposal of the

	material	material, PCB containing material carefully removed, as they become accessible	hazardous material
6	Dismantling, storage, recycling and disposal	Cutting of metal parts segregation of material for recycling and processing	Storage and disposal of the hazardous material

### **Design, Construction and Operation of shipbreaking facilities**

In technical guidelines there are a number of measures and recommendations that can be adopted in dismantling facilities in order to get good practices in design, construction and operation of ship dismantling facilities; resulting in development of an environmentally sound dismantling facility.

A number of hazards are due to oils and fuels, bilge and ballast water, paint and coatings, asbestos, PCB's, batteries, freon etc. In addition to these other potential hazards regarding to health and safety includes

- Exposures to heat/ vibration / noise
- Procedure followed and use of dangerous tools e.g cutters/ grinders
- Accident factors; electrical shocks, falling from heights, non-breathable or explosive atmospheres
- Quality control; reuse of ropes, chains recovered from ships/ cranes and lifting equipment
- Contingency; first aid facilities/ fire brigades
- Accommodation; Shelter/ clean water facilities and sanitary facilities

In technical guidelines there are various recommendations that can reduce or eliminate or reduce these hazards through proper planning and also through implementation of effective safe management and safe operational procedures.

**Table 3.2: Environmental Hazards and Preventive Measures**

<b>Environmental Hazards</b>	<b>Preventive Measures</b>
Oil and Fuels	On ship dismantling facilities there must be adequate storage and disposal facilities
Explosives	Compartments of ship must be ventilated in order to avoid explosion. No smoking signs must be put up on isolated areas. Fire extinguishing equipment immediately available and workers are sufficiently trained.
Bilge and Ballast water spills	Pumping equipment and containments must be sufficiently available
Paints and loading releases of environment	Separate area/ zone must be created for paint removal operation with impermeable floor and work place must be properly ventilated
Asbestos	There must be enclosed chamber in ship in order to avoid dispersion of air emission of asbestos. Personal protection equipment (PPE) must be provided to workers.
PCB's	These type of materials must be identified and labeled. Careful removal of PCB's containing materials, without use of heat inducing equipment (such as torch cutters)

### 3.3 The London Convention

London Convention is a common name of the convention on the prevention of "Marine Pollution by Dumping of Wastes" and it agreed in June 1972 at Stockholm. The main purpose of this agreement is to prevent dumping at seas and hence to control pollution of seas. It comprehensively covers various disposal of wastes from ships/vessels, aircrafts and platforms in sea. It came into force on August 30, 1975.

The London Convention consists of 22 Articles and three Annexes. The materials included in Annex I are generally not allowed to be dumped in ocean but a few materials of Annex I may be allowed to be dumped if only present in trace amounts. Annex II include those materials which are allowed to be dumped in ocean but only with special care and procedures (Annex I and Annex II are commonly referred as black list and grey list respectively). The guidelines of technical factors that should be considered in issuance of ocean dumping permits are described in Annex III.

London Convention was implemented mainly to protect seas from disposal of hazardous wastes that could lead to cause serious environmental threats not only to human health but also can harm marine life. The implementation of this convention has helped to stop damage to seas and oceans through dumping (London Convention, 1972).

At present 78 parties have signed the convention and Pakistan is also among signatories.

### **3.4 MARPOL 73/78**

The International Convention for the Prevention of Pollution from Ships commonly termed as MARPOL 73/78 was held in 1973 and then subsequently modified by a Protocol of 1978. (Hence MARPOL stands for marine pollution and 73/78 represents years)

MARPOL 73/78 is the most important conventions to protect seas and oceans from pollution. It was proposed mainly to protect seas from pollution caused by dumping, release of oils and exhaust pollution. The stated object of this convention is to protect marine environment by elimination of pollution caused by release of oils, dumping of harmful materials and minimization of any accidental discharge of substances.

The MARPOL convention was opened for signing on 17 February 1973, but did not come into force until 2 October 1983. The main text of the convention was modified



by a Protocol in 1978. A total of 136 countries have signed the convention and are included in parities of the Convention. The signatories of the Convention represent 98% of the world's total shipping tonnage.

The text of MARPOL contains 6 annexes. All of these annexes are concerned with various forms of marine pollution caused from ships

- Annex I describes regulations for the control of pollution by oil. According to which all oils must be removed from the ship before beaching i.e it must be thoroughly cleaned.
- Annex II contains regulations to prevent pollution by release of hazardous liquid substances used on the ships.
- Annex III describes regulations for all harmful and hazardous substances carried by ships and are capable of causing sea pollution.
- Annex IV describes regulations to avoid contamination of sea water by waste water used on ships. According to Annex IV, this sewage water must be removed before any demolition process starts and all dismantling facilities must be equipped with the facility to safely remove and handle the waste water.
- Annex V provides regulations to prevent sea pollution by any garbage produced on ships. According to Annex V, it is very necessary to remove all garbage from ship before dismantling.
- Annex VI contains regulations to avoid any air pollution cause by ships.

To become a party of MARPOL it is complementary to accept Annex I and II. Annex III-VI can be implemented on voluntary basis. Most of the Annexes require the establishment of waste reception and handling facilities on the ship dismantling yards.

It is responsibility of flag state (the country where the ship is registered) to certify that a ship is in compliance with pollution prevention standards set by MARPOL. All parties

of the convention are responsible to implement convention through formulation of national policies and laws (MARPOL, 1973).

### **3.5 The United Nations Conventions on the Law of Seas (UNCLOS)**

The United Nations Convention on the Law of the Sea (UNCLOS) is commonly named as Law of the Sea treaty or Law of the Sea Convention. It is an international agreement reached during the third Conference of United Nations on Law of Seas, (1973-1982) and replaced four 1958 treaties. It came into force in 1994. This convention describes the regulations for responsibilities and rights of countries to use oceans. According to convention it is necessary for a signatory to formulate guideline at national level to protect environment of seas, to regulated businesses and to manage and use of marine natural resources.

UNCLOS defines all problems concerning oceans and seas. It also describes other interconnected issues which need to be addressed. Hence it comprehensively covers all the issues of seas and oceans such as

- (1) Jurisdiction of nations over maritime areas
- (2) Economic activities
- (3) Preservation of marine environment from pollution and other activities
- (4) Development of marine science and technology.

Till now 158 countries and the Europeans community have signed the Convention. Pakistan has also ratified the convention.

### **3.6 International Maritime Organization (IMO)**

The International Maritime Organization (IMO) was established in 1948 in Geneva and came into force in 1958. Its former name was Inter-Governmental Maritime Consultative Organization (IMCO) but this was change in 1982 to IMO.

The main purpose of IMO is to form and implement guidelines to regulate shipping. It comprehensively covers all aspects of shipping like safety, legal matters, environmental problems, maritime security, technical co-operation and shipping efficiency.

Norway proposed to add the issue of ship scarping as to IMO's marine environmental protection committee in 1998 to IMO's agenda. It was decided to include items of ship recycling in agenda MEPC/44 and also invited many interested parties and a consultant committee. This committee gave a mandate to technical working group of Basel convention to collaborate with IMO so that they can together prepare guidelines or environmentally sound management on dismantling of ship and also to discuss related legal aspect with technical and local experts. As a result IMO become active and agreed to consider matter further to establish a correspondence group 46. This correspondence group (CG) provides information at MEPC 46 about deficiencies in national regulation on the issues related to environmental occupational health and safety and no enforcement standards and rules regulations. International governing frames are also lacked for ship recycling practices. In April 2001 MEPC 46 re-established the correspondence group and renewed its term of reference.

1. It will identify all stakeholders of ship and their role during the life cycle of ship.
2. It will identify and elaborate role of IMO in ship recycling.
3. It will identify the standards or guidelines established in the international/national or industrial laws that are applicable to ship recycling.
4. It can also recommend possible courses of action elaborating with pros and cons associated with each action.

In this way IMO finally drafted guidelines on ship recycling in 2004, along with Maritime and Environmental Protection Committee. The guidelines basically identified voluntary measures that must be necessarily taken by ship breaking industries, flag state, stakeholders and other relevant authorities (IMO, 2004).

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There were growing concerns about shipping industry by government and by NGO's about:

- Who will decide legal position and safety provisions for workers in ship breaking industry.
- Lack of environmental concerns.

International Chamber of Shipping taking account of all these aspects took initiative to establish Industry Working Party on Ship Recycling (IWPSR) in February 1999. The primary mandate of IWPSR was to establish "Industry code of practice on ship recycling" The code was adopted in August 2001. This code helped in the preparation of inventory of potentially hazardous materials on board. It is also basis for IMO's own guideline. It requires from ship owners as well as from the shipping companies to initiate a complete program that will identify and record any potentially hazardous materials as well as to make effort to minimize the potential hazardous materials on the ship board (ICS, 2001).

For the future concerns, it encouraged and advised the naval architectures and ship builders, that while designing and constructing ship minimum hazardous chemicals must be used because they are ultimately disposed off. Also it is suggested that they must create "Green Passport" for new ships. But some non-enforceable nature of these guidelines seriously weakens their applicability and potential effects.

### **3.8 Stockholm Convention on Persistent Organic Pollutants**

The Stockholm Convention on Persistent Organic Pollutants (POP's) was adopted in 2001. Its main purpose was to protect human health and environment from dangerous effects of POP's. POP's are organic pollutants that are highly toxic, persistent, bioaccumulate, thus enter in the food chain and remain deposited inside the body of human being, hence travel long distances in the environment. The main objective of the convention is the restriction of production and use of internationally produced POP's (industrial chemicals and pesticides). It also aims at continuing minimization of using

Recently developed a guideline according to which

- Ships are now required to have a Green Passport that will specify that the hazardous substances which are on board.
- Also ship-builders must produce “Clean ships” that have environment friendly products used for their manufacturing.

However IMO failed to accept and compliment the existing legislation and regulation dealing with the transboundary movement of hazardous waste (Basel convention). Hence Green Peace is concerned with new guidelines that can change the current practices and to stop this illegal business.

### **3.7 The International Chamber of Shipping**

The main trade association for ship-owners is the International Chamber of Shipping (ICS) and it was formed in 1921. It is mainly concerned with all operational, legal and regulatory issues. National ship-owner associations are among its members and represents 75% of the world's tonnage.

ICS is very different from other international shipping trade associations. All different types of trades from shipping industry e.g passenger ship traders, bulk carrier operators, container liner traders and tanker operators. It both includes ship-owners and third party managers (ICS, 2009).

The main objective of International Chamber of shipping industry was the promotion of industry by:

- Encouraging high standards of operations including safe shipping operations.
- Provision of high quality and efficient shipping services
- It also strives for its shipping industries adherence to international adopted standards and procedures.

these chemicals and ultimately elimination of releases of unintentionally produced POP's, such as dioxins and furans, as in case of shipbreaking they are produced by open burning of products containing PCB's and paints. Stockpiles must be managed and disposed in a safe, efficient and environmentally sound manner. Certain trade restrictions are also imposed by the convention.

The Stockholm Convention (in its article 3.2) restricts the import and export of POP's to cases, where the purpose is environmentally sound disposal. It also requires that POP's not to be transported across the international boundaries. If international trade is necessary then relevant international rules, standards and guidelines must be followed as mention in Article 6.1.

The Stockholm Convention also requires developing strategies for identifying waste produced as POP's, and how to manage them in an environmentally sound manner. These POP's must be destroyed or transformed irreversibly. At the request of conference of Pleni-potentiaries adopted by Stockholm Convention a technical working group was developed by Basel convention. This working group developed technical guideline on POP's wastes. The Stockholm Convention elaborates its converts from the parties to take measures from the reduction or elimination of POP's releases from international production and use (Article 3), its unintentional production (Article 5), stockpiles and wastes (Article 6), communication of hazard information (Article 10) and information exchange and research on POP's alternatives (Article 9, 11)

The chemicals selected for elimination under the Stockholm Convention contain chemicals produced during ship dismantling e.g hexachlorobenzene (HCB) and polychlorinated biphenyls (PCB's). The convention also requires labeling and removal of PCB containing products by 2025.

Concept of Best Available Techniques (BAT) and Best Environmental Practices (BEP) are elaborated by the conference of the parties.

Future establishment, by conference of parties of Stockholm Convention provide a subsidiary body to be called "Persistent Organic Pollutants Review Committee". The committee will assess chemicals that have been proposed for addition for the convention and recommend to the conference of parties (Stockholm Convention, 2001).

### **3.9 The Rotterdam Convention on Prior Informed Consent Procedure for Hazardous Materials/Chemicals and Pesticides in International Trade**

During the past few decades there is heavy production of different chemicals as well as their trade, that resulted in potential risks posed by hazardous chemicals and pesticides. Those countries are more vulnerable that do not have much information about hazards related to these chemicals and do not know how much information about hazards related to these chemicals is required and also do not know how to monitor these chemicals. In 1980's UNEP and FAO have developed information exchange systems having voluntary code of conduct in prior informed consent procedure in 1989. This convention entered into force on 24<sup>th</sup> February 2004 (Rotterdam Convention, 1998).

#### **Issues related to Shipbreaking**

Export of end of life vessels is actually transboundary movement of hazardous wastes. According to Rotterdam convention the importing state must provide information of hazardous waste present, also it is responsibility of exporting state to provide information about how to monitor these hazardous chemicals, this is "Prior Informed Consent Procedure" of Rotterdam Convention.

There are a number of chemicals and pesticides inside ship that falls in the category of hazardous chemicals e.g polychlorinated biphenyls, polychlorinated tetraphenyls, tetra methyl lead and industrial chemicals e.g asbestos, polybrominated biphenyls, tetraethyl lead (TEL) and tetramethyl lead (TML). But in several cases Green-Peace pointed out that ship sent for dismantling have been exported without prior alerting of the importing state. This is particularly the case of Pakistan

### **3.10 International Labour Organization (ILO)**

The International Labour Organization (ILO) is a specialized agency of the United Nations that deals with labour issues. Its headquarters are in Geneva, Switzerland. The main objective of this organization is to seek the promotion of social justice and to protect the internationally recognized human and the labour rights.

#### **Issues Related to the Ships**

In order to improve the safety and health of thousands of workers working in ship breaking yards, a guideline have been established under the auspices of ILO. It also cover worker's occupational health and safety issues left out by technical working group of UNEP and correspondence group of IMO (ILO, 2003). Hence ILO invited both of these IMO and UNEP to address these issues. In the 279<sup>th</sup> session of ILO's Governing Body (November 2000), a tripartite meeting on social and labour impact of globalization in the manufacture of transport equipment was called. In their meeting it is decided that ILO would prepare a draft of best practices adopted suitable to the local conditions, leading to preparation of a comprehensive code on occupational safety and health in ship-breaking. Also ships must have an inventory of hazardous chemicals on board updated throughout the life of vessel and government must encourage in this step (ILO, 2000).

In order to promote decent work, ILO works through the facilitation of social and national levels. ILO's secretarial activities program lead to the development of some publications.

- Is there a decent way to break up ships, discussion paper (Bailey, 2001)
- Workers safety in shipbreaking industries. An issue paper (Andersen, 2001)
- Documentary video, "The Shipbreakers" (2001)

#### **Objective of ILO**

- (1) Raising awareness among workers
- (2) Focusing on occupational health and safety issues.



ILO will continue its awareness agenda at national level through a technical cooperation program. This program will include practical actions and measures adopted towards the implementation of schemes for “Sustainable Ship Decommissioning for Disposal and Recycling”

ILO organized national tripartite workshop in Chittagong (Bangladesh) and India and a fact finding mission at the Gaddani Estate (Pakistan). Sometimes these are undertaken jointly by Basel convention and with IMO. The mission is in addition to occupational health and safety issues also identified decent, work deficit with respect of social protection such as pensions, sickness, injury and disability benefits and unemployment insurance, welfare provisions, basic living condition and training all of which require considerable improvement.

### **3.11 Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships**

For safe and environmentally sound recycling of ships, International Maritime Organization adopted a new international convention, at a diplomatic conference at Hong Kong China in May 2009.

The IMO convention imposes new conditions on ship from its manufacturing processes until its final demolition process, from cradle to grave. The IMO convention discusses different problems related to ship recycling, after ten years of observation and discussion, it imposed some obligations on ship owners e.g in order to minimize the risk to workers in the recycling yard. Inventory of hazardous material data sheet must be prepared and maintained throughout life cycle of ship. Also, a new obligation created by this convention is that ship owners should finally sell their end of life vessel to only those recycling facilities that meet the IMO standards and have been approved by flag state and by authorities in ship recycling state (The Hong Kong Convention, 2009).

**Maintenance of inventory of hazardous materials**

Inventory of hazardous materials, its preparation and maintenance is a principal obligation for shipowners. This must include:

1. On the ship where hazardous material is located i.e identification of location of hazardous material.
2. How much quantity of hazardous material is located i.e quantification of hazardous material

Hence this document must contain three sections:

Part I: List of hazardous materials inherent in the structure of ship

Part II: Operational waste i.e. the waste produced during demolition process of end of life vessel

Part III: Storage of the hazardous material in environmentally safe and sound manner

Part I must be maintained throughout the life cycle of ship, while Part II and Part III should be prepared prior to its delivery to recycling facilities.

**Selling a ship for recycling in accordance with IMO convention**

This new obligation will create a commercial environment i.e competitiveness among ship recycling facilities to create/ generate facilities and adopt process that are environmentally sound and certified, hence attracts the shipsellers to send their end of life vessels.

There are also two options for sale of ships. Either direct sale to ship recycling facility. Although it requires specific and detailed knowledge of recycling market, but it will pay more to the ship owners or use services of cash buyers that will purchase their vessel at the final voyage or at the point of handover to recycling facilities. However the buyer must accept some liabilities based on the accuracy of information about the yard.

Hence a contract of sale is developed between the ship owner and buyer. This contract includes practical liabilities on the responsible authorities; if they are unable to fulfill or refuse these liabilities then it is recommended that an alternative buyer/facility should be sought out.

The principal requirement for ship recycling facility is to develop a recycling plan for specific vessel. The recycling plan is assisted by inventory of hazardous materials provided by ship owner. This plan includes estimates of stores and operationally generated waste that can be produced/present in the ship structure. Plan must also include details about the fact that ship recycling facility can manage properly and hand in a safe environmentally sound manner. This plan should be sent to shipowner; who would ensure that the facility can manage hazardous materials properly. If any discrepancy found and identified by shipowner, the plan is immediately sent back to facility to take further action.

However, sometime facility require prior removal of dangerous substance before delivery and this must be documented in recycling plan.

#### **Prepare ship for safe entry for hot work**

Many recycling states in their national legislation mention clearly that chemical and oil tankers of crew/ship must be cleaned and 'gas freeing'. Ship recycling facility seek assurance, as mentioned in the contract of sale provided by this convention, that all cargo hold bunkers are 'gas freed' and prepared for hot work throughout the demolition process. If the recycling facility failed to provide this assurance, an alternative buyer should be sought.

The IMO convention requires an international reporting system between governments to guarantee compliances. This will provide a direct benefit to the shipowner that it can sent its ship to recycling facility, which can act in accordance with applicable terms of conventions and also received acknowledgement of flag state.

The competence of the facility can be checked by the factor that it possesses an approved facility management plan. It is possessed, and then it gives an assurance that ships are recycled in a safe and environmentally sound manner. A facility management plan should contain subsidiary plans and sections addressing different areas as mentioned below

### **Facility management**

It includes training program of workers that will help and guide them to different ship recycling operations in an environmentally sound manner. To deal with accidents emergency preparedness and response plan must also be implemented. In order to check the performance of the ship recycling operation, a system of regular monitoring is devised and a system for record keeping that help to check the performance of ship recycling operations, reporting the discharges, emission and potential risk of causing damage to workers working in that environment and also hazards to environment.

### **Workers health and safety**

For workers health and safety, facility management plan will check, the provisions and availability of personal protective equipment and clothing needed for all ship recycling operations. Training of workers is utmost important, so that they can undertake the risky operations with skill.

### **Waste Treatment**

Facility management plan will check the capacity and treatment ability of facility recycling. The following waste streams are of main concerns:

- Waste having heavy metal residues. E.g Hg, Pb, Cd, hexavalent chromium
- Paints and coatings that are highly flammable and during cutting it may produce toxic releases
- PCBs, CFCs and halogen containing substances.

The success and progress of this convention lies in its “live document” that is open for being reviewed and revised frequently in light of the industry experience. This will also help to apply the convention requirement and market moves towards compliance.

## CHAPTER 4

### STUDY METHODOLOGY

Study methodology of a research is much important and it defines the authenticity and reliability of work. Although there are various steps involved but there are two important steps of my research methodology.

#### 4.1 Collection of Information

Different sources were utilized to collect information. The authenticity of the material was kept in view and it was my utmost effort to collect information from most reliable sources and some times a comparison from different sources was carried out to check validity of certain data. Following were the main sources of obtained information.

- i. Journals available on web either free to access or access provided by HEC to Islamic International University, Islamabad.
- ii. Libraries (Central Library, Islamic International University, Islamabad; The National Library, Islamabad and Library of Pakistan Environmental Protection Agency, Islamabad)
- iii. Online information available on web pages of various national and international organizations
- iv. Information obtained from officials of different related National and Provincial Environmental agencies. Following officials have been interviewed by me.
  - a. Technical Officer (Chemical) Ministry of Environment, Government of Pakistan
  - b. Deputy Director (EIA/Monitoring) Pakistan Environmental Protection Agency, Government of Pakistan.
  - c. Deputy Director, Balochistan Environment Protection Agency, Government of Balochistan, Pakistan.

## **4.2 Comparison and Analysis**

On the basis of information collected, comparison and analyses were performed to compare the environmental conditions at Pakistani shipbreaking yards with that of standards set by international laws and convention, to determine economical benefits of shipbreaking industry and to the country and to point out a number of improvements for development of this industry in the country

Gap analysis was conducted by comparison of likely standards developed under the ship recycling convention and other relevant guidelines e.g the guidelines of the Basel Convention and International Labor Organizations.

Assessment of the hazardous waste handling and disposal whether it is accordance with the objective and targets of International treaties and Convention.

## **CHAPTER 5**

### **FINDING AND ANALYSIS**

#### **5.1 Introduction**

When old ships are no longer useful they are sold for scrap. The reuse of steel and other resources is beneficial from a life cycle assessment point of view, but over the years the ship-breaking industry has gravitated toward low labour cost countries with weak regulations on occupational health and environment and/or little enforcement. The main reason that why globally shipbreaking activities are centered in those countries which have comparatively weaker regulatory systems, because ships contain many hazardous materials. These hazardous materials if not dealt properly, can have significant detrimental effects on humans and the environment. The global centre of the ship-breaking and recycling industry is in the South Asia Region, specifically Pakistan, Bangladesh and India. The three countries cover 70-80% of the international market for ocean-going vessels with China and Turkey occupying the rest of the market. Only about 5% of global volume is scrapped outside these five countries (LITEHAUZ, 2009).

#### **5.2 History of Shipbreaking activities in Pakistan**

Pakistan's shipbreaking industry is considered as one of the oldest industry of such kind in the sub-continent region. Because of some international and local factors, shipbreaking activities remained inconsistent. At start, Ghans Bandar near Port of Karachi was the centre for such activities but this was then restricted to dismantling of smaller vessels like boats, barges and tugs etc.

Although shipbreaking activities at Coasts of Gadani started earlier than 1947 (before independence of Pakistan) but later (after independence) this seasonal industry was converted into a regular industry. Although some entrepreneurs tried hard to establish shipbreaking industry in Pakistan but despite of their efforts Gadani yards lacked very basic infrastructure. There were no medical services, household utilities, accommodation, roads and other facilities.



Finally in 1960s, Gadani ship breaking yards started working regularly and during 1970s it emerged as one of the major industry of the Country. In 1978, The Government of Pakistan took major decisions to boost the capacity of shipbreaking industry and hence declared Gadani as a port, released funds for required infrastructure and reduced import duties on end of life vessels. During the years 1969 to 1983, shipbreaking industry was at boom and in early 1980s; some 30,000 workers were directly employed at yards. Even larger number of people were earning indirectly through industries relying on scrap materials as raw materials and other trades. Although once it was considered as largest shipbreaking yards in the world but this industry saw a decline. The decline was not only because of shipbreaking rival yards in Bangladesh and India but also due to imposition of heavy import duties and other taxes.

During 1980s, the shipbreaking industry was producing near about one million tonnes of scrap steel per year but in the year 2001 it produced only 0.16 million of steel scrap. So keeping in view the plight of shipbreaking industry in 2001, Government of Pakistan took steps to boost shipbreaking activities again and reduced imports duties from 15% to 10% and also offered various incentives. After that shipbreaking industry improved, at present 0.5 million tonnes of steel scrap is being produced, some 6,000 workers are directly employed on the yards and is capable of dismantling on average 10 ships a year.

### **5.3 Location**

Gadani ( $26^{\circ} 5' 53$  N and  $66^{\circ} 34' 44$  E) is situated about 50 km northwest of Karachi city, the financial capital of Pakistan, a drive of roughly an hour from the Karachi city.

The ship recycling area at Gadani is a stretch of about 10 km in length. It presently consists of about 130 operating plots with each plot having a uniform water front of 220ft and onshore depth of 550fts or more. Most of the plots are privately owned by a local people with just 31 owned by the Balochistan Development Authority (BDA). The annual cost per plot charged by the private plot owners is almost five times that

charged by the BDA. Since 1978, the BDA has met the basic infrastructure needs of ship breakers although this has been limited to poor quality access roads. The supply of electricity is intermittent and unreliable and very few yards are connected to the grid, despite their falling under the Karachi Electric Supply Corporation catchment area. Despite a large-scale water supply scheme, there is still a severe shortage of water and yard owners has to privately purchase supplies of water.

Ships to be broken up are run aground on the beach under their own power, and then it is gradually dismantled. As the weight of the ship lessens, it is dragged further onto the beach until completely scrapped. In common with many other breakers in the region, scrapping ships at Gadani uses large amounts of local cheap labour with minimal mechanical assistance.

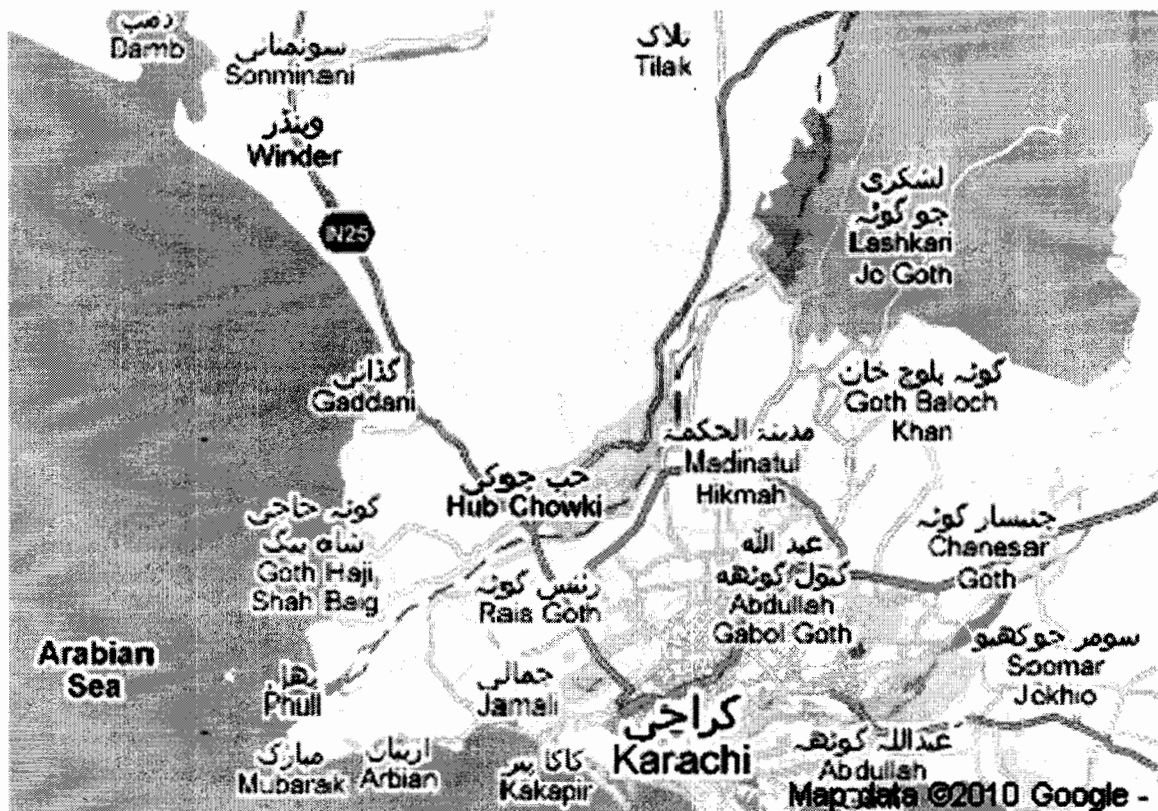
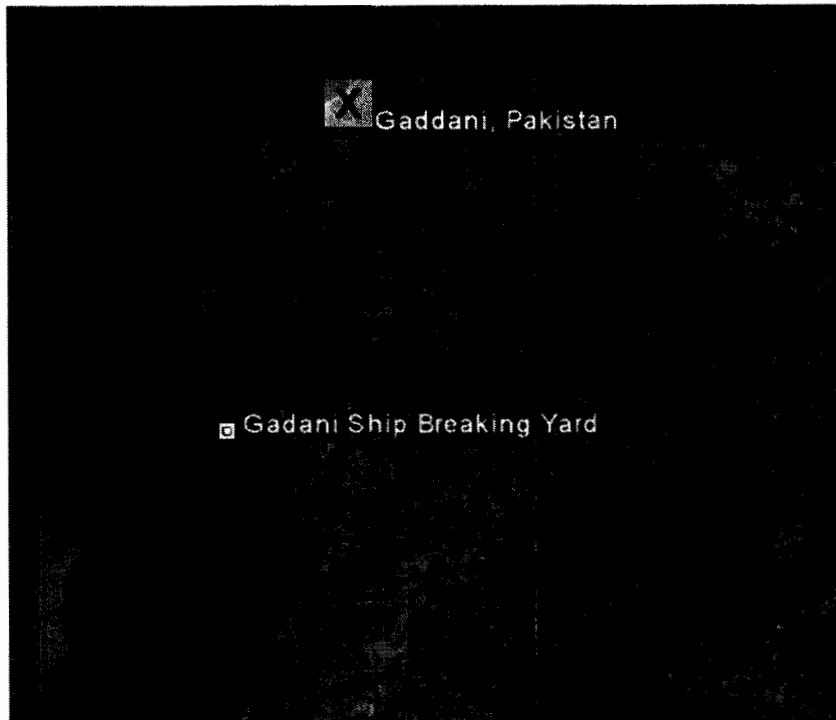


Figure 5.1 Location of Gadani in Pakistan.



**Figure 5.2** Location of Gadani at Coastal area of Pakistan



**Figure 5.3** Location of Gadani Ship breaking Yard with respect of Gadani in Coastal area of Pakistan



**Figure 5.4** Birds eye view of Gadani Shipbreaking yards.

#### **5.4 Current Condition of Shipbreaking Industry in Pakistan**

During its heyday, approximately 30,000 workers were said to be directly employed by the Gadani ship-breaking yards. In recent years this has decreased significantly to between 6,000 and 8,000, with approximately 4,000 more indirectly employed through ancillary activities. Both figures are likely to increase in the coming years. Industry representatives indicate that virtually no woman or child is employed in the ship-breaking yards. Our research found that the up to 75% of the total workforce are migrant laborers, although this statistic varies significantly between yards.

Working conditions at Gadani have been denounced by labor organizations and there is a higher degree of mechanization than in India or Bangladesh, which mitigates some risks. However, the industry is still needs to be modernized. There is conflicting evidence regarding the state of working conditions and safety and hazard management at Gadani. Injuries and fatalities in 2009 have been attributed to dangerous conditions,

although our research indicates that recent improvements have been made and the use of PPE is now mandatory in many yards. However, healthcare facilities are ill-equipped to deal with the nature and extent of injuries common to ship-breaking. Only basic first aid is provided to workers on site, and no trained medical staff members are present. The seriously injured are transported to Karachi, and the resulting delays for treatment usually prove to be fatal.

The Gadani workforce is made up of salaried and daily wage employees. The average daily wage for an eight hour shift is between Pak Rupees 350-700 (approximately 4-8 US Dollars), depending on experience. An additional four hours of overtime is commonplace and paid at the same rate, with workers opting to leave yards that cannot offer overtime. Gadani is only area in the region where labour shortages have proved to be a problem. Salaried workers provide the required skills in the yards, and earn between Pak Rupees 25,000-30,000 (approximately 300-370 US Dollars) per month. After the closure of a Ship Breakers College, which used to provide technical training to new recruits, workers now receive training "on the job" by assisting and shadowing the more experienced and skilled employees. Career progression is based on years of service and only the most experienced and longest-serving workers do demolition work aboard the ship itself.

There is little information available on the living conditions of ship-breaking workers. The vast majority of workers appear to be provided with accommodation by the yard owners, containing the bare minimum of facilities recovered from the ships themselves. The accommodation available to workers at Gadani appears to be of a slightly higher standard than the accommodation available to Bangladeshi and Indian counterparts. However, there is no supply of potable water and an absence of sanitation facilities. A scheme to provide 1,000 housing units for workers was recently announced.

The Gaddani workers have organized themselves into a Ship-breaking Labour Union, which successfully campaigned for a 40% wage increase, better working

conditions and improvements of medical facilities in February 2009. Other reports describe a “pocket” union comprised of “loyal workers” that has been put in place by the ship-breakers as rival to the official union, thus denying the worker a true representation.

## **5.5 Environmental conditions at Ship Recycling Yards in Pakistan**

### **Metal Cutting**

Metal cutting operation is done by bare handed workers using oxy-acetylene torch cutters. Currently, hydraulic cutters are not in use. Hydraulic cutters are only common in developed shipbreaking countries, with strict environmental regulations and their enforcement e.g Netherland. The workers are mainly illiterate, unaware of health hazards and not provided with personal protective equipment. These workers enter into contaminated, hazardous, explosive and improperly ventilated atmospheres of closed cavities. The cutting operation continues throughout the day and even at night, in the absence of proper lighting. As metal surfaces are coated with lead and tin containing paints, during cutting operation this paint is burnt into smoke and this hazardous smoke is inhaled by workers. During cutting operation insulation of cables containing PCB's are also burned that produces severely hazardous materials e. g dioxins. Although decisions made at International conventions require the working space pre-cleaned from any oil or other hazardous material, properly ventilated working atmosphere and use of special clothing along with goggles, gloves, safety shoes and breathing equipment. But the international conventions and resulted national policies are not important for shipbreakers and are totally ignored; even the local environmental protection authorities are working blindly and take no actions at all.

### **Oil and Fuels**

The majority of ships scrapped on Pakistani beaches are oil tankers. Pakistani breakers are specialized in large tonnage vessels. When a ship arrives for scrapping, it contains large quantities of oils and fuels of different types e.g engine oil, greases, lubricating oil, sludge located in different compartments of ships. In case of oil tankers,

the storage tanks contain large quantities of sludge. The oil is usually drained out simply by drilling holes into ship structure. This recovered oil is not separately handled, even this is mixed and drained openly in the ocean or in the nearby ground pits that are not generally covered or sealed to protect oil seepage into soil and ground water reservoirs. The vessel's piping normally contains some quantity of oil, fuel sludge and associated residues. Instead of fully emptying and cleaning the compartments of the vessels, cutting commences. During cutting, this fuel often results in small explosions. For handling, safe disposal and treatment of oils, sludge and other associated residues no facilities are present at yards.

### **Bildge and Ballast Water**

Bildge water, containing hazardous materials is directly released into open ocean, without taking any precautionary measures. Release of bildge water into open ocean is not allowed and several international conventions had put ban on this activity. Instead of releasing this water directly, international laws propose treatment of this water to make it safe for release. But currently there is no such facility available at yards and also no plan to install bildge water treatment facility has been chalked out.

When a ship arrives for dismantling it contains huge volume of ballast water that is brought on board intentionally to make balance of the vessel. As in the case of bildge water, ballast water is also drained directly into ocean. Ballast water contains marine organisms from different regions therefore its release into ocean is very harmful to the local marine ecosystem due to the introduction of endemic species. Mostly oil tankers are dismantled at Pakistani yards, and it is a common practice in old tankers that in case of need some cargo tanks are also filled with water, so ballast water is often contaminated with oil. During ship dismantling procedure, rain also adds to ballast water; hence workers are forced to perform dismantling procedures in this polluted water. Currently there is no facility for recommended and safe de-blasting of vessels at Gaddani yards. No separate evaporation pits are available. Therefore, environmentally safe handling of ballast water is totally ignored by the shipbreakers and local law enforcement authorities.

**Paints and Coatings**

At Gaddani yards, painted metal surfaces are not mechanically/ chemically cleaned before torch cutting. When paints are burned during torch cutting, TBT, lead compounds and chromates are released in the form of smoke and fumes into atmosphere. Oil based paints mostly contains PCB's hence its burning results in release of dioxins. It results in air pollution, and specially affecting workers performing torch cutting procedures without any breathing equipment. There is no distinction between different paints and all paints are handled in the same way whether they are antifouling, oilbased or flammable. After cutting the painted metal plates, no labeling is performed, so there is no distinction between coated paints and coated metal processing. During processing in re-rolling mills, the hazardous oxidation products of paints are released into air due to lack of air pollution control.

The yards also lack in Analytical laboratory facilities. The contamination caused by paints in soil, water and air cannot be measured. Hence all the process of paint removal and handling of painted objects is carried out without taking in account of the environmental hazards caused by paints.

**Asbestos**

On shipbreaking yards of Pakistan there is no site for dumping disposal of asbestos and asbestos containing material (ACM). Asbestos fibers and flocks fly around in open air. Workers take out asbestos insulation material with their hands, dry it in sun, keep in their sleeping quarters. Once dried, it is broken into small pieces to be sold. Workers also take out asbestos and glass wool from engine room of scrapped ship without having any protective measures, for example they do not wet it with water before handling. The workers are not specially trained for the removal of asbestos or asbestos containing material. There is a need of having specialized workers for this job.

No survey of the ship is carried out in order to make an inventory of asbestos or asbestos containing material. So before dismantling workers do not know that where they



will encounter asbestos and in what quantity. There is also no practice of record keeping of ACM i.e place of recovery, quantity, handling procedure and its disposal. There is no provision of specialized covered vehicles for safe transportation of asbestos from dismantling yards to dumping site. No measures are taken to stop re-entry of asbestos in the market. As yards lack an analytical laboratory, therefore no air surveillance activity undertaken on quantity of asbestos fibers is flying around in the yards environment.

### **Polychlorinated Biphenyls**

Polychlorinated biphenyl (PCB) containing materials are considered as extremely hazardous and these materials require special monitoring and handling. But at Pakistani yards, PCB containing materials are piled openly. No inventory for PCB containing materials onboard is made. Workers remove PCB materials with bare hands and without use of any personal protective equipment. Also workers performing this job are not properly trained for this. The recovered PCB containing objects are not sorted on the basis on the type, no labeling is done to differentiate between different PCB material types.

The PCB containing materials are thrown openly and in some cases PCB materials are burned openly, which is highly condemned activity. The international and national laws require special handling of PCB containing materials according to the nature of source and concentration. But no laboratory facilities are available to differentiate between different PCB containing materials, usually a sampling and chemical analysis is required for this purpose.

### **Other Waste Streams**

There are lot of other hazardous materials which, if not properly handled and disposed can cause severe threats to environment. For example radioactive materials are not identified and thus it is not known that how these materials are handled, and what damage these materials are causing. The PVC objects are sometimes burned openly which result in the release of highly toxic dioxins. Instead PVC objects require disposal

at proper sites. Mishandling of refrigeration equipment results in the release of CFC's into the atmosphere.

There are a lot of chemicals and materials on board like antifreeze fluids, solvents/ thinners, batteries and battery electrolyte, evaporator dosing and de-scaling acids, corrosion inhibitors, compressed gases (acetylene, propane and butane) and plastics which require special handling and disposal or recycling in order to protect workers from accidents and to avoid release of toxic chemicals to the environment.

### **5.6 Hazardous Work Conditions**

As ship dismantling is a very hazardous and dangerous job, where workers not only endanger their lives by exposing themselves to hazardous chemicals but also they perform risky operations. Workers involved in ship dismantling activities always require special training and protective equipment, so that they may be able to perform their job with safety.

Currently Gadani ship breaking yards lacks facilities to facilitate workers safety. All the workers are forced to work in dirty atmosphere, with bare hands, no special clothing and with no special equipment. Most importantly these workers have no specific training / education. Also there is lack of basic infrastructure and proper roads, hospital, housing and sanitation facilities are not according to requirements.

The first requirement for safe working is clean working atmosphere. The ship must be cleared before any dismantling work commences. Normally ship arrives with lot of hazardous materials on it e.g oils, bilge water etc. All work places must be easily accessible and properly ventilated. At Gadani yards no measures are taken to facilitate workers during dismantling operation.

The workers require personal protective equipment at all stages of dismantling operation. During metal cutting they require fire resistant clothes, gloves, gum boots,

glasses and also breathing equipment (in cases where ventilation is not proper). During removal of oils and other lubricants, workers need special clothing and gloves to avoid dermal contact. Asbestos removal requires special breathing equipment, so that flying fibers are not inhaled by workers. At Pakistani yards workers are not provided with personal protective equipment to meet safe working requirements. Hence workers are exposed to all dangerous chemicals and materials involved in the procedure, this have a long term effect on workers health. Non-provision of personal protective equipment is against labour rights and illegal in international and national laws.

During dismantling of ships, accidents are normal throughout the Asia. The main causes of accidents are due to slippage of oil spills, falling of metal plates, explosions, fires etc. Another common cause of accidents are use of improper equipment, which are not certified for that job e.g use of ropes and chains recovered from ship for load bearing applications. Lack of training is another major cause of accidents. Also there are insufficient facilities to deal with any emergency. So there is immediate need to clear working space before dismantling procedure, to put warning signs at hazardous working sites to avoid entry of irrelevant workers, to provide rescue facilities and proper training to workers.

Currently no hospitalization facilities are available to workers and all workers need to visit hospitals in Karachi City. Hardly basic first aid facilities are available which are not sufficient for all workers. There is no ambulance made available by ship breakers and in case of emergency workers use private ambulance services which are only available in Karachi some 50 km apart. So in case of emergency it takes a lot of time for ambulance to reach Gadani yards and the resulting delays for treatment can prove to be fatal. Non-availability of proper hospital, doctors and other medical facilities lead to the increased death rates of workers. Workers have to pay for their medical treatment and ship breakers offer little or no contribution. Therefore all workers must have medical insurance arrange by yard owners.

At Gadani beach workers are only provided with small quarter for residential purpose. The housing colonies of workers are not properly managed and are filled with heaps of hazardous materials. There is no proper sanitation system and all residents use untreated and contaminated water for drinking. Sewerage is also not properly designed to meet the requirement of the community. No area is provided to workers for recreational activities. In short workers are living in an area with insufficient and improper living facilities. A lot of improvements are required in this area. A scheme to provide 1,000 housing units to workers was recently announced.

There are no training institutes which can provide proper and scientific training for various type of dismantling jobs. There was a college which used to provide training but after the closure of Ship Breakers College, workers now receive training "on the job" by assisting and shadowing the more experienced and skilled employees. But learning on the job is not easy and not always safe for a new recruit. So a training institute is also in high demand to meet the trained work force for various dismantling operations.

The Gadani workforce is made up of salaried and daily wage employees. The average daily wage for an eight hour shift is between Pak Rupees 350-700 (approximately 4-8 US Dollars), depending on experience. An additional four hours of overtime is commonplace and paid at the same rate, with workers opting to leave yards that cannot offer overtime. Gadani is only area in the region where labour shortages have proved to be a problem. Salaried workers provide the required skills in the yards, and earn between Pak Rupees 25,000-30,000 (approximately 300-370 US Dollars) per month. Career progression is based on years of service and only the most experienced and longest-serving workers do demolition work aboard the ship itself.

The Gaddani workers have organized themselves into a Ship-breaking Labour Union, which successfully campaigned for a 40% wage increase, better working conditions and improvements of medical facilities in February 2009. Other reports

describe a “pocket” union comprised of “loyal workers” that has been put in place by the ship-breakers as rival to the official union, thus denying the worker a true representation.

### **5.7 Contamination Caused by Shipbreaking Activities**

The effects of ship breaking activities on the environment can be measured by measuring the amounts of various potential pollutants, released during ship breaking process. A variety of tests can be performed and impact of ship breaking industry can be judged by analyzing samples of seashore water, shore soil and surrounding air.

Few reports exist on studies at the ship recycling area at Gadani Beach. A number of case studies of environmental impact assessments (EIA) for dismantling of specific ships revealed that the beaches have become contaminated by ship recycling activity, but only limited number of parameters have been studied involving oil, greases and bacteria. There are only a few reports available on the contamination caused by heavy metals, PCB, TBT and other pollutants.

Recently a survey of ship breaking industry at South Asian countries was conducted by consortium of international and locally based consultants for World Bank. The final draft of report named “The Ship-breaking and Recycling Industry in South Asia” was submitted on 31<sup>st</sup> December 2009. This report presented the result of concentrations of heavy metals, asbestos and PCB’s content in seashore soil (LITEHAUZ, 2009).

The investigations of sampled beach material for ship recycling yards for site characterization assessments conducted for this study showed the presence of heavy metals at the working areas, chromium, lead and mercury. The concentrations of chromium ranged from 2.42 to 22.12 mg/kg, for lead from 11.3 to 197.7 mg/kg and for mercury from 0.078 to 0.158 mg/kg.

Asbestos was not found at the one site for which samples were analyzed. This is not surprising as it is understood that onsite burial is a common practice although the locations are not marked. The surface samples taken may not have disturbed an asbestos containing layer.

PCB's were found to be widely distributed over the yards sampled, concentrations varying from 0.01 to 11.52 ppb. There was no overall pattern discernible with concentrations being higher across the yard than at a selected "hot spot". This is consistent with cutting and other activities being carried out at multiple locations without preventive measures to control releases to the soil.

In a separate exercise, tin was measured as indicative of the presence of TBT on paint samples. This is not conclusive but the evidence from the ship samples (paint chips) indicates that further confirmatory work should be done on sediments and soils at the yard, specifically to examine for the presence of TBT. Oils were found in all samples tested ranging from 485 mg/kg to 4,300 mg/kg indicating general contamination (LITEHAUZ, 2009).

#### **5.8 Ship breaking and National Environmental Policy of Pakistan**

The National Environmental Policy of Pakistan was finally drafted in July 2005. It comprehensively covers all aspects of environment and aims to protect, conserve and restore the environment of Pakistan. The Six Objectives of the Policy includes conservation, efficient management, environmental policy making, capacity building, meeting international obligations and mass awareness. Although currently there are no national guidelines available for environmentally safe and sound dismantling of ships. But guidelines presented in the National Environmental Policy can describe a framework for making of national shipbreaking policy.

National Environmental Policy of Pakistan is applicable on each and every aspect of shipbreaking industry. A detail of the guidelines presented in the National

Environmental Policy with relevant issues in Ship breaking industry in Pakistan are discussed below.

Guidelines under the Heading 3.1 (Water Supply and Management), requires the provision of water treatment facilities and drinking water supply to all citizens of Pakistan, also establishment of water quality monitoring systems are emphasized. But at Gaddani yards, workers colony lacks any drinking water supply system. Guidelines under the Heading 3.2 (Air Quality and Noise), requires the control and reduction of harmful emissions in air but at local ship breaking yards open burning of PCB and PVC containing material is a common practice, the burning of paints during torch cutting and release of asbestos fibers during mishandling pollute the ambient air. Guidelines under the Heading 3.3 (Waste Management), requires the installation of waste water treatment plants, management of hazardous wastes, to control oil spills and to control Marine pollution. But at Pakistani dismantling yards, hazardous waste such as asbestos and PCB containing materials are not properly managed, Oils are not properly contained and are mostly spilled, large amounts of hazardous wastes are added directly to sea in the form of bidge and ballast water, also there are no waste water treatment facilities available. According to Heading 4.1 (Poverty), all citizens of Pakistan must be provided with water supply and sanitation facilities and Heading 4.4 (Health), to enforce health and safety rules and regulations. But at Gaddani yards there are no proper water supply and sanitation facilities available and no enforcement of health and safety regulations. Heading 5.3 (Capacity Development), requires the provision of staff, equipment, infrastructure and financial resources to implement the Policy but at Pakistani ship breaking yards there is lack of basic infrastructure e.g dumping sites and roads, also there is lack of proper monitoring equipment. Heading 5.5 (Public Awareness and Education), requires public awareness and establishment of environmental education and training institutions but there are no programs for awareness of local people and training of workers working at Gaddani yards.

### **5.12 Implementation of International Laws**

The World Bank report on Strategic Country Environmental Assessment for Pakistan ((LITEHAUZ, 2009), reported that although efforts have been made for the development of national environmental legislation but regulatory authorities are need to be developed. Hence there is urgent need for the development of particular regulatory authority to regulate and monitor ship dismantling industry in Pakistan.

On 15<sup>th</sup> December 2009, Pakistan submitted Stockholm Convention National Implementation Plan (NIP). Ship dismantling is not mentioned in any section of NIP. According to NIP there are no particular laws for polychlorinated biphenyls and a ban is proposed on the import of PCB's or PCB containing material. But NIP not recognized ship dismantling industry as a large source of import and release of PCB's and PCB containing materials. There is a need of consideration for the development of a comprehensive national environmental legislation for the effective control of all POP's.

### **5.13 Role of Shipbreaking Industry in Economy of Pakistan**

Although activities involved in ship breaking have serious environmental impacts. But Shipbreaking in Pakistan holds great potential as it provides substantial revenue to the government, employment opportunities for thousand of workers/, raw material to our national steel industry and saves a huge amount of foreign exchange by reducing the import of steel materials.

Practically most of the parts of ships/vessels are recyclable hence, shipbreaking could be a sound sustainable industrial activity, if it is done in accordance to the international laws. In the terms of OECD report on ship scrapping, ship demolition recovers large volumes of obsolete tonnage from fleet, recyclable many of the ship's material used in ship's construction and a major employer in the main shipbreaking areas (OECD, 2001).



Ship mostly consists of steel and after dismantling steel is the primary recyclable product. Therefore in a developing country like Pakistan ship dismantling industry can play an important role by boosting the production of steel and hence benefiting country's economy. Some 95% of total revenue, generated from recycling of ship, comes from the sale of scrap steel and the remainder from other recyclable items.

In total there are about 80 scrap melting plants (mainly induction furnaces), and 334 re-rolling mills. Of these re-rolling mill, mostly (about 250) are located in Punjab. But most of the scrap and plates produced from ship dismantling goes in to the melting and re-rolling mills of Balouchistan or Sindh (about 75%) and remainder scrap is recycled in Punjab. Most of the local re-rolling mills (In Balouchistan and Karachi) depend mainly on scrap from ship dismantling for their inputs.

Currently the steel production of Pakistan is around 3 million tones but the consumption is around 5 million tones. Hence Country needs to import about 2 million tones of steel annually. At present 500,000 (0.5 million) tones of steel is produced by ship dismantling yards of Gaddani. There are totally 131 dismantling yards are available, only 30 of them are active. Hence Gaddani has a potential of increased ship dismantling activities and can handle four times more ships than are currently dismantled. Therefore, Pakistani ship recycling industry can generate more than 2 million tones steel, thus saving a huge amount of revenue spent each year, just on import of steel.

The revenues for ship breakers in Gadani, Pakistan, stem from two sources: steel and other recyclable items. The sales price of steel plates varies according to quality. The sample ship provides 12,580 tons of steel, generating total revenue of approximately \$4,992,800. The common practice in Pakistan is to sell all other recyclable items to a bulk buyer at a small premium over the normal steel price, amounting to an estimated US\$512,700 in revenue, with machinery and generators accounting for the greatest share. In total, it is estimated that the ship generates revenue of approximately \$5,505,500. The analysis found that initial investment costs for civil works and equipment depends on a

number of factors, although considerable investments are also made in infrastructure. The investment/depreciation costs amount to approximately \$18,300 (LITEHAUZ, 2009).

In terms of financial costs, the highest interest rates in the South Asian Region are charged in Pakistan, ranging from 17% to 18% per annum. This amounts to \$265,700 per ship for Gadani ship breakers for 180 day tenure. The ship-breaking industry in Pakistan is subject to four types of taxes including a Balochistan Development Authority charge. These amounts approximately to \$693,600. Shipyards are either owned by local Balochi leaders or are leased from Balochistan Development Authority and thus a rental is charged per plot (LITEHAUZ, 2009).

Wage levels are considerably higher in Gadani than in the yards of other countries in the same region. Combined labor costs for the dismantling of the sample ship amount to \$233,400. Estimates indicate that Pakistani workers should be substantially more efficient than in India, where more workers are employed over a longer dismantling period, reflecting, in part, a higher level of mechanization in Gadani. With the limited data available, it is estimated that similar consumable costs are incurred for Pakistan as for India. After dismantling, steel is transported across Pakistan at the cost of the ship breaker, and so additional costs are incurred for transport of approximately \$49,500 per ship. Various operating costs are also incurred throughout the breaking process, for instance, tug charges and EIA/IEE costs (LITEHAUZ, 2009).

Pakistan federal government imposes heavy taxes on import of iron and steel material to promote indigenous production of iron and steel. Government had also planned to impose additional taxes on ship dismantling industry but the provincial government of Balochistan opposed this, therefore the federal government postponed imposition of new taxes indefinitely. Pakistani shipbreakers are already paying heavy taxes; about 13% of the total revenue is paid as taxes while other countries in the region (India and Bangladesh) are charged only about 5% of the total revenue as taxes, tariffs and duties. Heavy taxes have not only discouraged local ship breakers but also resulted in

the major shift of industry to other countries. In ship dismantling industry of Pakistan, profitability is already lower, hence industry have no capacity to bear required expenses for environmental sound management.

#### **5.14 National Strategy**

There is need of investment by Government to improve capacity of institutes and also to enforce the laws, not only to protect workers but also to protect environment in ship dismantling process. Although Gaddani is a relatively unpopulated area, but the infrastructure need to be improved in terms of safety and capacity of main roads so that huge amounts of waste and recyclable materials can be transported. Management of hazardous waste is also a key challenge and for this purpose significant capacity and infrastructure development is required, so that standard set by international agreement and guidelines can be met.

Development of management and disposal of hazardous waste will not only benefit the ship breaking industry but also help in the improvement of environment of local population, urban zone of Karachi and Karachi Port. Currently machines are widely in use and Personal Protective Equipment (PPE) are also in use, but in some areas improvement is still needed. Following are the main priority actions that can help in the improvement of ship dismantling conditions, so that international conventions/treaties can be implemented.

- A facility for the hazardous waste treatment is required so that all hazardous waste is managed in an environmentally sound manner.
- There is need of technical assistance, so that capacity of ministry of environment and environmental protection agencies can be enhanced.
- There is need for the establishment of a authority which can assist in drafting of new legislations and on the basis of which, regulations and guidelines are formulated to protect human health and environment.

- There is need to develop technical capacity in various sectors of ship dismantling industry.
- There is also need for the provision of housekeeping facilities for the proper and leak proof storage of hazardous waste.
- There is a need for the development of access roads and other infrastructure (e.g hazardous waste disposal facility)
- There is need to implement guidelines, to inspect a ship before it beaches.
- Guidelines and procedures should be established to prevent effects of ship dismantling industry on human health.

According to a World Bank report (LITEHAUZ, 2009), the provision of above mentioned facilities will cost about 75 million USD.

Use of machinery for lifting plates and other loads, use of PPE and other improvements in facilities have provided a safer and advanced working environment than other countries in the region. But on the basis of LDT scrapped high costs are required to upgrade the ship dismantling industry, this is primarily because of low volume of ships scrapped in Pakistan. Following are the necessary measures, which are required for compliance with international agreements.

- Registration of workers and provision of PPE
- Provision of onsite pollution and safety control equipment
- Plan preparation for Ship Recycling and EHS management
- Training of workers
- Health care facilities
- Machinery and training for disposal of hazardous waste
- Facility for thermal treatment

According to a World Bank report (LITEHAUZ, 2009), the provision of above mentioned facilities will cost about 40 million USD.

The compliance with international agreements will put a major economic burden on the ship dismantling industry of Pakistan. The primary factor for this is lower number of ships dismantled in Pakistan. The profit (per LDT) of ship breakers will be affected and recycling cost will reach about 80 USD per LDT when all environmental measures are taken. Therefore if ship breakers have to bear all costs of compliance, then ship dismantling industry in Pakistan will be finished. It is expected that all costs for the upgrade of reception facilities and other infrastructure such as roads, electricity, water and sanitation should come from Public investment. Similarly it is very unusual that only one ship breaker manages the hazardous waste facility and serves other clients on payment (LITEHAUZ, 2009).

Government of Pakistan can help in achieving environmental goals of ship dismantling industry by provision of major hazardous waste facility, roads, electricity, sanitation, water. To encourage ship dismantling activities in environmentally sound manner, the Government can lower the import and custom duties on end of life vessels and also partially subsidize imposed taxes. But despite of the crucial situation of the industry the Government is planning to impose more taxes on this industry. So making more difficult for the industry to comply with international agreements and facilitate workers.

## **CHAPTER 6**

### **DISCUSSION**

#### **6.1 Suggested Precautions**

On the basis of laws and regulations proposed by various international conventions and agreements, we propose the following suggestions for environmentally sound management of selected materials.

##### **Metals**

Various protective measures should be adopted during cutting of metals, not only to protect the environment from released contaminants but also to protect the workers. Before start of any torch cutting activity, coating on metal surface should be analyzed and if it is found to be highly flammable or toxic then it must be removed in the form of strip from the area to be cut. All areas of ship where torch cutting is to be carried out must be cleared and made safe, before any hot work starts. The areas within, or adjacent to areas that contained flammable liquids and/or accessories connected that contained fuel and other combustible materials must be on cleared on priority for hot work.

The concentration of flammable vapours must be measured and only those areas should be declared clear, that contains less than 10% of minimum threshold limit of explosion. The empty metal containers such as fuel tanks must be filled with water and thoroughly cleaned, vented and then tested before cutting. All the hollow structures must be sufficiently vented, so that all accumulated gases are released to avoid any pressure buildup due to heat produced in cutting operation.

The bright light, noise, ricochets and heat produced during metal cutting may damage the workers health. Therefore all workers must be provided with appropriate personal protective equipment (PPE) including safety helmets, goggles and clothing made of fire retardant fabric. During cutting operation there must not be any object in the clothing and near the worker that can catch fire. In many cases a large magnitude of noise

is generated during dismantling operation so worker must be equipped with equipment to reduce the exposure.

If the cutting operation is not to be performed in enclosed and confined spaces or the metals are not coated with toxic materials then cutting operation can be performed without mechanical ventilation and respiratory equipment. But if the cutting operation is to be performed in confined spaces and mechanical ventilation is not either possible or feasible then workers must use air-line respirators during cutting operation. There must be person outside the confined space to maintain communication with the workers inside, so that in case of emergency assistance can be provided in no time. If the workers are engaged in cutting those metals whose surface is coated with toxic substances, then use of exhaust ventilation and air-line respirators should be mandatory.

### **Waste Handling**

The metal recovered from dismantling of ships can be sold to a scrap metal broker or directly to re-rolling and re-melting companies. But in some cases, where coated scrap metal is not recycled, then it must be managed as hazardous waste and should be disposed off accordingly. If the recyclable metal is mixed with not recyclable materials, then it can be recovered using separators and shredders. The remaining non-metallic materials that are non-recyclable must be managed as hazardous waste and disposed off properly, as it may contain environmentally hazardous materials like asbestos and PCB's. Scrap metal which have been sent from dismantling facility to recycling facilities may be coated with hazardous or toxic substances. Therefore the receivers must be informed about toxic coatings on metals and they should be encouraged to take actions for prevention of pollution, caused by recycling of metals coated with toxic and hazardous substances.

During recovery of copper wire from cables recovered from ships, the cables are sometimes burned and in this way highly toxic substances are produced and liberated to atmosphere. Therefore the operators must be encouraged to separate copper from

insulation by mechanical methods. The cable insulation can contain hazardous materials and can produce hazardous substances if not properly disposed (Basel Annex III, H13), therefore it must be disposed in a proper way.

## **Oil and fuel**

### **Waste Handling**

Oil and fuel that has been recovered and removed from the ship must be stored in a safe manner, the storage containers must be checked for leakage, and there must be monitoring for overfill. The containers must also be protected from being corroded. The storage facility must be equipped with an efficient leak collection system and all record must be kept.

Used oils are those oils which are either refined from crude oil or synthetically made, and also contains various type of contaminants which have been added up during the course of its use. Used oils must be considered as hazardous waste and should not be mixed with other waste materials, and if mixed with any other waste material then the entire mixture should be considered as hazardous waste and disposed off accordingly. There must be provision of dedicated container or tanks for the storage of used oil and all these containers must be labeled as "Used Oil". Most of the used oils can be recycled and recycling of used oils mostly proves to be economical.

A ship dismantling facility normally have to handle large amounts of used oils, so a specific oil spill preparedness contingency plan should be prepared that provides instructions on handling, recovery and recycling of used oil and oil containing materials. The plan should be an integral part of the general Contingency and Preparedness Plan for the dismantling facility.

## **Bilge and Ballast water**

An international convention for the control and management of ships ballast water and sediments is in the process of development under IMO.



Discharging ballast water directly in to the sea water can lead to the introduction of invasive species and pose a biological threat to the marine environment. Therefore the vessel should undergo de-ballasting in a recommended way. Currently IMO Assembly resolution A.868(20): "Guidelines for the control and management of ships ballast water to minimize the transfer of harmful aquatic organisms and pathogens", provides guidelines for the de-ballasting of vessels (IMO, 1997).

### **Waste Handling**

A safe way to handle Bilge and ballast water is to transfer it to onshore evaporation pits (in case of ballast water) or to storage tanks (in case of bilge water), that have been made specifically for this purpose. MARPOL convention, Annex I, provides regulations, indicating permissible levels of oils in discharge ballast water. Other regulations also available that specifies permitted level of other contaminants. In cases where level of contaminants is above the permitted levels then ballast water should be treated before discharge. Therefore the dismantling facility must be equipped with a central waste water treatment plant (MARPOL, 1973).

### **Paints and Coatings**

Before torch cutting of metals it is not necessary to remove paints from the metal surface unless either during process toxic compounds are released to the atmosphere or the paint is highly flammable. Therefore before the cutting of any painted surface, an evaluation must be conducted to determine whether the cutting operation will result in release of toxic compounds and to determine the flammability of paints. If the paint is found to be toxic then it should be removed at least a distance of about 10cm from the area to be cut. But if the removal of paint is not feasible or possible then cutting can be performed provided that the workers are equipped with breathing equipment such as air-line respirators. To remove paints and coating from the metal surfaces, following three methods are commonly used:

- **Chemical stripping:** The paints can be removed and stripped away by used of various solvents. The used solvent containing toxic paint must be collected and discharged as hazardous waste.
- **Abrasive blasting:** A surface can be blasted with abrasive e.g slag, grits or steel shots. In blasting high-pressure equipment is used and if the condition of the equipment applied is not satisfactory then it can pose a potential threat to the worker using the equipment. Hence regular checking of the blasting equipment is necessary. Worker using such equipment must wear protective clothing, goggles and used noise control equipment. The waste generated during abrasive ballast, contains residues of hazardous coating, and if slag is used as abrasive material then it can be contaminated with lead, arsenic and cadmium. Therefore any waste generated during ballasting operation must me managed as hazardous waste.
- **Mechanical removal:** The paints and coating can also be removed using power tools or thermal tools but use of thermal tools in not appropriate for removal of PCB containing paints.

All methods for removal of paints and coatings, that are described above can lead to the emission of toxic compounds to the atmosphere. These compounds can enter human bodies through inhalation and result in the cause of cancer. A part from toxic compound emissions, paint removal activities also result into generation of large amounts of toxic waste, which should be handled and managed accordingly.

All metallic parts removed from ships, coated with either toxic or flammable paints, should be labeled. All these paint coated metals will be then sent from dismantling facility to re-melting or re-rolling mills for recycling. During reprocessing of these coated metals, a lot of substances can be released to the atmosphere, but at reprocessing facilities the emissions can be easily controlled. Similarly flammable paints or coatings can be burned in a controlled process, but fire-fighting facilities must also be present at the

reprocessing facility to deal with any fire emergency. Thus the labeling of steel plates and other metals will help reprocessing facilities to determine the type of coated paint, and to take measures accordingly.

### **Waste Handling**

The waste generated during paint removal processes can also have a negative impact on the environment. Therefore any waste generated from processes of removal of paints and coating, should be regarded as hazardous waste and must be handled, managed and disposed off accordingly. Specific procedures may be adopted for management of such waste and should be included in the waste management plan for the dismantling facility. The pollution through surface runoff water should also be minimized by identifying and adopting best-management practices.

As different disposal facilities vary in size and location, and having different climate conditions, environmental setting, and hydrogeology, hence waste management plans should be facility specific. Wastes generated due to paint removal activities can include contaminated solvents, contaminated residues of sludges, rags contaminated by solvent, abrasive residues and paint chips. All the waste generated during such activities and which falls under the definition of hazardous waste (corrosive, flammable, toxic or reactive), must be handled and managed according to national and international regulations for management of hazardous waste.

### **Asbestos**

#### **Waste Handling**

Asbestos is a hazardous waste and is listed in Annex VIII (List A) of the Basel Convention. Hence it is not allowed to reuse or recycle asbestos. As asbestos is associated with several severe potential health impacts thus maximum precautions are necessary while handling it. These precautions includes protection of workers involved in removal of asbestos from ship, safe and secure disposal of asbestos and stopping asbestos from re-entering the market. The facility can either make a separate asbestos disposal

plan or can dispose asbestos as a part of overall waste management plan. The asbestos removal and disposal plan should be associated with the ship's inventory plan so that prior to removal, asbestos can be identified, quantified and localized. The PPE required for the workers removing asbestos from the ship and transporting it to disposal site must also be mentioned in the disposal plan. Removal and disposal of asbestos should be monitored by sampling and record keeping. Air-surveillance activities must also be the part of monitoring, so that the asbestos fibers in air can be quantified. The record keeping must also include all measurements, which have been taken to monitor exposure of asbestos to workers. The removed asbestos must be disposed and should not be sold to market. The asbestos must be kept wet before and during the removal process to avoid any dispersion of asbestos fibers in the air. It is advised that asbestos should always be removed by two workers, one wets the asbestos during removal operation and other performs the job of asbestos removal.

Only those workers should be employed, which are specially trained to perform this type of work. As there are several yards in one area, so these specially trained workers could be shared among several dismantling companies. All the workers engaged in removal and disposal of asbestos must use appropriate PPE (appropriate respirators, protective clothing, head covering, face shield, gloves and gumboots. The facility must also be responsible for the provision of hygienic facilities to workers. Dining areas, equipment room and shower area must be decontaminated.

If details about asbestos are not available in ship's inventory of hazardous materials, then a survey must be carried out to identify, quantify and localize asbestos and asbestos containing materials (ACM) on the ship. If any material is found to contain asbestos then instead of quantifying asbestos in that material, it might be feasible to consider all asbestos containing material hazardous and managed in the same way as asbestos alone. All ACM must be removed from the ship, before any activity that would disturb the materials is carried out.

During transportation of asbestos from dismantling site to disposal area, it can spill off from the vehicle, therefore leak proof containers with lids must be used for transporting asbestos. Asbestos should be disposed off in landfill (i.e burying in to the ground).

## **Polychlorinated Biphenyls**

### **Waste Handling**

Workers that are engaged in removal and disposal of PCB's or PCB containing materials must wear appropriated protective clothing or equipment to avoid any dermal contact or inhalation of PCB's. PCB's and PCB containing materials should only be removed and disposed off by specially trained workers, which have been trained for removal and disposal of such materials. As there are several yards in one area, so these specially trained workers could be shared among several dismantling companies.

Wastes that contain PCB's at a concentration level of 50ppm or above are declared as hazardous waste by Basel Convention. All PCB's and PCB containing materials must be removed before any demolition process starts and chemical analysis must be performed of all PCB containing and suspected materials. If the amounts of PCBs in any material falls into the range set by Annex A part II of Stockholm Convention, then the material should be disposed off according to the criteria described in Article 6 of the Stockholm Convention (Stockholm Convention, 2001).

PCBs or PCB containing materials should be stored in specified containers. The containers must be covered and properly labeled. The storage place for PCB materials must have a floor covering to avoid penetration of PCBs into the ground. Also these containers must be prevented from rain water, so that in case of spill, these materials do not penetrate the ground with rain water. The actual requirement for disposal may depend up the source, nature and concentration of PCB's in such materials.

## **6.2 Recommendations for Improvement**

As ship breaking industry is playing a positive role in our national economy thus it cannot be banned. A sustainable approach can be adopted to minimize the negative effects of ship dismantling industry on the coastal environment. Following steps can be taken for sustainable practice of ship dismantling activities at Gaddani yard.

### **Training**

Training of managers, supervisors and other workers is required in occupational health and safety and also environmental management. There is a need of training to develop and implement an environmentally sound ship dismantling plan which covers worker safety and training, protection of the environment and human health, roles and responsibilities of personnel, emergency preparedness, response and monitoring, reporting and record-keeping systems.

There is a need for the development of a training facility which can help ship dismantling industry by providing appropriate training in the following areas

- Inspection of ship to make an inventory of hazardous material
- Environmentally sound management of hazardous materials
- Preparation of plan for dismantling of ship
- Workers training so that they are able to perform their jobs efficiently and safely
- To produce specialized work force for specific jobs on board e.g cleaning of ship, removal of asbestos, steel plates cutting, loading and carrying of plates and other material from ship etc.
- To train personnel for identification, sampling and analysis of hazardous materials

Awareness of works and local population about health hazards and healthy activities is also very much important, so that they may be able to play their role in safe working and avoiding health hazards.

### **Legislation, Laws and Guidelines**

Currently there is lack of legislations and laws related to environmentally sound dismantling of ships. Although national environmental Policy is comprehensive but still not suggests about ship breaking industry. All international conventions and laws related to ship recycling industry must be translated into national guidelines of ship dismantling. For this purpose a responsible government institution which, after consultation with relevant organizations, employers and workers purpose breaking guidelines.

### **Monitoring and Law Enforcement**

Although there is lack of national guidelines for ship dismantling but our national policies and laws at least suggests how to handle hazardous wastes, prohibits open burning of wastes, requires the use of suitable PPE, and provision of proper living facilities to workers. But even these existing laws are hardly implemented. So in addition to formulation of new national guidelines, implementation of these laws must be ensured. Fines must be imposed on ship breakers not following laws and regulations and in extreme cases their permit should be cancelled.

Monitoring is another area which needs a lot of improvements. Currently there is no proper monitoring system. There is need for establishment of onsite monitoring lab, which will not only monitor the extent of release of various hazardous material from the ships being dismantled but will also the effect of dismantling activities on yards and local areas. A monitoring committee of qualified personnel should also be deployed on the yard, to monitor that the process of ship breaking is according to rules and regulations.

### **Development of Infrastructure**

Gaddani yards are currently lacking in basic infrastructure such as roads, uninterrupted supply of electricity, drinking water supply and proper sanitation facilities. There is urgent need to construct wide roads for the safe transport of workers to Karachi, for the safe and efficient transport of hazardous waste to dumping sites and for transport of recovered steel plates and other recyclable material to recycling facilities. Provision of

drinking water supply and sanitation facilities to the workers housing is also responsibility of local government authorities. The electricity supply is intermittent. Karachi electric supply company should take necessary steps to ensure continuous supply of electricity.

### **Provision of Waste Disposal Facilities**

Despite of large quantities of hazardous waste produced on the Gaddani yards, still there is lack of waste disposal facilities. There is a need of dump sites for asbestos and asbestos containing materials, and also for the disposal of other hazardous materials like PVC's. But disposal of PCB containing materials require special dumping and leak proof house keeping facilities. Similarly disposal of oils also require special disposal and house keeping facilities.

### **Financial Assistance for Facility Development**

After payment of import duties, custom duties and other taxes, the financial capacity of Pakistan's shipbreaking industry is not enough to bear all the expenses for environmental sound disposal of ships. So Government should provided sufficient funds for the establishment of central facilities like waste disposal sites, monitoring system, roads, drinking water, sanitation, electricity, hospitals and training institutes.

### **Ship Dismantling Plans**

The shipbreaking activities should be carried out in a planned and hygienic way. A layout should be designed before starting to break the ship. This layout must include preparation of ship inventory, pre-cleaning of ship, removal of bilge and ballast water, removal of accessories and machinery of ship and step wise dismantling. The plan must be prepared by highly experienced personnel and must also be properly documented. Plan must be checked and approved by a competent authority before any dismantling procedure starts.



### **Green Certification Scheme**

There is need for establishment of green certification scheme, it means that those dismantling yards which have proper facilities for the Environmentally Sound Dismantling of ships are certified as “green”. This will attract green recycling business and such yard may serve as model of best practice. The government can offer financial incentives to encourage establishment of green facilities by subsidizing imposed taxes for such yards. This will encourage competition among ship breakers to establish green dismantling facilities.

### **MARPOL Reception Facilities at Karachi Port**

Before dismantling, ships often arrive at Karachi Port for approval. Thus there is an opportunity to perform cleaning operations before actually process of dismantling starts. There are a lot of materials on board that can be easily removed before demolition of ship e.g removal of stored paints, chemicals, used oils, various solvents and bilge water. To manage the operationally generated waste of ships (going to Gaddani for dismantling) calling at Port of Karachi, the development of MARPOL reception facilities is proposed. This MARPOL reception facility (Karachi Port) must be provided with the capacity to handle solid waste and other non-operational waste.

A port waste management plan must be developed not only to serve ships for scrap but also ordinary merchant vessels. This plan is prepared to ensure cost efficient handling of ship's waste without causing delay of arrival of ship at Gaddani yard. For efficient ship waste handling IMO suggest preparation of port waste management plan. The first step will be to assist the port authorities to develop a port waste management plan which also features the financial sources.

### **Cargo Hold and Tank Cleaning**

Among other hazards, working in enclosed spaces such as tanks is among most serious hazards. Most commonly explosion caused by vapours in cargo tanks causes injuries and even deaths. Deaths are also reported from asphyxiation after entering into

low oxygen atmospheres in enclosed spaces. There is a need for enforcement of laws related to hot work in enclosed spaces. A better way is to establish a company, which specializes in cleaning of enclosed spaces and cargo holds and perform cleaning job before any hot work is started. The cleaning can be done either manually or chemically. All the oils, oily sludge, greases must be removed and disposed properly. Such company must also be responsible for issuance of clearance certificates for hot work in cargo hold and enclosed spaces. Therefore production of such clearance would be mandatory before starting of any hot work on the ship.

### **Prevention of Sea Pollution**

People living near sea shores rely mainly on sea foods. Therefore any disturbance in sea by dismantling activities will not only disturb the biodiversity of sea but also impose negative effects on human health. As most of the substance released during ship dismantling are hazardous and toxic, and are very much dangerous for aquatic life and human health. Hence,

- a) Scientific study should be carried out to assess the effects of ship dismantling activities on near sea shore water, aquatic life, sea shore soil and human health.
  
- b) To minimize hazards and environmental impact of dismantling industry there is need of collaboration & cooperation among scientists, policy makers, ship breakers, local representatives, N.G.O,s, and different stakeholders. For this purpose there is need of discussion, consultation and seminars.

### **Health and Safety**

Health and safety is one of the key areas in ship recycling industry and need proper attention and immediate actions. As the cost of provision of PPE (personal protective equipment) to workers is not as high as compared to cost of other facilities, so PPE can be provided to yard worker on priority basis. Ship breakers or owners must be responsible for provision of necessary PPE in general (goggles, gloves, gumboots and

helmets and working clothes) and appropriate PPE in specialized cases (fire proof clothing, breathing equipment etc) for workers and labours.

### **Accidents**

Accidents are very common during working in ship dismantling industry. Most common accidents involve crushing of workers under falling metal plates, explosion in enclosed areas, suffocation, falling of workers from heights etc. There is immediate need to take measure for reduction in accidents. Following actions can be taken to avoid or minimize occasions of accidents

- Warning signs must be displayed in hazardous areas, so that workers entering these areas must be aware of hazards.
- No irrelevant and illtrained worker should be allowed to enter and work in hazardous areas.
- Fire fighting equipment (fire extinguishers etc) must be available on ships, so that in case of emergency trained workers can help in saving life of others.
- Fire stations and hospitals should be setup near yards, for rescue and medical treatment of affected workers.

Ship breakers and owners must be responsible in providing treatment and compensations for labours. There must be surety of compensations and social security for victims of accidents and their families.

### **Record Keeping**

As in all other industries, record keeping is very essential in ship dismantling industry. Record must not only be kept to present before law enforcement authorities but also to monitor the progress of work. This can help in finding problem areas and to improve management plan for dismantling. It is recommended that following records must be kept

- Inventory of hazardous materials on the ship
- The date and time of removal of all materials, also the names of workers performing that job
- The type and quantity of hazardous and non-hazardous materials discharged from ship.
- The type and quantity of hazardous and non-hazardous materials transported to dump sites or recycling facilities. The time and date of transport, with vehicle number must also be kept in record.
- Names of all workers available to yard, categorized in terms of specialty of their work (e.g removal of asbestos, cutting of metals, loading, removal of oils and greases etc)
- The type and quantity of PPE issued to workers
- All accidents, causes of accidents, deaths and injuries

### **Collaboration and Coordination**

For effective ship breaking policy it is very essential to collaborate with international organizations and a coordination of all local legislative institutes, law enforcement agencies, NGOs, ship breakers and workers is important.

### **Rights of Workers**

There is need to take steps for effective implementation of international and national norms related to labour rights. Following steps must be taken to ensure the protection of labour rights.

- Set maximum and minimum number of working hours for which a worker can be hired
- Set minimum salary and overtime payment
- Set rule for salary deductions
- Allowance of holidays
- Living and medical facilities for workers

- Minimum weekly
- Freedom to Workers Union

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