Final Draft

IL&FS | Environment

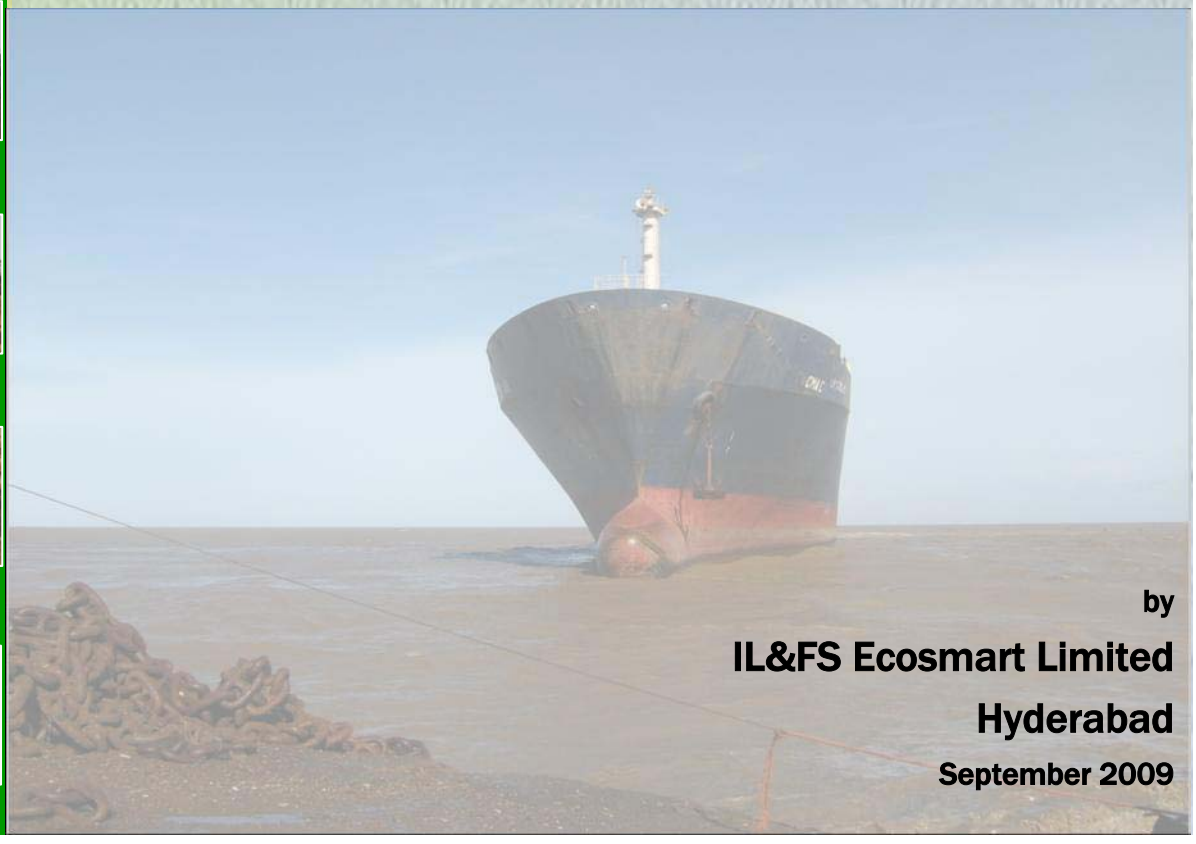
TECHNICAL EIA GUIDANCE MANUAL

FOR

SHIP BREAKING YARDS

Prepared for

Ministry of Environment and Forests
Government of India



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ACRONYMS

AAQ	Ambient Air Quality
ACM	Asbestos-containing Material
ACWM	Asbestos Containing Waste Material
ADB	Asian Development Bank
APHA	American Public Health Association
BIS	Bureau of Indian Standards
BOD	Biological Oxygen Demand
BOQ	Bill of Quantities
BOT	Build Operate Transfer
CAGR	Compound Average Growth Rate
CCA	Conventional Cost Accounting
CETP	Common Effluent Treatment Plant
CER	Corporate Environmental Reports
CFE	Consent for Establishment
CO	Carbon monoxide
CO2	Carbon Dioxide
COD	Chemical Oxygen Demand
CP	Cleaner Production
CPCB	Central Pollution Control Board
CRZ	Coastal Regulatory Zone
CSR	Corporate Social Responsibility
dBA	Decibels
DGFASLI	Directorate General, factory Advice Service and Labour Institutes
DO	Dissolved Oxygen
DMP	Disaster Management Plan
dwt	Dead Weight Tonnage
EAC	Expert Appraisal Committee
EBM	Environmental Baseline Monitoring
EcE	Economic-cum-Environmental
ECI	Environmental Condition Indicators
EFI	Electronic Fuel Injection
EIA	Environmental Impact Assessment
EPI	Environmental Performance Indicators
EMS	Environmental Management System
ETP	Effluent Treatment Plant
f/cc	fiber per cubic centimetre
FCA	Full Cost assessment

FHWA	Federal Highway Administration
GEMS	Global Environmental Monitoring System
GEPIL	Gujarat Enviro Protection and Infrastructure Ltd
GMB	Gujarat Maritime Board
GIS	Geographical Information Systems
GNS	Grain Neutral Spirits
HAP	Hazardous Air Pollutant
HEPA	High Efficiency Particulate Air
HTL	High Tide Line
IL&FS	Infrastructure Leasing and Financial Services
ILO	International Labour Organization
IMD	India Meteorological Department
IMFL	Indian Made Foreign Liquor
IMO	International Maritime Organization
IVI	Importance Value Index
km	kilometre
l	litres
LCA	Life Cycle Analysis
LDAR	Leak Detection and Repair
LDT	Light Displacement Ton
LSW	Light Ship Weight
M	metre
MoEF	Ministry of Environment & Forests
MT	Metric Tonne
NOx	Oxides of Nitrogen
NPE	Negative Pressure Enclosure
OHS	Occupational Health and Safety
OSHA	Occupational Safety and Health Administration
PACM	Presumed Asbestos Containing Material
Pb_3O_4	lead tetraoxide
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyls
PCC	Pollution Control Committee
PELs	Permissible Exposure Limits
PFCs	Perfluorocarbons
PPE	Personal Protection Equipment
ppm	Parts per Million
PPV	Peak Particle Velocity
PSA	Pressure Swing Adsorption

QRA	Quantitative Risk Assessment
RACM	Regulated Asbestos Containing Material
R&D	Research and Development
R&R	Resettlement and Rehabilitation
RPM	Respirable Particulate Matter
RSPM	Respirable Suspended Particulate Matter
RTDM	Rough Terrain Diffusion Model
SEAC	State Level Expert Appraisal Committee
SEIAA	State Level Environment Impact Assessment Authority
SPV	Special Purpose Vessels
SEZ	Special Economic Zone
SWMM	Stormwater Management Model
TCA	Total Cost Assessment
TDS	Total Dissolved Solids
TEQM	Total Environmental Quality Movement
TGM	Technical EIA Guidance Manuals
TSDF	Treatment Storage Disposal Facility
TSS	Total Suspended Solids
TWA	Time-weighted Average
UNEP	United Nations Environment Programme
UT	Union Territory
VOC	Volatile Organic Compound
VEC	Valued Environmental Components
WB	World Bank Group / The World bank
WBCSD	World Business Council on Sustainable Development

1. INTRODUCTION TO THE TECHNICAL EIA GUIDANCE MANUALS PROJECT

Environmental Impact Assessment (EIA) is a process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made. These studies integrate the environmental concerns of developmental activities into the process of decision-making.

EIA has emerged as one of the successful policy innovations of the 20th Century to ensure sustained development. Today, EIA is formalized as a regulatory tool in more than 100 countries for effective integration of environmental concerns with the economic development process. The EIA process in India was made mandatory and was also given a legislative status through a Notification issued in January 1994. The Notification, however, covered only a few selected industrial developmental activities. While there are subsequent amendments, this Notification issued on September 14, 2006 supersedes all the earlier Notifications, and has brought out structural changes in the clearance mechanism.

The basic tenets of this EIA Notification could be summarized into following:

- Pollution potential as the basis for prior environmental clearance instead of investment criteria; and
-
- Decentralization of powers to the State/Union Territory (UT) level Authorities for certain developmental activities to make the prior environmental clearance process quicker, transparent and effective.

Devolution of the power to grant clearances at the state-level for certain categories of the developmental activities / projects is a step forward to fulfill the basic tenets of the re-engineering *i.e.,* quicker, transparent and effective process but many issues come on its way of functional efficiency. These issues could be in technical and operational domains as listed below:

Technical Issues

- Ensuring level playing ground to avoid arbitrariness in the decision-making process
- Classification of projects which do not require public hearing and detailed EIA (Category B2)
- Variations in drawing Terms of Reference (ToR) for EIA studies for a given developmental activity across the States/UTs
- Varying developmental-activity-specific expertise requirement for EIA studies and their appraisal
- Availability of adequate sectoral experts and variations in competency levels
- Inadequate data verification, cross checking tools and supporting institutional framework

- Meeting time targets without compromising with the quality of assessments / reviews
- Varying knowledge and skill levels of regulators, consultants and experts
- Newly added developmental activities for prior environmental clearance, *etc*.

Operational Issues

- State/UT level EIA Authorities (SEIAA/UTEIAA) are formulated for the first time and many are functioning
- Varying roles and responsibilities of involved organizations
- Varying supporting institutional strengths across the States/UTs
- Varying manpower availability, *etc*.

1.1 Purpose

The purpose of developing the sector-specific Technical EIA Guidance Manual (TGM) is to provide clear and concise information on EIA to all the stakeholders *i.e.,* the project proponent, the consultant, the reviewer, and the public. The TGMs are organized to cover following:

1. Conceptual facets of EIA
2. Details on the developmental activity including environmental concerns and control technologies, *etc*.
3. Operational aspects; and
4. Roles and responsibilities of various organizations involved in the process of prior environmental clearance

For any given industry, each topic listed above could alone be the subject of a lengthy volume. However, in order to produce a manageable document, this project focuses on providing summary information for each topic. This format provides the reader with a synopsis of each issue. Text within each section was researched from many sources, and was usually condensed from more detailed sources pertaining to specific topics.

The contents of the document are designed with a vire to facilitate in addressing the relevant technical and operational issues as mentioned in the earlier section. Besides, facilitates various stakeholders involved in the EIA clearance process *i.e.,*

- Project proponents will be fully aware of the procedures, common ToR for EIA studies, timelines, monitoring needs *etc*., in order to plan the projects / studies, appropriately.
- The consultants across India will gain similar understanding about a given sector, and also the procedure for EIA studies, so that the quality of the EIA reports gets improved and streamlined.
- Reviewers across the states / UTs will have the same understanding about an industry sector and would be able to draw a benchmark in establishing the significant impacts for the purpose of prescribing the ToR for EIA studies and also in the process of review and appraisal.
- Public who are concerned about a new or expansion projects, can have access to this manual to know the manufacturing/production details, rejects/wastes from the

operations, choice of cleaner/control technologies, regulatory requirements, likely environmental and social concerns, mitigation measures, *etc*., in order to seek clarifications appropriately in the process of public consultation. The procedural clarity in the document will further strengthen them to understand the stages involved in clearance and roles & responsibilities of various organizations.

- In addition, these manuals would substantially ease the pressure on reviewers at the scoping stage and would bring in functional efficiency at the central and state levels.

1.2 Project Implementation

The Ministry of Environment & Forests (MoEF), Government of India took up the task of developing sector-specific TGMs for all the developmental activities listed in the re-engineered EIA Notification. Infrastructure Leasing and Financial Services (IL&FS) Ecosmart Limited (ECOSMART), has been entrusted with the task of developing these manuals for 27 industrial and related sectors. Ship Breaking Yard is one of these sectors, for which this manual is prepared.

The ability to design EIA studies for specific industries depends on the knowledge of several interrelated topics. Therefore, it requires expert inputs from multiple dimensions *i.e.,* administrative, project management, technical, scientific, social, economic risks, *etc*., in order to comprehensively analyze the issues of concern and to draw logical interpretations. Thus, ECOSMART has designed a well-composed implementation framework to factor inputs of the experts and stakeholders in the process of finalization of these manuals.

The process of manual preparation involved collection & collation of the secondary available information, technical review by sectoral resource persons and critical review and finalization by a competent Expert Committee composed of core and sectoral peer members.

The MoEF appreciates the efforts of ECOSMART, Expert Core and Peer Committee, resource persons and all those who have directly and indirectly contributed to this Manual.

1.3 Additional Information

This TGM is brought out by the MoEF to provide clarity to all the stakeholders involved in the 'Prior Environmental Clearance' process. As such, the contents and clarifications given in this document do not withstand in case of a conflict with the statutory provisions of the Notifications and Executive Orders issued by the MoEF from time-to-time.

TGMs are not regulatory documents. Instead these are the tools designed to assist successful completion of an EIA.

For the purpose of this project, the key elements considered under TGMs are conceptual aspects of EIA; developmental activity-specific information; operational aspects; and roles and responsibilities of involved stakeholders.

This manual is prepared considering the Notification issued on September 14, 2006 and the updates. For recent updates, if any, may please refer the website of the MoEF, Government of India *i.e.,* www.envfor.nic.in.

2. CONCEPTUAL FACETS OF EIA

2.1 Environment in EIA Context

"Environment" in EIA context mainly focuses, but is not limited to physical, chemical, biological, geological, social, economical, and aesthetic dimensions along with their complex interactions, which affect individuals, communities and ultimately determines their forms, character, relationship, and survival. In the EIA context, 'effect' and 'impact' can often be used interchangeably. However, 'impact' is considered as a value judgment of the significance of an effect.

Sustainable development is built on three basic premises *i.e.,* economic growth, ecological balance and social progress. Economic growth achieved in a way that does not consider the environmental concerns will not sustain in the long run. Therefore, sustainable development needs careful integration of environmental, economic, and social needs in order to achieve both an increased standard of living in short term, and a net gain or equilibrium among human, natural, and economic resources to support future generations in the long term.

"It is necessary to understand the links between environment and development in order to make development choices that will be economically efficient, socially equitable and responsible, and environmentally sound." Agenda 21

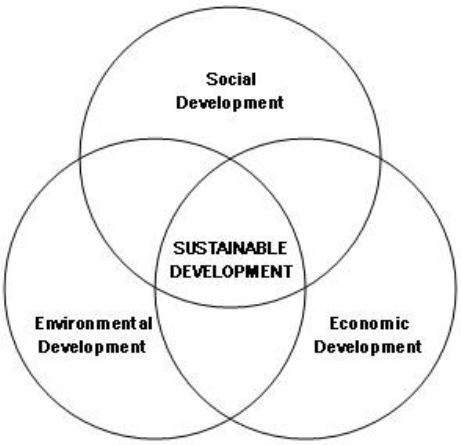

Figure 2-1: Inclusive Components of Sustainable Development

2.2 Pollution Control Strategies

Pollution control strategies can be broadly categorized into preventive and reactive. The reactive strategy refers to the steps that may be applied once the wastes are generated or contamination of receiving environment takes place. The control technology or a combination of technologies to minimize the impact due to the process rejects/wastes varies with the quantity and characteristics desired control efficiency and economics.

Many a number or combination of techniques could be adopted for treatment of a specific waste or the contaminated receiving environment, but are often judged based on techno-

economic feasibility. Therefore, the best alternative is to take all possible steps to avoid pollution itself. This preventive approach refers to a hierarchy that involves i) prevention & reduction; ii) recycling and re-use; iii) treatment; and iv) disposal, respectively.

Therefore, there is a need to shift the emphasis from the reactive to preventive strategy *i.e.,* to promote preventive environmental management. Preventive environmental management tools may be classified into following three groups:

Management based tools	Process based tools	Product based tools
Environmental Management System (EMS) Environmental Performance Evaluation Environmental Audits Environmental Reporting and Communication Total Cost Accounting Law and Policy Trade and Environment Environmental Economics	Environmental Technology Assessment Toxic Use Reduction Best Operating Practices Environmentally Best Practice Best Available Technology (BAT) Waste Minimization Pollution Prevention Cleaner Production Cleaner Technology Eco-efficiency	Industrial Ecology Extended Producers Responsibility Eco-labeling Design for Environment Life Cycle Assessment (LCA)

These tools are precisely discussed in next sections.

2.3 Tools for Preventive Environmental Management

The tools for preventive environmental management can be broadly classified into following three groups:

- Tools for assessment and analysis
- Tools for action; and
- Tools for communication

Specific tools under each group are discussed precisely in next sections.

2.3.1 Tools for assessment and analysis

2.3.1.1 Risk assessment

Risk is associated with the frequency of failure and consequence effect. Predicting such situations and evaluation of risk is essential to take appropriate preventive measures. The major concern of the assessment is to identify the activities falling in a matrix of high & low frequencies at which the failures occur and the degree of its impact. The high frequency, low impact activities can be managed by regular maintenance *i.e.,* LDAR (Leak Detection and Repair) programmes. Whereas, the low frequency, high impact activities are of major concern (accidents) in terms of risk assessment. As the frequency is low, often the required precautions are not realized or maintained. However, these risk assessment identify the areas of major concerns which require additional preventive measures, likely consequence distances considering domino effects, which will give the possible casualties and ecological loss in case of accidents. These magnitudes demand the attention for preventive and disaster management plans (DMPs). Thus is an essential tool to ensure safety of operations.

2.3.1.2 Life Cycle Assessment

A broader approach followed to deal with environmental impacts during entire ship breaking process is called the LCA. This approach recognizes the environmental concerns are associated with every step of the processing and also examines environmental impacts of the product at all stages of the product life cycle. LCA is concerned with reducing environmental impacts at all the stages and considering the total picture rather than just one stage of the production process.

By availing this concept, firms can minimize the costs incurred on the environmental conservation throughout the project life cycle. LCA also provides sufficient scope to think about cost-effective alternatives.

2.3.1.3 Total Cost Assessment

Total Cost Assessment (TCA) is an enhanced financial analysis tool that is used to assess the profitability of alternative sources of action in ship breaking. This is particularly relevant to pollution prevention options during all the stages of ship breaking. TCA involves all the relevant costs and savings associated with the ship breaking yard such as supply and demand for the vessel for scrapping, various costs involved in breaking and also sale and purchase of the vessel.

The assessments are often beneficial in respect of the following:

- Identification of costly resource inefficiencies
- Financial analysis of environmental activities/projects
- Prioritization of environmental activities/projects
- Evaluation of sale and purchase of the vessel
- Evaluation of Supply and Demand of the vessel
- Benchmarking against the performance of other processes or against the competitors

A comparison of cost assessments is given below:

- Conventional Cost Accounting (CCA): Direct and indirect financial costs+ Recognized contingent costs
- Total Cost Assessment (TCA): A broader range of direct, indirect, contingent and less quantifiable costs
- Full Cost assessment (FCA): TCA + External social costs borne by society

2.3.1.4 Environmental Audit/Statement

The key objectives of an environmental audit includes compliance verification, problem identification, environmental impact measurement, environmental performance measurement, conforming effectiveness of EMS, providing a database for corrective actions and future actions, developing companies' environmental strategy, communication and formulating environmental policy.

The MoEF, Government of India issued Notification on 'Environmental Statements' (ES) in April, 1992 and further amended in April 1993 – As per the Notification, the industries are required to submit ES to the respective State Pollution Control Boards (SPCBs). ES is a pro-active tool for self-examination of the industry itself to reduce/minimize pollution

by adopting process modifications, recycling and reusing of the resources. The regular submission of ES will indicate the systematic improvement in environmental pollution control being achieved by the industry. In other way, the specific points in ES may be used as environmental performance indicators for relative comparison, implementation and to promote better practices.

2.3.1.5 Environmental indicators

Indicators can be classified into Environmental Performance Indicators (EPI) and Environmental Condition Indicators (ECI). The EPIs can be further divided into two categories *i.e.,* operational performance indicators and management performance indicators.

The operational performance indicators are related to the processes and other operational activities of the ship recycler. These would typically address the issue of material recovery, energy consumption, the quantities of wastewater generated, other solid wastes generated, emission from ship breaking, *etc*.

Management performance indicators, on the other hand, are related to the management efforts to influence the environmental performance of the organization's operations.

The environmental condition indicators provide information about the environment. These indicators provide information about the local, regional, national or global condition of the environment. This information helps the organization to understand the environmental impacts of its activities and thus these indicators help in taking decision to improve the environmental performance.

Indicators are basically used to evaluate environmental performance against the set standards and thus indicate the direction in which to proceed. Selection of type of indicators for a firm or project depends upon its relevance, clarity and realistic cost of collection and its development.

2.3.2 Tools for action

2.3.2.1 Environmental policy

An environmental policy is a statement of the organization's overall aim and principles of action w.r.t. the environment, including compliance with all relevant regulatory requirements. It is a key tool in communicating the environmental priorities of the organization to all its employees. To ensure an organization's commitment towards formulated environmental policy, it is essential for the top management to be involved in the process of formulating the policy and setting priorities. Therefore, the first step is to get the commitment from the higher levels of management. The organization should then conduct an initial environmental review and draft an environmental policy. This draft should be discussed and approved by the board of directors and finally the approved environmental policy statement must be communicated internally among all its employees and must also be made available to the public.

2.3.2.2 Market-based economic instruments

Market-based instruments are regulations that encourage behavior through market signals rather than through explicit directives regarding pollution control levels. These policy

instruments such as tradable permits, pollution charge are often described as harnessing market forces. Market-based instruments can be categorized into four major categories *i.e.,*

- Pollution Charge: Charge system will assess a fee or tax on the amount of pollution a firm or source generates. It is worthwhile for the firm to reduce emissions to the point, where its marginal abatement costs are equal to the tax rate. Thus the firms control pollution to different degrees *i.e.,* High cost controllers – less; low-cost controllers – more. The charge system encourages the industries to further reduce the pollutants. The charges thus collected can form a fund for restoration of the environment. Another form of pollution charge is a deposit refund system, where the consumers pay a surcharge when purchasing a potentially polluting product, and receive a refund on return of the product after useful life span at appropriate centers. The concept of extended producer's responsibility is brought in to avoid accumulation of dangerous products in the environment.
- Tradable Permits: Under this system, firms that achieve the emission levels below their allotted level may sell the surplus permits. Similarly the firms, which are required to spend more to attain the required degree of treatment/allotted levels, can purchase permits from others at lower costs and may be benefited.
- Market Barrier Reductions: Known market barrier reduction types are as follows:
  - Market Creation: Measure and facilitate the voluntary exchange of rights and thus promote efficient allocation
  - Information Programmes: Ecolabeling and energy efficiency product labeling requirements
- Government Subsidy Reduction: Subsidies are the mirror images of taxes and, in theory, can provide incentives to address environmental problems. However, it has been reported that the subsidies encourage economically inefficient and environmentally unsound practices, and often lead to market distortions due to differences in the area. However, in the national interest, subsidies are important to sustain the expansion of production. In such cases, the subsidy may be comparable to the net social benefit.

2.3.2.3 Innovative funding mechanism

There are many forums under which the fund is made available for the issues which are of global/regional concern (GEF, OECD, Deutch green fund, *etc*.) *i.e.,* climate change, Basal convention and further fund sources are being explored for the Persistent Organic Pollutants Convention. Besides these global funding mechanisms, a localized alternative mechanism for boosting the investment in environmental pollution control must be put in place. For example, in India the Government has established mechanism to fund the common effluent treatment plants, which are specifically serving small and medium scale enterprises *i.e.,* 25% share by the state Government, matching grants from the Central Government and surety for 25% soft loan. It means that the industries need to invest only 25% initially, thus encouraging voluntary compliance.

There are some more options *i.e.,* if the pollution tax/charge is imposed on the residual pollution being caused by the industries, municipalities, *etc*., funds will be automatically generated, which, in turn, can be utilized for funding the environmental improvement programmes. The emerging concept of build-operate-transfer (BOT) is an encouraging development, where there is a possibility to generate revenue by application of advanced technologies. There are many opportunities, which can be explored. However, what is required is the paradigm shift and focused efforts.

2.3.2.4 EMS and ISO certification

EMS is that part of the overall management system, which includes the organizational structure, responsibilities, practices, procedures, processes and resources for determining and implementing the forms of overall aims, principles of action w.r.t. the environment. It encompasses the totality of organizational, administrative and policy provisions to be taken by a firm to control its environmental influences. Common elements of an EMS are the identification of the environmental impacts and legal obligations, the development of a plan for management & improvement, the assignment of the responsibilities and monitoring of the performance.

2.3.2.5 Total environmental quality movement (TEQM)

Quality is regarded as

- A product attribute that must be set at an acceptable level and balanced against the cost
- Something delivered by technical systems engineered by experts rather than the organization as a whole
- Assured primarily through the findings and correction of mistakes at the end of the production process

One expression of the total environment quality movement (TQM) is a system of control called Kaizen. The principles of Kaizen are:

- Goal must be continuous improvement of quality instead of acceptable quality
- Responsibility of the quality shall be shared by all members of an organization
- Efforts should be focused on improving the whole process and design of the products

With some modifications, the TQM approach can be applied in the improvement of corporate environmental performance in both process and product areas.

2.3.2.6 Eco-labeling

It is known as the practice of supplying information on the environmental characteristics of a product or service to the general public. These labeling schemes can be grouped into three types:

- Type I: Multiple criteria base; third party (Govt. or non-commercial private organizations) programme claims overall environmental preferability.
- Type II: Specific attributes of a product; often issued by a company/industrial association
- Type III: Agreed set of indices; provides quantified information; self declaration

Among the above, Type I schemes are more reliable because they are established by a third-party and considers the environmental impacts of a product from cradle to grave. However, the labeling program will only be effective if linked with complementary programme of consumer education and up on restriction of umbrella claims by the producers.

2.3.2.7 Cleaner production

Cleaner production is one of the tools, which influences the environmental pollution control. It is also seen that the approach is changing with time *i.e.,* dumping-to-control-to-recycle-to-prevention. Promotion of cleaner production principles involves an insight into the processes not only to get desired yield, but also to optimize resource conservation and implications of the waste treatment and disposal.

2.3.2.8 4-R concept

The concept endorses utilization of waste as a by-product to the extent possible *i.e.,* Recycle, Recover, Reuse, Recharge. Ship breaking forms an excellent example for this concept. Recycling refers to using wastes/ by-products in the process again as a raw material to maximize the production. Recovery refers to engineering means such as solvent extraction, distillation, precipitation, *etc*., to separate the useful constituents of the wastes, so that these recovered materials can be used. Reuse refers to the utilization of waste from one process as a raw material to other. Recharging is an option in which the natural systems are used for renovation of waste for further use.

2.3.2.9 Eco-efficiency

The World Business Council on Sustainable Development (WBCSD) defines eco-efficiency as "the delivery of competitively priced goods and services that satisfy human needs and bring quality of life, while progressively reducing ecological impacts and resource intensity throughout the life cycle, to a level at least in line with earth's carrying capacity". The business implements the eco-efficiency on four levels *i.e.,* optimized processes, recycling of wastes, eco-innovation and new services. Fussler (1995) defined six dimensions of eco-efficiency, which are given below to understand/examine the system.

- Mass: There is an opportunity to significantly reduce mass burdens (fuels, utilities consumed during the life cycle)
- Reduce Energy Use: The opportunity is to redesign the product or its use to provide significant energy savings
- Reduce Environmental Toxins: This is a concern to the environmental quality and human health. The opportunity here is to significantly control the dispersion of toxic elements.
- Recycle when Practical: Designing for recycling is important
- Working with Mother Nature: Materials are borrowed and returned to the nature without negatively affecting the balance of the ecosystem.
- Make it Last Longer: It relates to useful life and functions of products. Increasing the functionality of products also increases their eco-efficiency.

The competitiveness among the companies and long-term survival will continue and the successful implementation of eco-efficiency will contribute to their success. There is a need to shift towards responsible consumerism equal to the efficiency gains made by corporations – doing more with less.

2.3.2.10 Industrial ecosystem or metabolism

Eco-industrial development is a new paradigm for achieving excellence in business and environmental performance. It opens up innovative new avenues for managing business and conducting economic development by creating linkages among local 'resources', including businesses, non-profit groups, governments, unions, educational institutions, and communities for creative fostering of dynamic and responsible growth. Antiquated business strategies based on isolated enterprises are no longer responsive enough to market, environmental and community requirements.

Sustainable eco-industrial development has a systematic view of development, business and environment attempting to stretch the boundaries of current practice - on one level, it as directly practical as making the right connections between the wastes and resources needed for production and at the other level it is a whole new way of thinking about doing business and interacting with communities. At a most basic level, each organization seeking higher performance within itself. However, larger chunk of eco-industrial activity is moving to a new level by increasing the inter-connections between the companies.

Strategic partnership, networked manufacturing and performed supplier arrangements are all the examples of ways used by the businesses to ensure growth, contain costs and to reach out for new opportunities.

For most businesses, the two essentials for success are the responsive markets and access to cost-effective, quality resources for developing products or delivering services. In absence of these two factors, every other incentive virtually becomes a minor consideration.

Transportation issues are important at two levels – the ability to get goods to market in an expeditious way is essential to success in this day of just-in-time inventories. The use of least impact transportation, with due consideration of speed and cost, supports business success and addresses the concerned in the community.

Eco-industrial development works because it consciously mixes a range of targeted strategies shaped to the contours of the local community. Most importantly, it works because the communities want nothing less than the best possible in or near their neighborhoods. For companies, it provides a path towards significant higher operating results and positive market presence. For our environment, it provides greater hope that the waste will be transformed into valued product and that the stewardship will be a joint pledge of both businesses and communities.

2.3.2.11 Voluntary agreements

Voluntary environmental agreements among the industries, government, public representatives, NGOs and other concerned towards attaining certain future demands of the environment are reported to be successful. Such agreements may be used as a tool wherever the Government likes to make the standards stringent in future (phase-wise-stringent). These may be used when conditions are temporary and requires timely replacements. Also these may be used as supplementary/ complimentary in implementation of the regulation. The agreements may include:

- Target objectives (emission limit values/standards)
- Performance objectives (operating procedures)

- R&D activities – Government and industry may have agreement to establish better control technologies.
- Monitoring & reporting of the agreement conditions by other agents (NGOs, public participants, civil authority, *etc*.)

In India, MoEF has organized such programme, popularly known as the corporate responsibility for environment protection (CREP) considering identified 17 categories of high pollution potential industrial sectors. Publication in this regard, is available with Central Pollution Control Board (CPCB).

2.3.3 Tools for communication

2.3.3.1 State of environment

The Government of India brought out the state of environment report for entire country and similar reports available for many of the states. These reports are published at regular intervals to record trends and to identify the required interventions at various levels. These reports consider the internationally accepted DPSIR framework for the presentation of the information. DPSIR refers to:

- D – Driving forces – causes of concern *i.e.,* industries, transportation, *etc*.
- P – Pressures – pollutants emanating from driving forces
- S – State – quality of environment *i.e.,* air, water & soil quality
- I – Impact – Impact on health, eco-system, materials, biodiversity, economic damage, *etc*.
- R – Responses – action for cleaner production, policies (including standards/guidelines), targets, *etc*.

Environment reports including the above elements gives a comprehensive picture of specific target area in order to take appropriate measures for improvement. Such reports capture the concerns which could be considered in EIAs.

2.3.3.2 Corporate Environmental Reporting

Corporate Environmental Reports (CER) are just a form of environmental reporting defined as publicly available, stand-alone reports, issued voluntarily by the industries on their environmental activities (Borphy and starkey-1996). CER is a means to environmental improvement and greater accountability, not an end in itself.

Three categories of environmental disclosure are:

- Involuntary Disclosure: Without its permission and against its will (env. Campaign, press, *etc*.)
- Mandatory Disclosure: As required by law
- Voluntary Disclosure: The disclosure of information on a voluntary basis

2.4 Objectives of EIA

Objectives of EIA include the following:

- To ensure that the environmental considerations are explicitly addressed and incorporated into the development and decision-making process;
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of development proposals;
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their functions; and
- To promote development that is sustainable and optimizes resource use and management opportunities.

2.5 Types of EIA

Environmental assessments could be classified into four types *i.e*. strategic environmental assessment, regional EIA, sectoral EIA and project level EIA. These are precisely discussed below:

Strategic environmental assessment

Strategic environmental assessment (SEA) refers to systematic analysis of the environmental effects of development policies, plans, programmes and other proposed strategic actions. SEA represents a proactive approach to integrating environmental considerations into the higher levels of decision-making – beyond the project level, when major alternatives are still open.

Regional EIA

EIA in the context of regional planning integrates environmental concerns into development planning for a geographic region, normally at the sub-country level. Such an approach is referred to as the economic-cum-environmental (EcE) development planning (Asian Development Bank, 1993a). This approach facilitates adequate integration of economic development with management of renewable natural resources within the carrying capacity limitation to achieve sustainable development. It fulfils the need for macro-level environmental integration, which the project-oriented EIA is unable to address effectively. Regional EIA addresses the environmental impacts of regional development plans and thus, the context for project-level EIA of the subsequent projects, within the region. In addition, if environmental effects are considered at regional level, then the cumulative environmental effects of all the projects within the region can be accounted.

Sectoral EIA

Instead of project-level-EIA, an EIA should take place in the context of regional and sectoral level planning. Once sectoral level development plans have the integrated sectoral environmental concerns addressed, the scope of project-level EIA will be quite minimal. Sectoral EIA helps in addressing specific environmental problems that may be encountered in planning and implementing sectoral development projects.

Project Level EIA

Project level EIA refers to the developmental activity in isolation and the impacts that it exerts on the receiving environment. Thus, it may not effectively integrate the cumulative effects of the development in a region.

From the above discussion, it is clear that the EIA shall be integrated at all levels *i.e.*, strategic, regional, sectoral and project level. Whereas, the strategic EIA is a structural change in the way the things are evaluated for decision-making, the regional EIA refers to substantial information processing and drawing complex inferences. The project-level EIA is relatively simple and reaches to meaningful conclusions. Therefore in India, largely, the project-level EIA studies are taking place and are being considered. However, in the re-engineered Notification, provisions are incorporated for giving a single clearance for the entire industrial estate for e.g., Leather parks, pharma cities, *etc*., which is a step towards the regional approach.

As we progress and the resource planning concepts emerge in our decision-making process, the integration of overall regional issues will become part of the impact assessment studies.

2.6 Basic EIA Principles

By integrating the environmental impacts of the development activities and their mitigation in early stages of project planning, the benefits of EIA could be realized in all stages of a project from exploration, planning, construction, operations, decommissioning and beyond site closure.

A properly-conducted-EIA also lessens conflicts by promoting community participation, informing decision-makers, and helps in laying the base for environmentally sound projects. An EIA should meet at least three core values (EIA Training Resource Manual, UNEP 2002,):

- Integrity: The EIA process should be fair, objective, unbiased and balanced
- Utility: The EIA process should provide balanced, credible information for decision-making
- Sustainability: The EIA process should result in environmental safeguards

Ideally an EIA process should be:

- Purposive - should inform decision-makers and result in appropriate levels of environmental protection and community well-being.
- Rigorous - should apply ‘best practicable’ science, employing methodologies and techniques appropriate to address the problems being investigated.
- Practical - should result in providing information and acceptable and implementable solutions for problems faced by the proponents.
- Relevant - should provide sufficient, reliable and usable information for development planning and decision-making.
- Cost-effective - should impose the minimum cost burdens in terms of time and finance on proponents and participants consistent with meeting accepted requirements and objectives of EIA.

- Efficient - should achieve the objectives of EIA within the limits of available information, time, resources and methodology.
- Focused - should concentrate on significant environmental effects and key issues; *i.e.,* the matters that need to be considered while making decisions.
- Adaptive - should be adjusted to the realities, issues and circumstances of the proposals under review without compromising the integrity of the process, and be iterative, incorporating lessons learnt throughout the project life cycle.
- Participative - should provide appropriate opportunities to inform and involve the interested and affected public, and their inputs and concerns should be addressed explicitly in the documentation and decision-making.
- Inter-disciplinary - should ensure that the appropriate techniques and experts in the relevant bio-physical and socio-economic disciplines are employed, including the use of traditional knowledge as relevant.
- Credible - should be carried out with professionalism, rigor, fairness, objectivity, impartiality and balance, and be subject to independent checks and verification.
- Integrated - should address the inter-relationships of social, economic and biophysical aspects.
- Transparent - should have clear, easily understood requirements for EIA content; ensure public access to information; identify the factors that are to be taken into account in decision-making; and acknowledge limitations and difficulties.
- Systematic - should result in full consideration of all relevant information on the affected environment, of proposed alternatives and their impacts, and of the measures necessary to monitor and investigate residual effects.

2.7 Project Cycle

The generic project cycle including that of ship breaking yard has six main stages:

1. Project concept
2. Pre-feasibility
3. Feasibility
4. Design and engineering
5. Implementation
6. Monitoring and evaluation

It is important to consider the environmental factors on an equal basis with the technical and economic factors throughout the project planning, assessment and implementation phases. EIA should be introduced at the earliest in the project cycle and must be made an integral part of the project pre-feasibility and feasibility stage. If the EIA considerations are given due respect in the site selection process by the project proponent, the subsequent stages of the clearance process would get simplified and would also facilitate easy compliance to the mitigation measures through out the project life cycle.

A project's feasibility study should include a detailed assessment of significant impacts, the prediction and quantification of impacts and delineation of Environmental Management Plan (EMP). Findings of the EIA study should preferably be incorporated in the project design stage so that the project as well as the site alternatives is studied and

necessary changes, if required, are incorporated in the project design stage. This practice will also help the management in assessing the negative impacts and in designing cost-effective remedial measures. In general, EIA enhances the project quality and improves the project planning process.

2.8 Environmental Impacts

Environmental impacts resulting from proposed actions can be grouped into following categories:

- Beneficial or detrimental
- Naturally reversible or irreversible
- Repairable via management practices or irreparable
- Short-term or long-term
- Temporary or continuous
- Occurring during site preparation phase or dismantling phase
- Local, regional, national or global
- Accidental or planned (recognized before hand)
- Direct (primary) or Indirect (secondary)
- Cumulative or single

The category of impact as stated above and its significance will facilitate the Expert Appraisal Committee (EAC) to take a view on the ToR for EIA studies, as well as, in decision making process about the developmental activity.

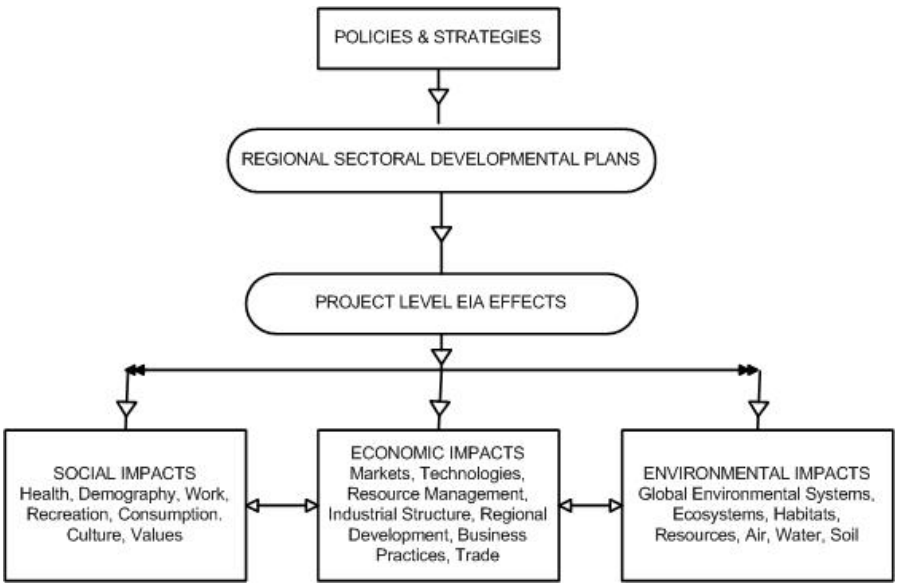

Figure 2-2: Types of Impacts

The nature of impacts could fall within three broad classifications *i.e.,* direct, indirect and cumulative, based on the characteristics of impacts. The assessment of direct, indirect and cumulative impacts should not be considered in isolation nor can be considered as separate stages in the EIA. Ideally, the assessment of such impacts should form an integral part of all stages of the EIA. The TGM does not recommend a single method to assess the types of impacts, but suggests a practical framework/ approach that can be adapted and combined to suit a particular project and the nature of impacts.

2.8.1 Direct impacts

Direct impacts occur through direct interaction of an activity with an environmental, social, or economic component. In ship breaking yards – accumulation of debris and paint chips in sea/beach, open burning of debris at site, release of ODS salvaged from breaking, spillage of oil and sediments – being the most important environmental factors may contaminate the basic environmental media. Also, for example, the discharge of bilge and ballast water, exposure to hazardous materials by workers would directly impact the water and soil quality in the vicinity and finally the health of the workers.

2.8.2 Indirect impacts

Indirect impacts on the environment are those which are not a direct result of the project, often produced away from or as a result of a complex impact pathway. The indirect impacts are also known as secondary or even tertiary level impacts. For example, release of hazardous substances containing paint chips during sheet/plate cleaning before re-heating/re-rolling, release of dioxins and furans from poly chloro biphenyl (PCB) containing sheets into air may be inhaled by the people who work in or live near these activities. Another example of indirect impact is the decline in water quality due to the discharge of bilge and ballast water into the sea. This, in turn, may lead to a secondary indirect impact on aquatic flora in that water body and may not be any further fishing activities. Reduction in fishing harvests, affecting the incomes of fishermen is a third level impact. Such impacts are characterized as socio-economic (third level) impacts. The indirect impacts may also include growth-inducing impacts and other effects related to induced changes to the pattern of land use or additional road network, population density or growth rate. In the process, air, water and other natural systems including the ecosystem may also be affected.

2.8.3 Cumulative impacts

Cumulative impact consists of an impact that is created as a result of the combination of the projects evaluated in the EIA together with other projects in the same vicinity, causing related impacts. Figure 2-3 depicts the same. Respective EAC may exercise their discretion on a case-by-case basis for considering the cumulative impacts.

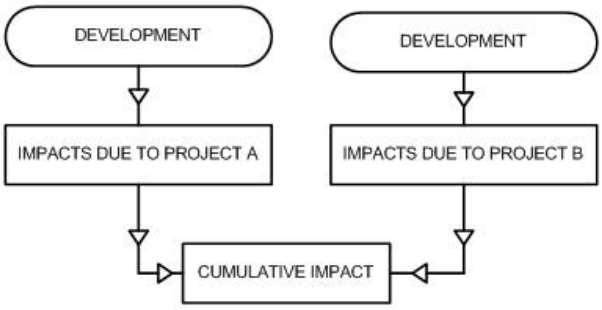

Figure 2-3: Cumulative Impact

2.8.4 Induced impact

The cumulative impacts can be due to induced actions of projects and activities that may occur if the action under assessment is implemented such as growth-inducing impacts and other effects related to induced changes to the pattern of future land use or additional road

network, population density or growth rate (e.g. excess growth may be induced in the zone of influence around the proposed industry, and in the process causing additional effects on air, water and other natural ecosystems). Induced actions may not be officially announced or be a part of any official plan. Increase in workforce and nearby communities contributes to this effect.

They usually have no direct relationship with the action under assessment, and represent the growth-inducing potential of an action. New roads leading from those constructed for a project, increased recreational activities (e.g., hunting, fishing), and construction of new service facilities are examples of induced actions.

However, the cumulative impacts due to induced development or third level or even secondary indirect impacts are difficult to be quantified. Because of higher levels of uncertainties, these impacts cannot normally be assessed over a long time horizon. An EIA practitioner can only guess as to what such induced impacts may be and the possible extent of their implications on the environmental factors. Respective EAC may exercise their discretion on a case–by-case basis for considering the induced impacts.

2.9 Significance of impacts

This TGM establishes the significance of impacts first and proceeds to delineate the associated mitigation measures. So the significance here reflects the "worst-case-scenario" before mitigation is applied, and therefore provides an understanding of what may happen if mitigation fails or if it is not as effective as predicted. For establishing significance of different impacts, understanding the responses and interaction of the environmental system is essential. Hence, the impact interactions and pathways are to be understood and established first. Such an understanding will help in the assessment process to quantify the impact as accurately as possible. Complex interactions, particularly in case of certain indirect or cumulative impacts, may give rise to non-linear responses which are often difficult to understand and therefore their significance difficult to assess. It is hence understood that indirect or cumulative impacts are more complex than the direct impacts. Currently the impact assessments are limited to direct impacts. In case mitigation measures are delineated before determining significance of the effect, the significance represents the residual effects.

However, the ultimate objective of an EIA is to achieve sustainable development. The development process shall invariably cause some residual impacts even after implementing an EMP effectively. Environmentalists today are faced with a vital, not-easy-to-answer question—"What is the tolerable level of environmental impact within the sustainable development framework?" As such, it has been recognized that every ecosystem has a threshold for absorbing deterioration and a certain capacity for self-regeneration. These thresholds based on concept of carrying capacity are as follows:

- Waste emissions from a project should be within the assimilative capacity of the local environment to absorb without unacceptable degradation of its future waste absorptive capacity or other important services.
- Harvest rates of renewable resource inputs should be within the regenerative capacity of the natural system that generates them; depletion rates of non-renewable inputs should be equal to the rate at which renewable substitutes are developed by human invention and investment.

The aim of this model is to curb over-consumption and unacceptable environmental degradation. But because of limitation in available scientific basis, this definition

provides only general guidelines for determining the sustainable use of inputs and outputs. To establish the level of significance for each identified impact, a three-stage analysis may be referred:

- First, an impact is qualified as being either negative or positive.
- Second, the nature of impacts such as direct, indirect, or cumulative is determined using the impact network
- Third, a scale is used to determine the severity of the effect; for example, an impact is of low, medium, or high significance.

It is not sufficient to simply state the significance of the effect. This determination must be justified, coherent and documented, notably by a determination methodology, which must be described in the methodology section of the report. There are many recognized methodologies to determine the significance of effects.

2.9.1 Criteria/methodology to determine the significance of identified impacts

The criteria can be determined by answering some questions regarding the factors affecting the significance. This will help the EIA stakeholders, the practitioner in particular, to determine the significance of the identified impacts eventually. Typical examples of such factors (one approach reported by Duval and Vonk 1994) include the following:

- Exceedance of a Threshold: Significance may increase if the threshold is exceeded. For e.g., Emissions of PM10 exceed the permissible threshold.
- Effectiveness of Mitigation: Significance may increase as the effectiveness of mitigation measures decreases. e.g., control technologies, which may not assure consistent compliance to the requirements.
- Size of Study Area: Significance may increase as the zone of effects increases.
- Incremental Contribution of Effects from Action under Review: Significance may increase as the relative contribution of an action increases.
- Relative Contribution of Effects of Other Actions: Significance may decrease as the significance of nearby larger actions increase.
- Relative Rarity of Species: Significance may increase as a species becomes increasingly rare or threatened.
- Significance of Local Effects: Significance may increase as the significance of local effects is high.
- Magnitude of Change Relative to Natural Background Variability: Significance may decrease if effects are within natural assimilative capacity or variability.
- Creation of Induced Actions: Significance may increase as the significance of the induced activities is also high.
- Degree of Existing Disturbance: Significance may increase if the surrounding environment is pristine.

For determining the significance of impacts, it is important to remember that secondary and higher order effects can also occur as a result of a primary interaction between the project activity and local environment. Wherever a primary effect is identified, the

practitioner should always think if secondary or tertiary effects on other aspects of the environment could also arise.

The EIA should also consider the effects that could arise from the project due to induced developments, which take place as a consequence of the project. Ex. Population density and associated infrastructure and jobs for people attracted to the area by the project. It also requires consideration of cumulative effects that could arise from a combination of the effects due to other projects with those of other existing or planned developments in the surrounding area. So the necessity to formulate qualitative checklist is suggested to test significance, in general.

3. SHIP BREAKING YARD

3.1 Introduction

A Ship can be defined as a vessel of any type whatsoever operating under its own power or otherwise in the marine environment, including hydrofoil boats, air-cushion vehicles, and submersibles, floating craft, and fixed or floating platforms, and a vessel that has been stripped of equipment, or is towed.

The Ministry of Steel in pursuance to Supreme Court of India directive brought 'Draft Comprehensive Code on Ship Recycling Regulations'. This code defines the Ship as a vessel and other floating structures for breaking. Ship ceases to be a ship once bill of entry for home consumption is filed with the customs declaring it as cargo (for demolition). It is suggested that this definition must be followed in the interest of Indian ship breaking yards.

Based on their use, ships may be categorized as commercial, fishing, and military vessels. Commercial vessels in turn can be broadly classified as cargo, passenger and special purpose ships. Fishing vessels can be made a subset of commercial vessels. However, their size is very small. Military or naval vessels can be categorized as warships, submarines, support and auxiliary vessels, combat vessels, battleships and many others. Yields vary with the category of ship, and also with the environmental concerns. Thus it is important to understand the categories of ships. Some of these ship categories are discussed below:

- Cargo Ships: These transport dry and liquid cargo. Dry cargo is carried in bulk carriers, container ships, and general cargo ships. Liquid cargo is generally carried in bulk abroad in chemical tankers, oil tankers and LNG tankers.
  - Bulk Carriers: Used to carry ore, grains, cattle, phosphates, coal, soyabeans, China clay, *etc*.
- General Cargo Ships: These carry all types of products such as big bags (containing food products like cocoa and coffee beans) and large machine parts except products or liquids in bulk. These ships are increasingly replaced by container ships.
  - Container Ships: These ships carry medicines, food products, machinery, powder chemicals, household appliances and computers. Container ships are considered as an important means of transport for the future and its major advantage is its handling efficiency.
  - Chemical Tankers: They carry liquids like Sulphuric acid, Phosphoric acid, Phenols, *etc*. They also carry products like molasses and edible oils like palm oil, vegetable oils.
  - Oil Tankers: These are of two types — crude and product tankers. Crude tankers carry large quantities of unrefined crude oil from its point of extraction to refineries. Product tankers, on the other hand, are designed to move petrochemicals from refineries to points near consuming markets.
  - LNG Tankers: These ships are designed to transport Liquefied Natural Gas.

- Passengers: Passenger ships range in size from small river ferries to giant cruise ships. These can be categorized as ferries, ocean liners and cruise ships. These ships carry passengers and can sail on much longer as the ships are maintained in a good condition.
  - Cruise Ships: These are used for pleasure voyages. Cruise ships operate mostly on routes that return passengers to their originating port.
  - Ferries: Ferries are used to transport freight (Lorries and containers) and even railroad cars. Most ferries operate on regular, frequent and return services. These also form the part of public transport systems of many waterside cities and islands.
  - Ocean Liners: These are designed to transport people from one seaport to another along regular long-distance maritime routes according to the schedule. These are strongly built with high freeboards to withstand sea states and adverse conditions encountered in the Open Ocean and stores large capacities of fuel, victuals and other stores which could be consumed on voyages which take several days to weeks.
- Special Purpose Vessels (SPV): These ships are designed to perform specific tasks and include tugboats, pilot boats, rescue boats, cable ships, research vessels, survey vessels and ice breakers.
  - Drill Ships: These are fitted with drilling apparatus for exploratory drilling of new oil or gas wells in deep waters. Drill ships can drill in water depths of over 2000 metres (m).
- War Ships: These ships carry weapons, ammunition and supplies for its crew.
- Fishing Vessels: These are used to catch fish in the sea, lake or river. Different kinds of vessels are used for commercial and recreational fishing. Based on the type of fish, fishing method, geographical origin there are different categories of fishing vessels.

Ship breaking is an inseparable part of the shipping business. For as long as ships have existed, 'ship breaking', has been the way ships ended their lives if they are not lost at the sea. Compared to ship building, ship breaking is a rough business. Most of the world's ship breaking industry uses manual labour to dismantle ships.

In the 18th century, ships were sold to a breaker for recovery of spare parts, firewood, iron and brass parts for continued use in new ships or for re-melting. Everything was reused in some way. The economics of the system was very straightforward - the owner receives money for his ship; the breaker receives enough money for his scrap to pay his expenses and make a profit.

Dismantling of vessels was a common scene at the ports, especially throughout Southern Europe from the late 1940s to the 1960s.

Till early 1980's vessels were scrapped in Japan, Korea and Taiwan. However, for the last 25 years, India, Bangladesh and Pakistan have been the global centers for ship breaking Industry. Here, the ships are scrapped directly on the beaches or the vast inter-tidal mudflats exposed daily by about 10 m tidal gauge. The beaching method of the Indian sub-continent relies heavily on low labour cost, since it involves very little mechanization.

Each year between 200 and 600 sea-going ships of over 2,000 dead weight tonnage (dwt) are dismantled worldwide. This number may significantly increase, if the decision on replacement of single hull tankers comes into effect.

Single hull tankers are more likely than double hull vessels to rupture and break up, spilling oil into the sea. As per the International Maritime Organization (IMO) regulations, single hull tankers are phased out or converted to a double hull after certain age for the prevention of oil spills and pollution from ships. The double hull is designed to reduce the risk of oil spills from tankers involved in low energy collisions or groundings during the most critical part of a voyage.

A ship consists mostly of steel. Consequently, at the end of its useful life, it becomes a sought-after source of ferrous scrap particularly suited for reprocessing into simple steel products such as steel rods used in civil construction. The geographical migration of scrapping locations mirrors the global industrial economic development. It seeks areas providing:

- Sea beach
- Demand for scrap steel for reprocessing
- Demand for second-hand equipment and
- Supply of low-cost labour to carry out the labour-intensive extraction process

The vast majority of waste stream generated following the demolition or scrapping process is largely returned to good use. Usable equipment such as pumps, motors, valves, generators, *etc.,* is sold out which finds alternative applications and the scrap steel is reprocessed. The latter, as an alternative to steel production from ore, represents a significant savings in energy consumption perspective. Ship-scrapping is truly a sustainable activity from a resource utilization point-of-view.

Steel scrap obtained from tankers that have large flat panels is comparatively of higher quality. In developing countries, the scrap is simply heated and re-rolled into concrete reinforcing rods for sale to the construction industry but this may not meet the Bureau of Indian Standards (BIS) standard. Re-rolled steel is also ideal for sewage projects, metal rods and agricultural needs. In the advanced countries, scrap is completely melted down to make fresh steel.

Non-ferrous items like diesel engines, generators, deck cranes, compasses and other fixtures also offer lucrative returns when resold. Again the market for such items is more readily available in developing countries than in developed countries where technical standards are more demanding and refurbishing costs are higher.

On the flip side, ship-scrapping is not so user-friendly when the means adopted are considered and the consequences it generates are compared with respect to occupational safety, health and environment. The extent of damage caused by ship-scrapping to the environment and to the livelihood of the fishermen, peasants that share the environment, and to the lives and health of workers involved in these activities would include:

- Costs for loss of livelihood
- Clean up costs for polluted sediments
- Costs for asbestos liabilities
- Medical and compensation costs for losing the ability to work
- Medical and compensation costs for deaths and diseases caused by exposure to toxic substances, *etc*.

3.1.1 Ship breaking in India

Ship breaking is not new to India and this activity has been going on ever since 1912 in Kolkata and Mumbai. Steel scrap was worthwhile even then and countries that had yards to recycle ships were often considered to be economically fortunate.

When the first economic recession came around 1984 and the fleet owners thought that it was better to scrap ships than to maintain them, there was a huge backlog of ships to be demolished. As a result, labour got very expensive and sale of steel scrap failed to fetch profits. Meanwhile, India and some other eastern countries offered cheaper labour and hence became the destination for ship-scrapping industry. Due to increased import of ships for breaking, an emphasis was laid to examine various sites suitable for this activity. Considering the favorable parameters for beaching method like high tidal range, firm seabed, gentle seaward slope, *etc*., it was decided to set up a ship breaking yard in the western coast of Gulf of Cambay near Alang village. The first vessel – M.V Kota Tenjong was beached at Alang on 13th February, 1983. Since then, the yard has witnessed significant growth and has emerged as a leading ship breaking yard in the world.

The CPCB in Delhi has prepared environmental guidelines for ship-scrapping industries aiming to minimize the effect of the yards on the surrounding environment through proper location of breaking yards and by preparing and implementing an EMP and an Emergency Management Plan.

The guidelines include a description of the appropriate pollution control measures regarding solid waste, air pollution, water pollution and noise. This also includes aspects of workers' safety.

The Gujarat Maritime Board (GMB) has issued regulations covering safety measures for beaching of vessels since the year 2000. Substance of the regulation was the documentation of a gas-free certificate before beaching and a permission to start the cutting operations to be issued by the GMB following the removal of hazardous materials from the vessel. The gas-free certificate was introduced in 2001.

Indian Supreme Court order of 14th October 2003 on Hazardous Waste Management Rules, directs that the SPCB should ensure that the ship is properly decontaminated by the ship owner before breaking.

In June 2007, the Supreme Court of India established a panel to develop standard procedures and environment protocols for the Indian ship breaking industry.

3.1.2 Process of ship procurement for scrapping in India

Ship-owners who have decided to end the economic life of a vessel will contact demolition brokers who in turn look for a cash buyer. This basically happens when the maintenance cost of the vessel starts to exceed possible revenue, or when the vessel has become unattractive for the second-hand market, *i.e.*, it is unlikely that it can be sold on. The cash buyer can either be a dedicated broker or the scrap yard operator himself. Figure 3.1 shows the ship procurement process.

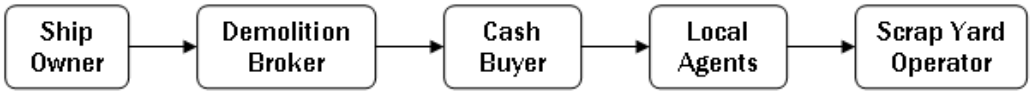

Figure 3-1: Ship Procurement Process for Scrapping in India

It is important to note that age of the ship is not the only factor in any scrapping decision. It is certainly one of the criteria as revenue earning capabilities could be influenced adversely by the imposition of 'over-age'.

Also repair and maintenance costs increase with age, as do the non-revenue earning periods when the vessel is out-of-service undergoing such work. Figure 3-2 explains how factors other than age are instrumental in determining if the ship has reached obsolesce.

The reasons for rise and fall of price are many but mainly depend on the freight movement around the globe. When there is any prime reason for increasing the freight movement or buoyant growth in international trade, supply of ship for dismantling decreases. The scrap value a ship will fetch depends not only on market conditions but is also affected by other factors like the amount and quality of the steel, the presence of metals such as Copper or Nickel, and the equipment that can still be sold. The highest prices for ship-scrapping are currently paid in Bangladesh.

Typically, the ship will take cargo for a final voyage to the area where the scrap yard is located. After completion of this voyage, the ship will be brought, under its own power, to the ship breaking yard where it will be dismantled.

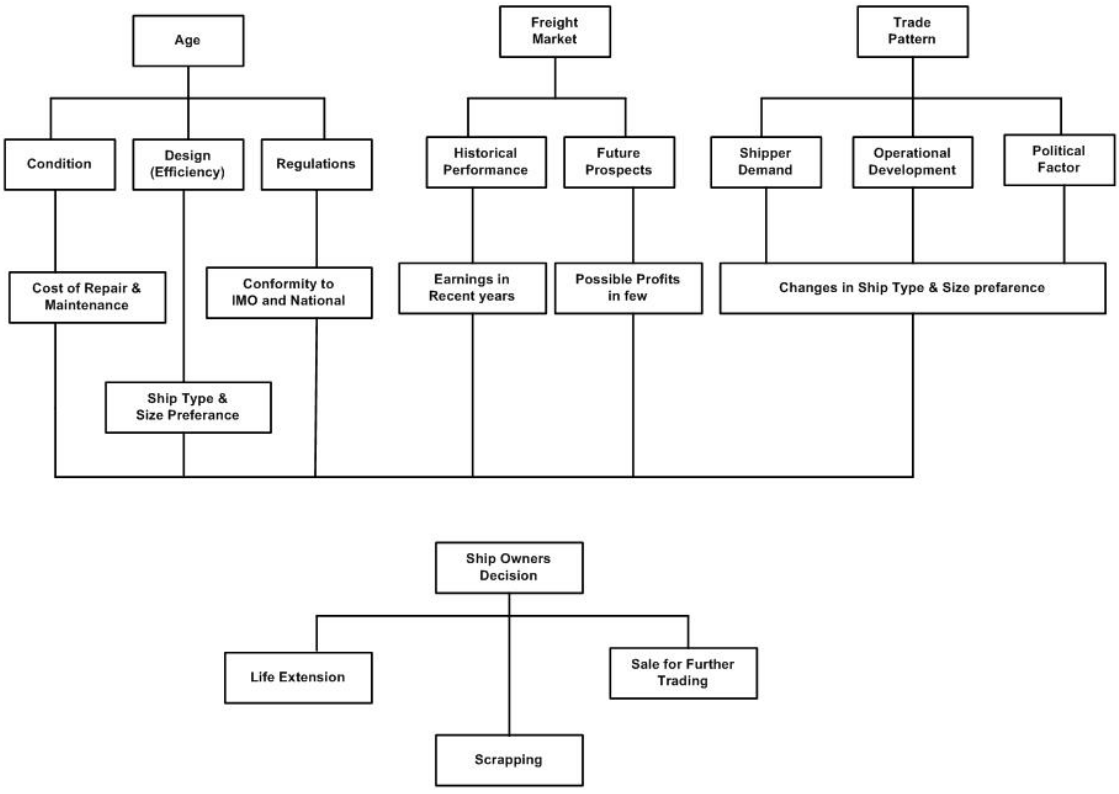

Figure 3-2: Ship Scrapping Decision Process

3.1.3 Ship breaking methods

Ships can be dismantled in water, on land (Dry-dock Method) and at water and land interface (Beaching Method). A very broad comparison between these three methods is given in Table 3-1 below:

Table 3-1: Broad Comparison of Three Ship Breaking Methods

Ship Breaking Method	In water	On land	At Water – Land Interface
Infrastructure	Buoy, Quay side [man-made]	Dry-dock [man-made]	Beach with large tidal Variation [natural]
Energy spent for Infrastructure	Medium	Large (Making of dry-dock using cement, steel *etc*.)	Nil (Tidal energy is naturally available)
Environmental Impact (assuming same standards of workmanship)	◄----------	Almost Same	----------►
Occupation Hazard (assuming same standards of workmanship)	◄----------	Almost Same	----------►
Environmental Impact due to de-commissioning of infrastructure	Medium (re-used with proper repair)	Large (dry dock, 'dumped')	Nil (Beach remains as such)
Source: Report of the Committee of Technical experts on Ship Breaking Activities, MoEF, Supreme Court of India			

The ship is sailed to the beach under its own power or is towed by barges. A beached ship is rendered immobile, and cannot usually be refloated. Beaching is thus irreversible. Subsequently the beached ship is dismantled section by section and brought to the yard for further cutting.

Any of the above ship breaking methods usually follows a series of steps as discussed below after towing the ship at site for scrapping:

- Conducting a Vessel Survey: Understanding and identifying various compartments of the ship to plan the work based on potential locations of hazardous materials.
- Removing fuels, oils, and other liquids and combustible materials: This process is continues throughout the ship breaking process. Hot work permits will be checked for dismantling the ship and also to ensure safety of workers.
- Removing the Equipment: Fixtures, anchors, chains, and small equipment are removed initially. Large reusable components (e.g., engine parts) are removed as they become accessible. Reusable materials and equipment may be sold directly with little or no refurbishment by the scrapping facility. Propellers may also be removed so that the hulk can be pulled into shallow water.

- Removing and Disposing Asbestos-containing Materials (ACM) and Polychlorinated Biphenyls (PCBs) Containing Materials: ACM is removed from cut lines so that large sections of the ship can be removed. The engine rooms which usually contain most of the asbestos take longer time for removal. PCB materials will be removed and cut.
- Preparing Surfaces for Cutting: Paint is removed after asbestos and PCBs are removed. The presence of hard-to-remove and potentially toxic materials may require specific cut-line preparation, such as grit blasting.
- Metal Cutting: During the cutting phase, the upper decks and the superstructure and systems are first cut, followed by the main deck and lower decks. Metal cutting is typically done manually using oxygen-fuel cutting torches, but may be done with shears or saws (for non-ferrous metals). Typically, as large parts of the ship are cut away, they are lifted by crane to the ground where they are cut to specific shapes and sizes required by the foundry or smelter to which the scrap is shipped. As cutting continues and the weight of the structure is reduced, the remaining hulk floats higher, exposing lower regions of the hull. Bilge water is sampled and discharged appropriately. Ultimately, the remaining portion of the hull is pulled ashore and cut.
- Recycling or Disposal of Scrap: Scrap metals, including steel, aluminum, copper, copper-nickel alloy, and lesser amounts of other metals, are sorted by grade and composition and sold to the re-melting firms or to scrap metal brokers. Valuable metals, such as copper in electric cable, that are mixed with non-metal material may be recovered using shredders and separators. The shredders produce a gravel-like mixture of metal particles and non-metal 'fluff'. The metals are then separated from the fluff using magnetic separators, air flotation, separator columns, or shaker tables. Other materials that are not recycled, including hazardous materials and other wastes, are disposed following the applicable laws and regulations.
- Reuse: Many parts such as engine, auxiliary diesel motors, pumps, winches, cranes, radar and electronic equipment can be directly reused. Tools, auxiliaries, lamps, TVs, fax machines, radios, tables, beds, fluorescent tubes, kitchen fittings, benches, ropes, safes, cables, ornamental plastic sheeting can be marketed to resellers.

Annexure I summarizes all the elements involved in ship breaking process.

3.2 Material recovery and waste generation factors

Ship breaking produces useful scrap material and also wastes in the form of solids and liquids. The scrap and the rejects from ship-scrapping process are listed in Table 3-2.

Table 3-2: Prevailing Scrap Recovery /Waste Generation Factors from Ship breaking

Material/waste	Scrap Recovery / Waste Generation from Ship Scrapping	Disposal Option
Scrap Material	Rerolling Scrap	Scrap Market
	Melting Scrap	
	Cast Iron Scrap	
	Non-ferrous Metal	
	Machinery	
	Wooden Furniture and Others	
	Weight Loss	

Material/waste	Scrap Recovery / Waste Generation from Ship Scrapping	Disposal Option
Solid wastes	Asbestos	Centralized TSDF
	Glasswool	
	Sludge residue & Contaminated Materials	
	Plastics and cables (with Paint chips)	
	Rubber	
	Fiberglass	
	Rexene	
	Iron Scales	
	Chicken mesh	
	Cardboard and packing material	
	Glass	
	Cement tiles	
	Municipal Solid Waste	Landfills
Liquid waste	Bilge Water (For a medium Ship)	Treatment Plants
	Oils and Fuels	

The quantity of these materials listed in Table 3-2 varies with the type of ship. Indicative percentage yield of scrap from specific types of ships is given in Table 3-3.

Table 3-3: Ship category-specific Indicative yield of materials (in % of LSW)

Ship category	Yield %						
	Reroll plate	Melting scrap	Cast iron	Non ferrous metals	Machinery	Wood and Misc	Weight lost
General cargo	56-70	10	2-5	1	4-8	5	9-15
Bulk carrier	61-71	8-10	2-3	1	2-5	1-5	10-16
Ore carrier	62-69	10	3	1	3-5	5	10-16
Passenger	44-58	10	5	1-2	10-15	5-7	11-17
Oil tanker	72-81	5-7	2-3	1-2	1-2	1-2	10-12
Ore bulk oil carrier	66-75	8-10	3	1	1-6	1-2	10-13
Naval ship	53-67	10	2-6	1-2	4-6	1-2	15-22
Container ship	63-67	10	3-4	1	5	5	10-13
Fishing / trawler or factory	47-67	10	3-8	1-2	2-10	5	12-18

The above Table indicates that a substantial portion of the recovered material includes re-rollable plates and melting scrap. While these percents are given in % by weights of the ship LSW (Light Ship Weight), exact percent share of the waste generations could not be seen in terms of the percentages as the total share of hazardous waste in a ship itself is substantially low in percentages. An effort has been made to compile the statistics of Alang ship breaking yard, which reveals the waste generation factors based on number of ships. Therefore, the factors could be derived based on this available data.

Table 3-4: Break-up of wastes from Ship breaking Activities at Alang Yard

Sl. No	Type of wastes	Quantity in Tonnes per 350 Ships
1	Asbestos	175
2	Glass wool	2000
3	Sludge residue & Contaminated material	400
4	Plastics and cables with paint chips)	20
5	Rubber	49
6	Fiber Glass	40
7	Rexene	50
8	Iron Scales	900
9	Chicken Mesh	175
10	Cardboard and packing material	35
11	Glass	175
12	MSW Landfill	5000
13	Cement Tiles	10000
Source: Gujarat Maritime Board		

3.2.1 Hazardous Material in Ships

Ships contain a wide range of hazardous substances such as sealants containing PCBs, various types of asbestos, thousands of liters of oil (engine oil, hydraulic and lubricant oils and grease), paints and others. During ship breaking, these materials find their way into the environment, if not identify, handle and dispose appropriately.

Potential hazardous materials which may be on board the ships that are delivered to ship breaking facilities as per Supreme Court Committee of experts are listed below.

- Operational Substances and Consumables
  - Cargo Residues including Slops
  - Dry tank Residues
  - Fuel oil, Diesel oil, Gas oil, Lubricating oil, Greases & Anti-seize Compounds
  - Hydraulic oil
  - Waste oils (contents of sludge tank)
  - Antifreeze fluids
  - Kerosene and White Spirit
  - Boiler and Feed Water Treatment Chemicals
  - Boiler and Feed Water Test Re-agents
  - De-ioniser Regenerating Chemicals
  - Evaporator Dosing and Descaling Acid
  - Domestic Water treatment Chemicals
  - Paints and Rust Stabilizers
  - Solvents and Thinners
  - Refrigerants (R12 or R22)
  - HALON
  - CO_2 (in cylinders - engine room fire protection)
  - Acetylene, Propane and Butane
  - Hotel Services Cleaners
  - Lead-acid Batteries
  - Battery Electrolyte
  - PCB and/or PCT and/or PBB at levels of 50 mg/kg or more

  - Mercury
  - Radio-active Material *i.e,*. liquid level indicators
  - Miscellaneous Medicines
  - Insecticide Spray
  - Miscellaneous Chemicals such as Alcohol, Methylated Spirits, Epoxy Resins, *etc*.
  - Plastics as covered by MARPOL
  - Raw and Treated Sewage
  - Perfluorocarbons (PFCs)
- Toxic Materials (as part of the ship‘s structure)
  - Asbestos
  - Lead-based Paint Coatings on Ship‘s Structure
  - Tin-based Anti-fouling Coatings on Ship’s Bottoms
  - Others

The hazardous wastes and substances during ship breaking process as listed in the ‘Report of the Committee of Technical Experts on Ship Recycling Activities’, Writ Petition No.657 of 1995, MoEF and Supreme Court Monitoring Committee is provided in **Annexure II**. Also the disposal options for the waste identified on the ship are provided in **Annexure III**.

3.2.2 Specific wastes of concern from ship breaking process and their management

Ship breaking process creates potential releases to the environment (air, water and land) due to:

- Insufficiencies in preparatory procedures prior to dismantling process
- Inability to collect, remove, secure onboard materials of concern during dismantling
- Insufficiencies in procedures related to the collection, storage, transport and disposal of substances

It is necessary to safeguard against these impacts on environment and health by taking corrective actions at appropriate stages of ship dismantling. Following a proper ship dismantling process would safeguard most of the environmental and health issues.

- Inventory of hazardous wastes onboard: Hazardous waste inventory that identifies, quantifies and locates the type of waste onboard should be carried out before the ship comes to the shore. Chemical safety data sheets should be made available for each hazardous substance that is identified. As per the High Power Committee, maintaining the complete inventory of hazardous wastes onboard is a mandatory task for any ship owner. This inventory shall be submitted by the State Maritime Board to the SPCB to ensure safe disposal of hazardous waste. Further permissions for ship anchoring and beaching will be based on hazardous waste inventory.
- Removing and cleaning of liquids, fuels and oils: Before start of ship dismantling, all the liquid residues should be removed and cleaned from the ship. This process may continue during the entire ship dismantling process.
- Safety and Security: There should be a safe working and operating procedures ensuring safe accessibility to all the areas and compartments of the ship and safe conditions for hot work.
- Removal of equipments: The consumable and loose equipment, which are easily accessible, should be removed first.

- Removal of Hazardous materials: The hazardous wastes identified by the inventory data is properly removed and disposed.
- Dismantling plan: Safe and practical cutting sequence is to be followed (Beaching method or dry-dock method or moored method). Dismantling plan should be drawn before start of the work. This plan forms the basis for sectional breaking of the ship
- Proper storage, breaking and disposal of waste: Waste obtained during dismantling is sorted and segregated based on the type of waste and disposal option.
- Specific wastes from the Ship breaking Yard are as follows:
  - Asbestos
  - Polychlorinated biphenyls (PCBs)
  - Bilge and ballast waters
  - oils and fuels
  - Metal cutting
  - Paints
- Removal and Disposal of Miscellaneous Ship Machinery

Techno-scientific and best management practices can be applied for handling, storing and disposing the hazardous materials generated during ship breaking process to ensure safety and health of the workers at the facility. Some of the handling and protective measures with respective environmental and health hazards are discussed in the following sections. The summary of the preventive measures for these hazards along with the media of contamination and pathways is given in **Annexure IV**. Pollutant-specific details on sources in ship, hazards, potential impacts, removal practices and procedures from the ship are discussed in the following sections.

3.2.2.1 Asbestos

Asbestos is a mineral with long, thin fibrous crystals. It is resistant to heat, electricity and chemical damage and has sound absorption and tensile strength. Asbestos, earlier viewed as a kind of miracle material, was widely used in ship building, particularly for insulation. Many products used on ships such as gaskets, valves, cables, adhesives, *etc*., contain asbestos. However, the risks associated with asbestos — including the risk of mesothelioma cancer and other lung diseases caused by inhaling the toxic fibers—make it a hazardous material to be dealt with. Hence the workers' exposure to asbestos in ship breaking activities, especially those involved in the removal and disposal of asbestos is considered a primary environmental and health and safety concern.

A) Sources in ships

- Bulkhead and pipe thermal insulation
- Bulkhead fire shields/fireproofing
- Uptake space insulation
- Exhaust duct insulation
- Electrical cable materials
- Brake linings
- Floor tiles and deck underlay
- Steam, water, and vent flange gaskets
- Adhesives and adhesive-like glues (e.g., mastics) and fillers

- Sound damping
- Molded plastic products (e.g., switch handles, clutch facings)
- Sealing putty
- Packing in shafts and valves
- Packing in electrical bulkhead penetrations
- Asbestos arc chutes in circuit breakers
- Pipe hanger inserts
- Weld shop protectors and burn covers,
- blankets, and any fire fighting clothing or equipment
- Any other type of thermal insulating material

B) Hazards

Workers may be exposed to asbestos while working on dismantling of ships –especially when removing asbestos-bearing thermal insulation; handling of circuit breakers, cable, cable penetrations; and removing floor tiles (from asbestos in the mast and in the tile). Asbestos fibers are minute, light and hence can remain suspended in air for longer periods. There are very high chances of workers inhaling these particles found suspended in these areas. Airborne asbestos fibers are small, odorless, and tasteless. They range in size from 0.1 to 10 microns in length (a human hair is about 50 microns in diameter).

Additional concerns can arise from handling and removing gaskets with piping and electrical systems, as well as molded plastic parts.

Para-occupational Exposure: Workers' families may inhale asbestos fibers released by their clothes that have been in contact with the ACM.

Neighborhood Exposure: People who live or work near asbestos- related operations may inhale asbestos fibers that have been released into the air by these operations.

C) Potential impacts

Asbestos affects the lungs resulting in loss of lung function that often progresses to disability or to death. Prolonged exposure to Asbestos may also result in cancer affecting various organs – mesothelioma (cancer affecting the membranes lining the lungs and abdomen), lung cancer, or cancers of the oesophagus, stomach, colon, and rectum. If inhaled, asbestos fibers can easily penetrate the body tissues, and may be deposited and retained in the respiratory tract and lung tissue. Because asbestos fibers remain in the body, each exposure increases the likelihood of developing an asbestos-related disease. Asbestos-related diseases may not appear until years after exposure. Ingesting Asbestos may be harmful, but the consequences of this type of exposure have not been clearly documented yet. It is noted that risks of asbestos exposure are multiplied 10-fold or more if a worker smokes.

D) Asbestos removal practices and procedures

i) Workers' protection

- The facility has to perform air surveillance activities in work areas where asbestos is being removed, including meeting the general monitoring criteria, conducting initial exposure assessments, and performing daily and periodic monitoring.

- The facility must keep an accurate record of all measurements taken to monitor the workers' exposure to asbestos.
- Facility is required to conduct medical surveillance for all workers who, for a combined total of 30 or more days per year, are performing asbestos removal work or are exposed at or above the permissible exposure limit. This includes medical examination and consultation prior to beginning work, at least annually, and upon termination of employment.
- The facility must establish and maintain an accurate record for each worker subject to medical surveillance. These records must be maintained for the duration of the worker's employment, plus an additional 30 years.
- Restrict working hours to a maximum of four hours in activities involving asbestos handling.

ii) Worker exposure limits

Facility must ensure that workers are not exposed to air-borne asbestos concentrations in excess of either of the following Permissible Exposure Limits (PELs).

- 0.1 fiber per cubic centimetre (f/cc) of air averaged over an eight-hour work shift. This PEL is called the time-weighted average (TWA) limit
- 1.0 f/cc of air averaged over a sampling period of 30 minutes. This PEL is called the excursion limit.

iii) Workers' training

- Facility must provide, at no cost, a training program for employees likely to be exposed to asbestos removal work during the ship breaking.
- Workers should be trained prior to or at the time of beginning the job and at least once a year afterwards. For asbestos removal operations that require the use of critical barriers and/or negative pressure enclosures, the facility must provide training to workers.
- The supervisors must be trained about the regulations and the means of compliance. Training must at least include: the application of regulations; notification requirements; material identification procedures; emission control procedures for removals; waste disposal practices; reporting and recordkeeping; and asbestos hazards and worker protection.

iv) Training records

- The facility must document the trainings attended and completed by each worker and supervisor. These records must be maintained for one year past the last day of employment.
- PPE is required to ensure that the workers involved in asbestos removal and disposal are using approved respirators. Respirators appropriate for the work being conducted must be provided free-of-charge by the facility. In addition, the facility is required to provide and ensure the use of protective clothing, such as cover-alls or similar full-body clothing, head coverings, gloves, and foot covering, to be used by the workers during the asbestos removal work. In addition, the facility should make sure that

appropriate PPE like face shields, vented goggles are provided and used wherever the possibility of eye irritation exists.

v) Hygiene facilities for workers

- A decontamination area which includes equipment room, shower area, clean room located adjacent to the regulated area for decontamination should be provided by the facility to the workers exposed to asbestos.
- The facility must provide lunch areas in which the airborne concentrations of asbestos are below the PELs.
- Supervisor must oversee the activities related to the stripping, removing or handling of Regulated Asbestos Containing Material (RACM).

vi) Supervisors' responsibilities

Supervisors' (commonly called the qualified person) responsibilities would include:

- Setting up of the regulated area, enclosure, or other containment; and ensure the integrity of the enclosure or containment.
- Set up procedures to control the entry and exit the area and/or enclosure.
- Supervise the 'All Workers' Exposure Monitoring Programme' and ensure that it is properly conducted.
- Ensure that the employees working within the enclosure using the PPE.
- Verify if the workers use the hygiene facilities and observe the decontamination procedures.
- Ensure thorough on-site inspection proper set up, use and functioning of the engineering controls.
- Ensure that the RACM is adequately wet when removed and remains wet until collected and contained for disposal. RACM contained in leak-tight wrapping needs not be wetted.
- ACM must be carefully lowered to the ground without being dropped, thrown, slid, or otherwise damaged or disturbed.
- ACM must be moved to the ground via leak-tight chutes or containers if removed from more than 50-feet above the ground (and not removed as a unit or section).
- When removing the RACM, facility is required to control visible emissions of asbestos to the outside air because no safe concentration of air-borne asbestos has ever been established

E) Best operating practices to control asbestos emissions

- Adequately wet RACM exposed during cutting or disjoining; and a misting unit can be used to create a high level of humidity within a removal area. It is believed that the fibers emitted into a saturated environment will absorb the wetting agent and fall out of the air faster, thus reducing airborne asbestos fiber levels.
- Carefully lower each unit or section to the floor and to the ground level without dropping, throwing, sliding, or otherwise damaging or disturbing the RACM

- After removal, these units or sections must be wrapped in leak-tight wrapping or stripped of RACM. If stripped, workers must:
  - Adequately wet the RACM during stripping or
  - Use local exhaust ventilation and collection system designed and operated to capture the particulate asbestos materials produced by the stripping.
  - The system must exhibit no visible emissions to the outside air.
- Cable stripping areas are usually treated as regulated areas because stripping produces fluff which may contain asbestos.
- Each regulated area must meet the following requirements:
  - Regulated areas must be marked in any manner that limits the number of workers in the area, and protects workers outside the area from exposure to airborne asbestos
  - Only authorized workers should have access to the regulated areas.
  - All workers entering and working in these areas must wear approved respirators. It should be noted that all workers must be medically approved to wear respirators and be part of a respirator protection program.
  - Workers must not be allowed to eat, smoke, drink, or chew tobacco or gum in regulated areas.
  - Under the asbestos abatement requirements, the facility must have a qualified person to supervise the work conducted in a regulated area.
  - Workers performing asbestos removal must enter and exit the regulated area through a three-stage decontamination area.

F) Engineering controls and work practices during removal of asbestos

- Because many workers may not be able to read or understand signs in English, post signs in English and other languages as appropriate.
- In addition to the emission controls (e.g., wet methods, prompt clean up and disposal of RACM wastes) described above, asbestos removal work must be performed using control methods, such as vacuum cleaners equipped with high efficiency particulate air (HEPA) filters to collect all debris and dust containing ACM.
- In addition, to achieve compliance with permissible exposure limits, the facility must use control methods including, but not limited to:
  - Local exhaust ventilation equipped with HEPA filter dust collection systems.
  - Enclosure or isolation of those processes producing asbestos dust.
  - Ventilation of the regulated area to move contaminated air away from the breathing zone of workers and towards a filtration or collection device equipped with a HEPA filter.
- To ensure that airborne asbestos does not migrate from the regulated area, facility can also use critical barriers or another barrier or isolation method. A critical barrier is one or more layers of plastic sealed over all openings into a work area or any other physical barrier sufficient to prevent airborne asbestos in the work area from migrating to an adjacent area.
- Negative Pressure Enclosure Systems: In a negative pressure enclosure (NPE), air is changed at least four times per hour and is directed away from workers within the

enclosure and towards a HEPA filtration or collection device. The NPE is kept under negative pressure throughout the period of its use. There is also a requirement to maintain a minimum of -0.02 column inches of water pressure differential. This is normally accomplished with a manometer.

- Glove bag system is a sealed compartment with attached inner gloves for the handling of ACM. Properly installed and used, glove bags provide a small work area enclosure and may be used to remove ACM from straight runs of piping and elbows and other connections.
- Negative pressure glove bag systems are similar to the glove bags described above, except a HEPA vacuum system or other device is attached to the bag. They may be used to remove ACM from piping.
- Negative pressure glove box systems: Glove boxes, which have rigid sides, are made from metal or another material which can withstand the weight of the ACM and water used during removal. A HEPA filtration system is used to maintain the negative pressure in the box. These systems can be used to remove ACM from pipe runs.
- Water spray process system can be used for the removal of ACM and Presumed Asbestos Containing Material (PACM) from cold line piping.
- After wetting, the facility must seal all Asbestos Containing Waste Material (ACWM) in leak-tight containers while it is still wet. The containers can be plastic bags, cartons, drums, or cans. For bulk wastes that will not fit into containers without additional recycling, the facility must put these wastes into leak-tight wrapping. The wrapping should be sealed (e.g., with duct tape) while adequately wet. If the ACWM is placed directly in trailers or roll-off boxes, the trailers or boxes should first be lined with plastic sheeting. After the ACWM is loaded, the trailer or roll-off box should be covered with a tarp while the ACWM is adequately wet.
- Some facilities are implementing a new policy to let no regulated materials touch the ground. Asbestos containers are being placed on the ship, and then directly transported for disposal when they come off the ship. In all cases, the ACWM should be wet when contained to prevent the release of asbestos fibers in case the container or wrapping is broken.
- Facility must send all ACWM to an authorized disposal site that receives ACWM.

3.2.2.2 Polychlorinated biphenyls (PCBs)

PCBs are man-made organic chemicals used in electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products, *etc*.

PCBs are found all over the older vessels and it is likely that a ship breaking facility may be faced with managing large quantities of PCBs. PCBs belong to a broad family of man-made organic chemicals known as chlorinated hydrocarbons. They are basically mixtures of synthetic organic chemicals with the same basic chemical structure and similar physical properties. PCBs, can range in toxicity and vary in consistency from thin light-colored liquids to yellow or black waxy solids. While sold under the trade name Arochlor, PCBs are known by many other trade names.

PCBs were widely used due to their non-flammability, chemical stability, high boiling point and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications including electrical, heat transfer, and hydraulic equipment; as plasticizers in paints, plastics and rubber products; in pigments, dyes and carbonless copy paper; and many other applications.

A) Sources in ships

PCBs are found in solid (waxy) and liquid (oily) forms in equipment and materials on ships being scrapped. These equipment and materials, which may contain PCBs in concentrations of at least 50 parts per million (ppm) include:

- Cable insulation
- Rubber and felt gaskets
- Thermal insulation material including fiberglass, felt, foam, and cork
- Transformers, capacitors, and electronic equipment with capacitors and transformers inside
- Voltage regulators, switches, reclosers, bushings, and electromagnets
- Adhesives and tapes
- Oil including electrical equipment and motors, anchor windlasses, hydraulic systems, and leaks and spills
- Surface contamination of machinery and other solid surfaces
- Oil-based paint
- Caulking
- Rubber isolation mounts
- Foundation mounts
- Pipe hangers
- Light ballasts
- Any plasticizers

B) Hazards

PCBs can be ingested, inhaled, or absorbed through the skin. They circulate throughout the body and are stored in the body's fatty tissue.

PCBs are toxic and persistent. They have reportedly caused a variety of adverse health effects, such as cancer in animals, as well as a number of serious non-cancerous health effects in animals (e.g., effects on the immune system, reproductive system, nervous system, and endocrine system). Studies in humans provide supportive evidence for potential carcinogenic and non-carcinogenic effects of PCBs. The different health effects of PCBs may be interrelated, as alterations in one system may have significant implications for the other systems of the body. In some cases, chloracne may occur in humans exposed to PCBs. Severe cases of chloracne are painful and disfiguring, and may be persistent.

It is very important to note that the composition of a PCB mixture changes following its release into the environment. The types of PCBs that bio-accumulate in fish and animals and bind to sediments tend to be the most carcinogenic components of PCB mixtures.

C) Measures for handling PCB

i) Worker protection practices

- Facility must ensure that workers are protected from exposure to air-borne PCB concentrations. Exposure to PCBs in the workplace includes two time-weighted averages for chlorodiphenyl. They are:
  - 1.0 mg/m^3 of workplace air over an eight-hour work shift for chlorodiphenyl containing 42 % Chlorine.

  - 0.5 mg/m^3 of workplace air over an eight-hour work shift for chlorodiphenyl containing 54 % chlorine.
- A worker's exposure to PCBs in any eight-hour work shift of a 40-hour week should not exceed these concentrations.

ii) Use of PPE

The facility is required to ensure that the workers involved in removal and disposal of liquid or solid PCB articles wear or use appropriate PPE. There is no regulation that specifies the type of clothing to use because this will vary from one removal and disposal scenario to the next. For example, for liquid PCBs, workers must wear PPE that protects against dermal contact; or inhalation of PCBs and/or materials containing PCBs.

The facility should bear the responsibility to determine the type of appropriate PPE to be used to protect the workers handling the PCB-contaminated materials. PPE may include, but are not limited to, coveralls or similar full-body clothing, head coverings, gloves, and foot covering; face shields; or vented goggles. This equipment/clothing must be disposed as PCB-remediation waste. If required, the workers must use approved respirators that are appropriate for the work being conducted. PPE must be provided free-of-charge by the facility.

The facility is responsible for establishing an effective respiratory program and workers are responsible for wearing their respirators and complying with the program. An effective respirator program must cover the following factors:

- written standard operating procedures
- selection
- training
- fit test
- inspection
- cleaning
- maintenance, and storage
- medical examination
- work area surveillance
- program evaluation

Facility may require conducting medical inspection for all workers who, for a combined total of 30 or more days per year, are performing PCB removal work or are exposed at or above the exposure limit. This includes medical examination and consultation prior to beginning work, at least annually, and upon termination of employment.

iii) Training practices

- At no cost, the facility should provide training for all the workers performing the PCB-removal activities prior to or at the start of the work.
- Effective respirator program including written standard operating procedures; selection; training; fit test; inspection, cleaning, maintenance, and storage; medical examination; work area surveillance; and program evaluation should be carried out.
- Training on PCB sampling while removing liquid and non-liquid PCBs.
- Training on determining the presence of PCBs in liquid-filled electrical equipment.

iv) PCB storage facility

- There should be a PCB storage facility for storage or disposal of PCB items with adequate roof and walls to prevent rainwater from reaching PCBs and PCB items and adequate floor which has continuous curbing with a minimum 6-inch high curb.
- The floor and curbing must provide a containment volume equal to at least two times the internal volume of the largest PCB article or container stored inside or 25% of the total internal volume of all PCB articles and containers stored inside, whichever is greater.
- Floors and curbing constructed of portland cement, concrete, or a continuous, smooth, non-porous surface which prevents or minimizes penetration of PCBs.
- No drain valves, floor drains, expansion joints, sewer lines, or other openings that would permit liquids to flow from the curbed area.
- Not located at a site that is below the 100-year flood water elevation.
- Instead of separate building an existing facility can also be used to act as a PCB storage facility which meets the above criteria.
- These PCB storage facilities must be marked and segregated from other activities.

v) Disposal of PCB liquids, items, wastes and electrical cables having PCB components

The facility must follow strict requirements for the disposal of PCB-containing or PCB-contaminated liquids, articles (e.g., transformers, capacitors, hydraulic machines, electrical equipment, fluorescent light ballasts), containers, spill material, bulk remediation wastes, and bulk product wastes. Depending on the item and its PCB concentration, the following kinds of disposal may be required:

- Licensed incinerator
- Hazardous waste landfill

For electrical cables having PCB components, the facility may use shredders and separators to recover recyclable metal that is intermixed with useless non-metallic material. Some shredder feedstock contains hazardous materials, such as PCBs or asbestos, which can be difficult to contain and effectively separate from the metals during the shredding and separation process. The facility ensures that hazards are properly controlled during shredding and separation and also that metals and fluff are properly managed thereafter.

3.2.2.3 Bilge and ballast waters

An important activity during ship breaking is the proper removal and disposal of wastewater, specifically bilge and ballast water. The activities, if not conducted properly, may impact the environment, health and safety concerns for workers.

Bilge water consists of stagnant, dirty water and other liquids, such as condensed steam, valve and piping leaks that are allowed to drain to the lowest inner part of a ship's hull (called as bilge). Bilge water may also be found in holding tanks onboard, often referred to as oily waste holding tanks or slop tanks.

Bilge water originates from many sources both when a ship is in operation and when a ship is being recycled. It may contain pollutants, such as oil and grease, inorganic salts, and metals (e.g., arsenic, copper, chromium, lead, and mercury). When a ship is in operation, bilge water may originate from leaks, spills, steam condensate, and boiler blow down. This drainage may include small quantities of oils, fuels, lubricants, hydraulic fluid, anti-freeze, solvents, and cleaning chemicals. During ship scrapping, bilge water is created through the accumulation of rain water (because the decks are open) and the collection of water from fire lines that leak, are left open or are used to wet down compartments. Additional bilge water may be generated during asbestos removal and metal cutting activities.

Ballast is typically water (e.g., port water, sea water) that is intentionally pumped into and carried in tanks to adjust a ship's draft, buoyancy, trim, and list, and to improve stability under various operating conditions. There can be several kinds of ballast water on a ship during its operation, including:

- Clean Ballast: Clean ballast is seawater that has been pumped into dedicated ballast tanks. Because these tanks are dedicated to ballasting operations, the seawater is not mixed with fuel or oil. Clean ballast water may contain pollutants, such as metals (e.g., iron, copper, chromium) and chemical constituents. These can come from additives (e.g., flocculant chemicals that facilitate the separation of suspended silts) or from contact of the water with the piping systems and ballast tank coatings (e.g., epoxy coatings and rust inhibitors containing petroleum distillates). The concentration of these pollutants is expected to increase the longer the water is in the clean ballast system.
- Compensated Fuel Ballast: During a ship's operation, compensated fuel ballast is seawater that is taken in by the ship to replace fuel as the fuel is used, thereby maintaining the ship's stability. The tanks are always full of fuel, seawater, or a combination of both. Depending on the seawater to fuel ratio at the time of scrapping, pollutants in compensated fuel ballast may include fuel, fuel additives (e.g., biocides added to control bacterial growth in the fuel oil), oil and grease, petroleum hydrocarbons and metals, which may result from leaching and corrosion of the fuel containment systems.
- Dirty Ballast: Dirty ballast is created when seawater is pumped into empty fuel tanks for the purpose of increasing ship stability. The seawater mixes with residual fuel producing dirty ballast. Pollutants in dirty ballast may include residual fuel, fuel additives (e.g., biocides), oil and grease, petroleum hydrocarbons, and metals (e.g., copper, nickel, silver, and zinc).
- Mud Ballast: Ballast can consist of materials other than water, such as mud or concrete. Mud ballast usually refers to drilling mud used in the petroleum drilling industry to lubricate drill bits and remove drilling debris. This type of ballast is typically treated with lubricants and corrosion inhibitors. The term mud ballast may also refer to concrete, rock, water, and other forms of locked-in ballast.
- Chromated Ballast Water: Sodium chromate may be added to ballast water to prevent algal growth at the time of vessel lay up. Total Petroleum Hydrocarbons (TPH), presence of PCBs, oils, metals in regulated concentrations is not a standard occurrence.

A) Hazards

In the event that the above mentioned pollutants are present at elevated concentrations in discharged bilge water and ballast water, there may be potential impacts to serious human health and environmental impacts. These are as described below:

- Bilge and ballast water containing metals cannot be removed through treatment or environmental degradation. These metals, if ingested, can cause various human health problems such as lead poisoning and cancer. Additionally, consumption of contaminated seafood has resulted in exposure exceeding recommended safe levels.
- Bilge water may contain toxic organics, such as solvents and PCBs, which can be cancer-causing and lead to other serious ailments, such as kidney and liver damage, anemia, and heart failure. Discharges of toxic organics can also result in the release of poisonous gas, which occurs most often when acidic wastes react with other wastes in the discharge.
- Bilge water may contain oils and fuels which can poison fish and other marine organisms. Since these pollutants can float on the water's surface and be blown into the shoreline, they can physically cover plants and small animals thereby interfering with plant life cycles and the animal respiration. Birds, fish, and other animals are known to abandon nesting areas soiled by pollution.
- Ballast water has the potential to contain plants and animals, including microorganisms and pathogens that are native to the location where the water was brought aboard. When the ballast water is transported and discharged into another port or coastal area, the surviving organisms have the potential to impact the local ecosystem. The invasion of non-indigenous aquatic species is an environmental concern with ballast water discharges as it can cause significant changes to ecosystems, upset ecological balances.

B) Measures

i) Booms to contain accidental discharges

- The ship breaking facility may require certain types and lengths of boom to help contain any accidental discharges of oil or oil-containing wastewater and reduce the potential for impacts to surrounding biological resources.
- For spill prevention or control, booms, oil sorbents and barriers, can be used to reduce impacts to the environment in the event of a spill.

ii) Cleaning tanks/compartments onboard

- Following the removal of bilge and ballast water from the ship, the ship tanks and/or compartments may need to be cleaned to remove any residual oil or waste prior to additional ship breaking activities (e.g., metal cutting).
- Workers may be required to follow the framed requirements for confined and enclosed space work and dangerous atmospheres.

iii) Cleaning after removal of bilge and ballast water

- Depending on the kind of residues in a tank or compartment after bilge or ballast water removal, facility may need to clean that space before any hot work can be performed.

- When cleaning spaces that contain or have last contained bulk quantities of liquids that are toxic, corrosive, or irritating, the facility must ensure that manual cleaning and other cold work is not performed until certain conditions are met. These conditions include, but are not limited to, the following:
  - Liquid residues of hazardous materials must be removed as thoroughly as practicable before workers start cleaning operations in the space.
  - Testing must be conducted by the facility's competent person to determine the concentration of flammable, combustible, toxic, corrosive, or irritant vapors within the space prior to the beginning of cleaning or cold work.
- Continuous ventilation must be provided at volumes and flow rates to ensure that these concentrations of vapors are within certain limits/levels, and testing must be conducted as often as necessary by the competent person during cleaning to assure that air concentrations stay within these limits/levels.
- Following cleaning, tanks or other areas that have or have contained flammable liquids must be certified by a marine chemist or authorized person from the respective Maritime Board, before any hot work can be performed.

iv) Confined or enclosed spaces - safe for entry

- The Ship will have several confined or enclosed spaces onboard.
- A confined space is defined as a compartment of small size with limited access such as a double bottom tank, cofferdam, or other space which, by its small size and confined nature can readily create or aggravate a hazardous exposure.
- An enclosed space is defined as any space, other than a confined space, which is enclosed by bulkheads and overhead. Enclosed spaces include cargo holds, tanks, quarters, and machinery and boiler spaces.
  - Concentrations of flammable vapors or gases
  - Concentrations (air) of toxics, corrosives, or irritants
- Before the workers enter a specific confined or enclosed space, facility's competent person must visually inspect the space for the presence of solids, liquids or other contaminants, and test the space for appropriate oxygen content.
- If the tests demonstrate that the oxygen content and air concentrations are within the required limits, then workers may enter the space to work. If the tests show that it is not safe to enter a space, then certain measures must be taken (e.g., ventilation, re-testing, labeling the space to prevent entry or prevent entry without the required protection) for that space.
- Ship breaking yard is required to train workers who enter confined or enclosed spaces or other areas with dangerous atmospheres to perform their work safely. Training in hazard recognition and the use of PPE should be conducted. The facility must provide workers entering these spaces with training before they are allowed to enter, and whenever there is a change in operation or in a worker's duties.

v) Discharging bilge and ballast water

- During ship-scrapping, bilge and ballast water are routinely transferred from the ship's tanks or bilges to onshore storage tanks, or directly overboard.
- The onboard water must be tested to determine pollutant concentrations either prior to transfer onshore or prior to discharge.

- Wastewater treatment may be required to remove certain pollutants (e.g., oils, fuels) prior to discharge. Oily sludges, which are often produced from wastewater treatment (or that are removed from tanks bottoms and bilges), may require management as used oil or hazardous waste.

3.2.2.4 Wastewater

Bilge and ballast water often contain concentrations of many pollutants, particularly oil and fuel, which must be reduced prior to wastewater discharge to a POTW or directly to surface waters. This reduction of pollutant concentrations is often required for the facility to meet permit and/or local limits.

Wastewater treatment processes may produce waste oil and oily sludge. These materials may be stored in containers or holding tanks and depending on their properties, either: (1) managed as used oil or (2) managed and disposed of as hazardous waste. The effluent discharges from an oil-water separator typically contain the same constituents present in bilge water, but with lower concentrations of oil and grease and oil-soluble components.

Oil-water Separator System: Treating bilge and ballast water when still onboard or stored in onshore tanks is typically accomplished using some type of oil-water separator system. While there are several types of oil-water separators available, it is important to install and use one that can remove any free, dispersed, and emulsified oils present in the wastewater. Oily water from other sources at the facility, such as tank bottoms, can also be treated using an oil-water separator. The end products of this process generally include waste oils, oily sludge, and effluent discharges. The effluent discharges typically contain the same constituents as were present in the original wastewater, but with lower concentrations of oil and grease and oil-soluble components. Some facilities pump ballast water into an onsite evaporation pit for treatment.

3.2.2.5 Oils and fuels

Some of the ships which are sold for scrapping may contain diesel fuel, fuel oil, natural and synthetic oils used as lubricants, and hydraulic oils.

This oil may refer to crude oil, petroleum and petroleum-refined products (diesel fuel, gasoline, kerosene) and non-petroleum oils such as synthetic oils (silicone fluids), tung oils, and wood-derivative oils (resin/rosin oils), animal fats and oil, and edible and inedible seed oils from plants.

A) Sources in ships

- Diesel fuel and fuel oil may be contained in various tanks throughout a ship,
- Lubricating oil in engine sumps, drums of unused lubricating oil in ship storerooms or engineering spaces, and sludge in fuel and cargo tanks.
- Oil, fuel, and sludge may also be found in the ship's machinery and piping system.
- Oil found on a ship as defined by the EPA is called as "used oil" and is defined as any oil that has been refined from crude oil or any synthetic oil that has been used. As a result of such use the used oil is contaminated by physical or chemical impurities.
- Used oil can be found in spent lubricating fluids which have been removed from engine crankcases, transmissions, and gearboxes; industrial oils such as compressor, turbine, and bearing oil; metal working oil; and refrigeration oil.

- Used oil may also be generated from vehicles and machinery used at the ship scrapping facility.

B) Hazards

i) Impacts during oil and fuel removal activities

- The primary danger to workers due to the presence of oil and fuel on ships is that of fire.
- Some crude oils and high-end products are highly toxic and present hazards to workers. But the types of oils and products like fuel oil, hydraulic oil, lubricating oil that are found on ships do not have toxic hazards above certain threshold limits, and therefore do not impose serious health threats to workers.
- Exposure to oil or fuel that have certain toxic hazards, exposure can cause damage to the liver, lungs, kidneys, heart, and the nervous system.
- Exposure pathways include dermal contact, consumption through bioaccumulation in marine life, consumption through contaminated soil, inhalation of fumes or particles (particularly in confined spaces), and consumption of contaminated water.

ii) Impacts during oil spills

The severity of the oil-spill impact depends on a variety of factors, including the physical properties of the oil - whether oils are petroleum-based or non petroleum-based, and the natural actions of the receiving waters on the oil. Each type of oil has distinct physical properties that affect the way it spreads and breaks down.

- The hazard it may pose to marine life (and human life), and the likelihood that it will pose a threat to natural and manmade resources. The rate at which an oil spill spreads determines its effect on the environment. Most oils tend to spread horizontally into a smooth and slippery surface, called a ‘slick,’ on top of the water.
- Petroleum-based oils and non-petroleum oils can have both immediate and long-term adverse effects on the environment and can be dangerous or even deadly to wildlife.
- Light refined petroleum products, such as gasoline and kerosene, spread on water surfaces and penetrate porous soils quickly.
- Fire and toxic hazards are high, but the products evaporate quickly and leave little residue.
- Alternatively, heavier refined oil products may pose a lesser fire and toxic hazard and do not spread on water as readily. Heavier oils are more persistent, and may present a greater cleanup challenge.
- Many non-petroleum oils have similar physical properties as petroleum-based oils. For e.g.., their solubility in water is limited, they both create slicks on the surface of water, and form emulsions and sludge. In addition, non-petroleum oils tend to be persistent, remaining in the environment for long periods of time.
- Oil spills can harm the environment in several ways, including the physical damages that directly impact wildlife and their habitats, and the toxicity of the oil itself, which can poison the exposed organisms.

- Spilled oil immediately begins to move, wither, changing its physical and chemical properties. As these processes occur, the oil threatens natural resources, birds, and mammals, as well as a wide range of subsurface marine organisms linked in a complex food chain. Some organisms may be seriously injured (acute effects) or killed (lethal effects) very soon after contact with the oil in a spill. However; non-lethal toxic effects are more subtle and often last longer.
- Marine life on reefs and shorelines is at risk of being smothered by oil that washes ashore or of being slowly poisoned by long-term exposure to oil trapped in shallow water or on beaches. Many different types of marine habitats exist with varied sensitivities to the harmful effects of oil contamination and different abilities to recuperate from oil spills. In some areas, habitats and populations can recover quickly. Unfortunately, in other environments, recovery from persistent or stranded oil may take years.
- Spilled oil can harm birds and mammals in many ways. When fur or feathers come into contact with oil, they get matted. This matting causes fur and feathers to lose their insulating properties, placing animals at risk of freezing to death. As the complex structure of the feathers that allows birds to float becomes damaged, the risk of drowning increases for birds.
- Some species are susceptible to the toxic effects of inhaled oil. Oil vapors can cause damage to an animal's central nervous system, liver, and lungs. Animals are also at a risk from ingesting oil, which can reduce the animal's ability to eat or digest its food by damaging cells in the intestinal tract. Some studies show that there can be long-term reproductive problems in animals that have been exposed to oil.

iii) Measures to control oil spills

Some of the most important activities during ship-scrapping are:

- Preventing oil discharges
- Being prepared to respond to spills, and
- Knowing how to respond to spills and recover spilled materials.

There are a number of advanced response methods available for controlling oil spills and recovering oil while minimizing their impacts on human health and the environment. The key to effective combating of spills is careful selection and proper use of equipment and materials best-suited to the type of oil and the conditions at the spill site. Most spill response equipment and materials are greatly affected by such factors as conditions at sea, water currents, and wind. Some of the response methods include mechanical containment or recovery, chemical and biological methods, natural processes, physical methods.

- Mechanical containment or recovery is the primary line of defense against oil spills. Containment and recovery equipment include a variety of booms, barriers, and skimmers, as well as natural and synthetic sorbent materials. Mechanical containment is used to capture and store the spilled oil until it can be disposed of properly.
- Chemical and biological methods can be used in conjunction with mechanical means for containing and cleaning up oil spills. Dispersants and gelling agents are most useful in helping to keep oil from reaching shorelines and other sensitive habitats. Biological agents have the potential to assist recovery in sensitive areas such as shorelines, marshes, and wetlands.

- Natural processes such as evaporation, oxidation, and biodegradation can start the cleanup process, but are generally too slow to provide adequate environmental recovery.
- Physical methods, such as wiping with sorbent materials, pressure washing, raking and bulldozing, can be used to assist the natural processes. Scare tactics are used to protect birds and animals by keeping them away from oil spill areas. Devices such as propane scare-crows, floating dummies, and helium-filled balloons are often used, particularly to keep away the birds.

C) Oil and fuel removal and storage

The procedures are similar to that of bilge and ballast water removal, storage and treatment. While the used oil attracts the legislations of the hazardous waste for proper collection, storage, environmentally sound technologies for breaking through authorized facilities.

3.2.2.6 Metal cutting

During ship breaking, the activities of metal cutting and scrap metal management present environmental as well as worker health and safety concerns.

Types of Metal Scrap Generation: Ship breaking generates several grades and kinds of scrap metal, commonly called scrap species that are bought and sold in scrap materials markets. The scrap markets can be broadly classified into those dealing with ferrous and non-ferrous scrap.

- Ferrous scrap: Ferrous scrap from ships comes from forgings, castings, shell plating, framing, deck plating, deck beams, bulkheads, pillars, girders, miscellaneous hull steel, foundations, and steel superstructures. In addition, some structural steel outfit, hull attachments, doors, hatches, deck outfit, steward's outfit, hull engineering items, piping, and miscellaneous machinery form ferrous scrap. Of these sources, the largest proportion is so-called "carbon steel," described in the scrap trade as No. 1 heavy melting scrap.
- Non-ferrous scrap: While there are many kinds of non-ferrous scrap, one of particular interest is copper-yielding scrap (*i.e.,* cuprous scrap). Cuprous scrap, which has a number of sub-species, includes bronze, brass, and various other copper alloys.

To be marketable, scrap metal typically has to meet certain standards, such as quality and specific dimensions, which a buyer (e.g., a smelter or scrap metal broker) imposes on a seller (*i.e.*, a ship breaking facility).

Metal cutting is the process of cutting a ship apart for recovery of materials, including several grades and types of scrap metal. During ship scrapping, the upper decks (the superstructure) and systems of the ship are cut first, followed by the main and lower decks. As large parts of the ship are cut away, they are lifted by crane to the ground where they are further cut into the shapes and sizes required by the buyer (smelter, scrap metal broker). As cutting continues and the weight of the structure is reduced, the remaining hulk floats higher exposing lower regions of the hull for cutting. Finally, the remaining portion of the hull is pulled ashore and cut into sections.

The metals on ships are typically cut using a variety of torches and mechanical cutters. Some of these are described below.

- Oxygen-fuel torch: An oxygen fuel torch is the tool of choice for cutting steel. It burns a wide variety of fuel (e.g., acetylene, propane, butane, fuel gas, natural gas) and uses either oxygen (liquid or compressed) or liquid air as the oxidizer and 'cutting gas' that serves to burn (oxidize) iron along the cut line. Oxygen-fuel torches operate with a flame temperature of 3,500E- 4,000 EF and flame velocities of 290 - 425 feet per second. Dozens of torches of different styles and torch tops are available depending on the type and supply pressure of the fuel and oxidizer, the thickness of the metal to be cut, and the environment where the work is done. The cutting speed of these torches ranges from 17 to 26 inches per minute depending on the steel thickness, fuel, oxidizer, and torch tip.
- Electric arc or Plasma arc torch: These torches generate temperatures high enough to liquefy almost any metal by the discharge of electric arcs. A cutting gas, often air, is used to blow away the molten metal. Manual electric arc torches are much slower than the oxygen-fuel torches, cutting at rates of no more than 10 inches per minute.
- Shears: Large industrial shears can quickly reduce large metal parts to small dimensions suitable for the remelting furnace with less labor than the torch or saw cutting. There are dozens of sizes of stationary and mobile shears available. Large shears have cutting rates measured in tens of feet per minute. The thickness, toughness, and dimensions of the metal to be sheared, the required cutting rate, and the product dimensions are important for selecting the proper kind of shears for the job.
- Saws: Several kinds of electric power metal cutting saws are available, including those with circular and reciprocating blades. Saws can be used only on non-ferrous metals.

A) Hazards

Ship breaking generates air pollutants. The torch cutting process generates large amounts of fumes and some or all of the following materials as particulates: manganese, nickel, chromium, iron, aluminum, asbestos, and lead.

It will also initiate small fires when oil or sludge is ignited by the torch. These fires are usually short-lived, but may generate some intense black smoke. The cutting torches themselves generate oxides of nitrogen (NOx) and sulfur (SOx), and the process of combustion produces carbon dioxide (CO_2) and carbon monoxide (CO). Other than these releases, remaining air pollutants from metal cutting are not likely to have a major air quality impact.

The improper storage or disposal of scrap metal and other waste generated from metal cutting (e.g., filings, shavings) may result in soil and/or water contamination, primarily from lead and other compounds. Specifically, if metal scrap and waste are not protected from exposure to stormwater, then metal wastes and contaminants from the scrap will be carried to surface waters and contribute to water contamination.

H&S Concerns of the Workers During Metal Cutting: One of the main worker safety issues during metal cutting is exposure to air contaminants including metal fumes, particulates, and smoke. These contaminants can have acute and chronic toxic effects on workers. For e.g., exposure to lead can cause poisoning and long-term damage to the central nervous system. Although ingestion, and in some cases, absorption of these contaminants is possible, inhalation is the main pathway of concern.

B) Measures

i) Metal cutting practices and procedures

For any surface covered by a preservative coating whose flammability is not known, the competent person must test this coating before the surface is cut. Under certain circumstances, the facility may be required to remove highly flammable or toxic coatings on surfaces to be cut.

The facility must ensure that all workers performing metal cutting of any type are wearing suitable PPE for eyes, hands and body. Workers performing metal cutting must not wear clothing with traces of flammable or combustible materials (e.g., grease or oil).

Metal cutting at the facility may produce noise levels exceeding 100 decibels (dBA). If there is a possibility of workers being exposed to such kind of noise pollution over a constant period of time, the facility must use feasible administrative or engineering controls to reduce the noise. If these controls fail to reduce the noise, then the facility must supply workers with necessary PPE.

ii) Metal cutting in open areas

- In open areas, workers at the facility can normally perform general metal cutting without mechanical ventilation or respiratory PPE, provided,
  - it is not done in confined or enclosed spaces and
  - metals containing or coated with toxic materials are not being cut.
- Workers cutting the metals containing toxic materials in open air must wear filter-type respirators.

iii) Metal cutting in confined / enclosed spaces

- Work at confined spaces may result in unsafe accumulation of contaminants. The facility must provide workers with suitable mechanical ventilation or respiratory PPE. Mechanical ventilation may consist of either a general mechanical ventilation system or a local exhaust system.
- General mechanical ventilation must have sufficient capacity and provide the number of air changes necessary to maintain fumes and smoke within safe limits. Mechanical ventilation or local exhaust ventilation is provided when cutting the Zinc-bearing base or filler metals or metals coated with Zinc-bearing materials, Lead-based metals, Cadmium-bearing filler materials, Chromium-bearing metals or metals coated with Chromium-bearing materials.
- Local exhaust ventilation must have freely movable hoods that can be placed as close as practicable by the metal cutter to the work. This system must have sufficient capacity and be arranged so as to remove fumes and smoke at the cutting site and keep the concentrations in the breathing zone within safe limits.
- Local exhaust ventilation or air line respirators are used when cutting metals containing lead (other than as an impurity) or metals coated with lead bearing materials, cadmium-bearing or cadmium-coated base materials, metals coated with mercury-bearing materials

- The required means of access to the space in more than one way should be provided for workers.
- If the ventilation ducts pass through these means of access, they must be arranged in order to allow free movement of workers at more than two points of access.
- If sufficient ventilation is not possible without blocking the means of access, workers must be able to use air line respirators and maintain communication with a colleague outside the confined space who will guide them in an emergency.
- Facility must provide the workers with local exhaust ventilation and air line respirators regardless of whether this work is being performed in an enclosed space or in the open air when working with beryllium-containing base or filler metals.

iv) Testing before cutting

- For drums, containers, or hollow structures which have contained flammable substances, the facility must fill them with water or thoroughly clean them of such substances, and ventilate and test them prior to cutting.
- The facility must provide a vent or opening in each drum, container, hollow structure, or jacketed vessel for the release of any pressure which may build up during heating.
- For structural voids such as skegs, bilge keels, fair waters, masts, booms, support stanchions, pipe stanchions or railings, the facility's competent person must inspect the object and, if necessary, test for the presence of flammable liquids or vapors and non-flammable liquids that could heat up and cause pressure.

v) Fire prevention requirements

- The facility must take the appropriate steps during metal cutting to prevent fires. This can include moving objects to be cut to a safe location or taking all movable fire hazards away from the object to be cut. If either of these is not possible, then the facility must take all steps possible to confine the heat, sparks, and slag, and to protect the immovable fire hazards from them.
- Cutting of particular objects such as tank shells, decks, overheads may result in the direct penetration of sparks or heat transfer which can cause fire in an adjacent compartment. In these situations, the same precautions must be taken on the opposite side as are taken on the side where the cutting is being performed.
- The facility must eliminate the possibility of fire in confined spaces as a result of gas escaping through leaking or improperly closed torch valves. This can be done by positively shutting off the gas supply to the torch at some point outside the confined space whenever the torch is not used, or left unattended for a substantial period of time (e.g., lunch hour). The torch and hose must be removed from the confined space overnight and during the shift changes.

3.2.2.7 Paints

The removal of paints prior to cutting may not be necessary in certain circumstances. However, wherever it is necessary, specific requirements must be followed. In addition, the removal of paint generates waste that must be managed and disposed according to the appropriate solid waste and/or hazardous waste regulations.

A) Sources in ships

Paint and preservative coatings can be found on both interior and exterior surfaces of a ship. Particularly on older ships, paint may be flammable or may contain toxic compounds, such as PCBs, heavy metals (e.g., lead, barium, cadmium, chromium, and zinc), and pesticides. Lead compounds, such as red lead tetraoxide (Pb3O4) and lead chromate, have been used extensively in marine paint. In general, metal-based paints, some containing as much as 30% heavy metals, were intended to protect ship surfaces from corrosion due to exposure to the elements. Other paints containing pesticides, such as tributyltin and organotin, are used on the hulls of ships to prevent the build up of sea organisms (e.g., bacteria, protozoa, barnacles, and algae).

B) Hazards

Removing paints and coatings have impacts on human health and environment.

- Chemicals and solvents used in stripping paints or coatings emit volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) into the atmosphere.
- Other removal methods (e.g., mechanical removal, abrasive blasting) generate dust, particulate matter, and emissions containing lead and other contaminants. These pollutants are hazardous to human health, and have a potential to cause acute and chronic toxic effects and even cancers to the humans working with them. For e.g., lead can cause poisoning and long-term damage to the central nervous system. Though they can be absorbed and ingested, the main pathway of concern for these pollutants is inhalation.
- Wastes (e.g., blasting residue, paint chips) generated from paint removal can have negative impacts on the environment if they are not properly contained and disposed of. If not contained by engineering controls, lead and other compounds from the waste may be discharged into nearby surface waters or may contaminate the soil at a facility.

C) Measures

i) Handling procedures

Paints and coatings are typically removed using one of the following three methods:

- Chemical Stripping: Paints and coatings are removed by chemical stripping using solvents, such as methyl ethyl ketone and 1,1,1-trichloroethane. Solvents, which may be toxic or flammable, can be sprayed, wiped, or brushed on the surface and then removed, along with the paint or coating, using rags or wipes. Wastes generated from chemical stripping include contaminated or spent solvent, solvent residue or sludge, solvent-contaminated wipes/rags, and waste paint.
  - Toxic Solvents: When toxic solvents (e.g., benzol, acetone, amyl acetate) are used the facility may enclose the area completely to prevent the escape of vapor into the work space. Either natural ventilation or mechanical exhaust ventilation can be used to remove the vapor at the source and dilute the concentration of vapors in the working space to a concentration that is safe (*i.e.*, below the PEL) for the entire work period. Workers should be protected against toxic vapors from these solvents using approved respiratory protective equipment. Suitable clothing and equipment should also be provided to the workers in order to avoid exposure

of skin and eyes to the toxic solvents and their vapors. If flammable solvents are used, the facility should also use the protective measures described below:

- Flammable Liquids: Additional precautions should be taken if flammable liquids are used to remove coatings. Proper ventilation should be provided so that the concentration of vapors should be below 10% of the lower explosive limit and these concentrations should be determined and monitored by the facility's competent person. Additionally, the facility should keep scrapings and rags soaked with flammable solvents in a covered metal container, only explosion-proof lights should be used, and fire extinguishing equipments should be kept handy in the work area.

- Abrasive Blasting: Paints and coatings are removed by blasting a surface with abrasives, such as copper slag, coal slag, steel grit, mineral grit, and steel shot. Blasting generates large amounts of dust, abrasive waste, and paint chips.
  - Equipment like hoses and fittings should be used which meets the requirements. Hoses should be able to prevent shocks from static electricity. Hose lengths should be joined by metal couplings secured to the outside of the hose to avoid erosion and weakening of the couplings.
  - Nozzles shall be attached to the hose by fittings that will prevent the nozzle from disengaging by accident, and nozzle attachments should be metal and fit onto the hose externally. A dead-man control at the nozzle should either provide direct cutoff or signal the operator to cut-off the flow. The facility should frequently inspect hoses and all fittings used for abrasive blasting to ensure timely replacement before an unsafe amount of wear has occurred.
  - Worker PPE: The facility should protect its workers (referred to as abrasive blasters) conducting blasting in enclosed spaces by hoods and air-fed respirators or by positive pressure air helmets. Abrasive blasters working in the open may use filter-type respirators when synthetic abrasives containing less than 1% free silica are used. Workers other than blasters, including machine tenders and the abrasive recovery team, should use eye and respiratory PPE in areas where unsafe concentrations of abrasive materials and dust are present

- Mechanical Removal: This involves the use of power tools or flame to remove paints and coatings.
  - Power Tools: The use of power tools, such as grinders, wire brushes, sanders, chipping hammers, needle guns, rotary preening tools, and other impact tools, generates waste such as dust and paint chips. Workers using power tools should be protected from eye injuries by making use of goggles or face shields. Portable electric tools should be grounded, and portable rotating tools should be adequately guarded to protect all workers from flying missiles.
  - Flame Removal: It should not be used on greasy or soft preservative coatings, or paints containing PCBs. The facility should not allow hardened preservative coatings to be removed by flame in enclosed spaces unless workers exposed to the fumes are protected by air-line respirators. In addition, workers performing this operation in the open air and those exposed to the resulting fumes, should be protected by fume filter type respirators

ii) Worker exposure limits

- During paint removal activities, the facility must ensure that workers are not exposed to any listed contaminant in excess of the PEL. For lead, which is commonly found in paint, the PEL is 50 Fg/m3 of air averaged over an eight-hour work day. The action level is 30 Fg/m^3 of air, also based on an eight-hour work day.
- The action level triggers several requirements such as exposure monitoring, medical surveillance, and training and education.
- Facility can control a worker's exposure by using engineering controls, work practices, and/or administrative controls.
- In case, if exposure cannot be reduced to or below the PEL through the use of controls or practices, the facility must provide PPE including, but not limited to, respiratory protection.

iii) Flammability test to paints and coatings

- Flammability of the coating should be known before cutting a surface covered by paint or preservative coating.
- The facility's competent person must conduct a test to determine the coating's flammability as paints and preservative coatings are considered to be highly flammable when scrapings burn rapidly.
- Highly flammable paints and coatings must be removed prior to metal cuttings to prevent ignition.
- These coatings may be burned away under controlled conditions.
- As a precaution, the facility must have a 1½ inch or larger tire hose with a fog nozzle, which has been uncoiled and placed under pressure, available for instant use in the immediate vicinity.

iv) Toxicity of paints and coatings

- Tests should be conducted to determine the toxins in paints and coatings.
- The facility should assume that all paints and coatings are toxic incase no tests are carried out.
- For testing toxic metals, random and representative bulk samples of suspect coatings should be collected.
- All toxic paints and coatings should be stripped for a distance of at least 4 inches (10 centimetres) from the area to be heated and also ensure that workers are protected by approved air-line respirators when working in enclosed spaces.

v) Air permits requirements

- Ship breaking activities, including surface preparation, generate air pollutants. Specifically, the use of solvents to strip coatings may result in the release of VOCs and HAPs to the atmosphere. Because small quantities of solvent are used overall, these emissions are not likely to be of sufficient magnitude to have appreciable ambient air quality impacts.

- If the facility emits regulated amounts of air pollutants, it must obtain the appropriate operating or pre-construction permit and comply with all emission requirements set forth in that permit.

vi) Disposal of Paint Removal Wastes

The removal of paints and coatings, regardless of the process used, generates wastes that must be managed and disposed. The facility must implement procedures to ensure that all wastes are contained and stored in a manner that will prevent their release into the environment.

3.2.2.8 Removal and disposal of miscellaneous ship machinery

During ship breaking, there are many types of machinery that are removed from a ship. Some of this machinery may be sold for reuse or recycled as scrap.

Ship machinery consists of various components that are removed from a ship during the breaking process. These may include, but not limited to the following:

- Main propulsion; turbine drain and leak off system
- Main reduction gears
- Main condenser
- Main air ejector
- Main circulating system
- Feed heaters
- Feed and condensate system
- Saltwater evaporator system
- Shafting, bearings, and stern tubes
- Propellers
- Miscellaneous shafting parts
- Lubrication oil system
- Miscellaneous engine oil tanks
- Cables/wires
- Fluff from wire/cable stripping
- Boilers including fuel oil burners and soot blowers
- Boiler draft system
- Air systems
- Automatic combustion system
- Stacks and uptakes
- Fuel oil service system
- Main steam piping
- Auxiliary stem piping
- Exhaust and escape piping
- Steam drain system
- Access systems
- Work shop, lifting, and handling gear
- Machinery space ventilation and fixtures
- Machinery space fixtures
- Miscellaneous instruments and gauges

A) Hazards

When removed from the ship, the machinery components are typically handled in the breaking yard. These components, which may be stripped of valuable materials and/or cut into smaller pieces, may contain or be contaminated with hazardous materials, including asbestos, PCBs, oils, and fuels.

The ship breaking yards must follow a handling procedure for the metal components that ensures prevention of soil, surface water, and groundwater contamination. If improperly stored, residues and hazardous materials from ship machinery components may come in contact with rain water and cause soil and/or water contamination.

Workers' exposure to any hazardous materials in ship machinery may potentially have serious health effects.

B) Handling Procedures

REMOVAL OF COMPONENTS DURING SHIP BREAKING: Components of the machinery are typically removed throughout the scrapping process. During the preparation phase of scrapping, small articles and propellers are removed, which allows the hulk to be pulled into shallow water where scrapping usually takes place. As layers of the ship are cut, large reusable or recyclable components are removed as they become accessible.

3.3 Infrastructure and Other Requirements for the Ship Breaking Yard

It is important to integrate all the facets concerned to the ship recycling while establishing the ship breaking yards *i.e.,* up-stream and down stream linkages. The major components to be integrated in the overall ship braking yards development are of infrastructure related, thus are emphasized here, besides others.

An integrated infrastructural developmental plan envisages closed loops for up-stream and down-stream linkages for the extent reasonably possible. Integrated approach aims for least possible net influence on the receiving social and environmental attributes, with financial benefit. Considering the benefits of the triple bottom approach, it is necessary to plan for establishment of scrap dealing market, re-rolling and allied industrial parks.

The Maritime Board through its adopted implementing agency/mode may like to take up following major activities:

- The Maritime Board may develop land for establishing scrap dealing market.
- The State Maritime Board may provide facilities at the site for removal of paint/coatings in enclosed chambers from sheets/plates before they are passed on to re-rolling mills located elsewhere. The paints chips/debris so collected must be treated as hazardous waste and transferred to TSDF or sold to licensed re-users. This waste should not be mixed with other wastes as paint chips may have future market value even with its low iron content.
- The Maritime Board may also acquire land for development of an industrial park to house re-rolling mills, melting units and other auxiliary units such as oxygen bottling units, commercial centers, *etc*. This industrial park shall also house the

auxiliary depending industries such as mild steel (flat bar, square bar, pipes *etc*.) and tube manufacturers; plates, wire, rods, grill manufacturers, *etc*.

- Appropriate monetary benefits that could be offered for initial mobilization may be extended by the Maritime Board.

- The infrastructural needs and others, which need to be taken up by a specially designed implementation mechanism are listed below:
  - Size of the ship breaking yard
  - Risk Assessment
  - Water supply
  - Sewerage
  - Stormwater drainage system
  - Bilge water collection and treatment
  - Ballast water collection and treatment
  - Municipal Solid Waste (MSW) collection and treatment
  - Hazardous waste disposal facility
  - Oily waste/residues collection and treatment/disposal
  - Mobile cranes, barges, mobile asbestos removal chambers, waste collection trucks and tankers, *etc*.
  - Road improvement and maintenance
  - Strengthening of fire fighting infrastructure
  - Training infrastructure development and organizing capacity building and certification courses
  - Truck parking facility
  - Township and community development infrastructure
  - Hospital management and medical infrastructure
  - Commercial centers
  - Greenbelt development and water harvesting
  - Safety, Health and Environmental management cell operations
- Facilitate the ship recyclers in respect to the following by establishing suitable organization/forum.
  - Adherence to legal and regulatory requirements
  - Industry best practices
  - Purchase of ships from international markets
  - Membership of International Recyclers Association
  - Awareness programmes, interaction meets with international experts
  - Registration of workmen/CPF account, *etc*.
  - Development of model ship breaking yards for leasing
- Development of Model ship breaking yards for lease - More and more ship breaking yards around the world are learning about the merits of green ship breaking. In addition, the international and national legal and voluntary requirements are increasingly influencing the ship breaking business, thus resulting in a shift towards the green-recycling concept and practices. Keeping this in the background the Maritime Boards in India may develop model green ship breaking facilities/yards. These yards could be leased to the ship-recyclers for a period for breaking the ships.

3.3.1 Size of the individual plot in the ship breaking yard

The size of the individual plots in the yard may depend on the type and number of ships dismantled at any point of time in a ship breaking facility, the general working conditions and occupational safety requirements.

While defining the appropriate size of the plot, following two considerations need to be kept in the background *i.e.,*

- Accommodating more than one vessel at a time within one single plot.
  - The size of the plot would depend on the size (small, medium, large) and number of vessels coming to the yard for breaking.

- Accommodating all the necessary units within the yard for the proper ship breaking process in line with the safety, health and environmental requirements. These units/facilities may depend on the type of the vessel but typically for any kind of ship the following are the requirements within the plot.
  - Temporary storage of oil sludge
  - PCB containing waste
  - Storage tank for bilge and ballast waters
  - Clear space for welding/cutting operations
  - Temporary storage of scrap
  - Asbestos handling facility (More concern with war ships)
  - Radio-active material handling chambers (More concern with war ships)
  - Protective wear keeping room
  - Area for loading and un-loading of at least a truck
  - Walk-through area and
  - Area for an office building with required workers amenities
  - Facilities for cleaning of sheets/plates from paints/coatings

Typical ship breaking yard would be as shown in the Figure 3-3. The yard is divided into zones based on the activities performed.

To ensure better safety and security of plots, open spaces (buffers) can be created after every 10 to 15 plots for giving emergency access/ parking to/for fire tenders, installing water lines for emergency services, access to beach, anchoring rescue boats and dinghies.

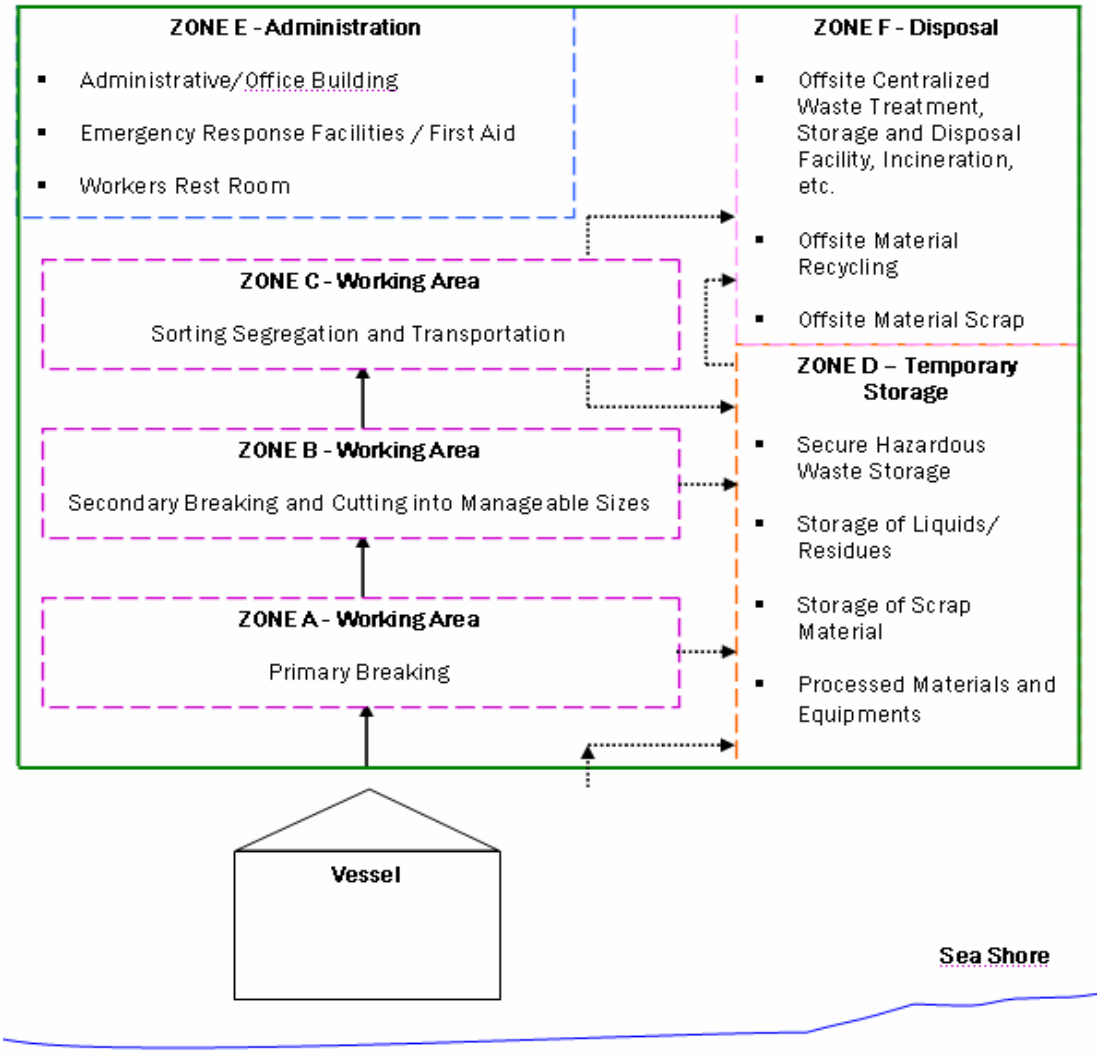

Figure 3-3: Conceptual Model Ship Breaking Unit in a Yard

Table 3-5: Zone-wise Recurrence of Predominant Hazards

Hazards	Zone A Primary	Zone B Secondary	Zone C Sorting	Zone D Storage	Zone E Office	Zone F Disposal
Oils and Fuels	***		*	*		*
Bilge and Ballast Water	**			*		*
Paint and Coatings	**	*	***			*
Asbestos	***	*	***	***		*
PCB	**		*			
Other Hazardous Wastes	**		*	*		*

*Note: The number of * indicates the degree of importance*

3.3.2 Risk assessment

All the accidents in the ship breaking yard that have occurred in the past resulted in great personal and financial loss. These accidents may be classified into natural (Cyclone and Earthquake) and man-made (Fire and Hazardous Cargo Handling).

Managing these risks of accidents in today's environment is the concern of every industry including Ship breaking Industry, because either real or perceived incidents can quickly jeopardize the financial viability of a business. Ship-breaking and cutting operations involve handling of heavy and hazardous components that have the potential for accidents which may be catastrophic to the yard, work force, environment, or public. The detailed description on risk assessment is discussed in chapter 4.

3.3.3 Water supply

An effective arrangement has to be made to provide and maintain adequate water supply for the workers within the yard. The influencing factors to arrive at water supply demand in the ship breaking yard are the number of workers, number of ships/% LDT. "Indian Dock Workers Act" (Factories Act) can be made useful in providing drinking water to the workers and their families efficiently.

3.3.4 Sewage

Sewage originates from household wastes, human and animal wastes, domestic portion of ship breaking units, storm runoff, groundwater infiltration, *etc*. An understanding of physical, chemical and biological characteristics of wastewater is very important for proper design, operation and management of collection, treatment and disposal of sewage. All these characteristics would depend on the water usage patterns in the community, commercial contributions, weather, infiltration, *etc*. Volume of sewage will be calculated by assuming that 80% of the water supplied forms sewage when the area is well-covered by sewerage network.

3.3.5 Stormwater drainage system

The ship breaking yard generates many polluting constituents including hazardous waste from the process which require proper collection, storage, transportation and disposal. Therefore, a stormwater drainage system along the ship breaking yards can ensure no washing effect of the chemicals/pollutants and also prevents possible pollution additions to the sea. As such, each yard shall have collection pits to store the initial rainwater to prevent pollution of coastal waters. Besides, existing creeks are also to be pitched on sides to prevent soil erosion and to protect the local land use.

3.3.6 Bilge and ballast water collection and treatment

Removal and disposal of bilge and ballast water is found to be an important activity in the ship breaking process which, when not conducted properly may lead to environmental and human health hazards. Ballast water is exchanged at high seas to avoid transfer of foreign organisms from foreign water to local ecosystem. However, the remaining ballast water present in the ship has to be removed, which is a continuous procedure throughout the ship breaking process. Whereas, bilge water can be assumed to be a one-time activity of emptying for few hours/days.

Based on the characteristics of bilge and ballast water the treatment scheme can be differed. Typically these wastewaters may contain metals, oils, fuels, grease, chemical contaminants, *etc*. Therefore the treatment scheme should be selected to remove these contaminants. For removing dissolved and suspended contaminants from wastewater, a multiple progressive system that chemically and electrically treats wastewater and separates oil and other contaminants from wastewater is required. This treatment technique requires a sump, holding tank, separating tank, ozone injection system, carbon filters, *etc*. The schematic view of this treatment process is shown in Figure 3-4.

Wastewater received by the sump is transmitted to the holding tank where it is treated over an extended period of time. During this process influent wastewater continues to off-load as fast as possible. Wastewater is then pumped into oil-water separator tank where free floating oil is allowed to rise and separates into an oil retention tank for pickup and recycling. Remaining wastewater undergoes electro-coagulation process where emulsions are broken down and compounds which need to be treated are created. The electro-coagulated treated water is transferred into a retention/separation tank to allow the contaminant particles to coalesce and separate. Making use of ozone injection system and activated carbon filter media water is transferred to a clean water holding tank. The carbon filter media absorbs carbon and acts as a filter for any solids present. This treated water is re-circulated until it exits the system discharge limits for organics and metals to meet the disposal standards.

After treatment, the treated water can be disposed off into the sea and can be used for other purposes based on its concentration level of contaminants.

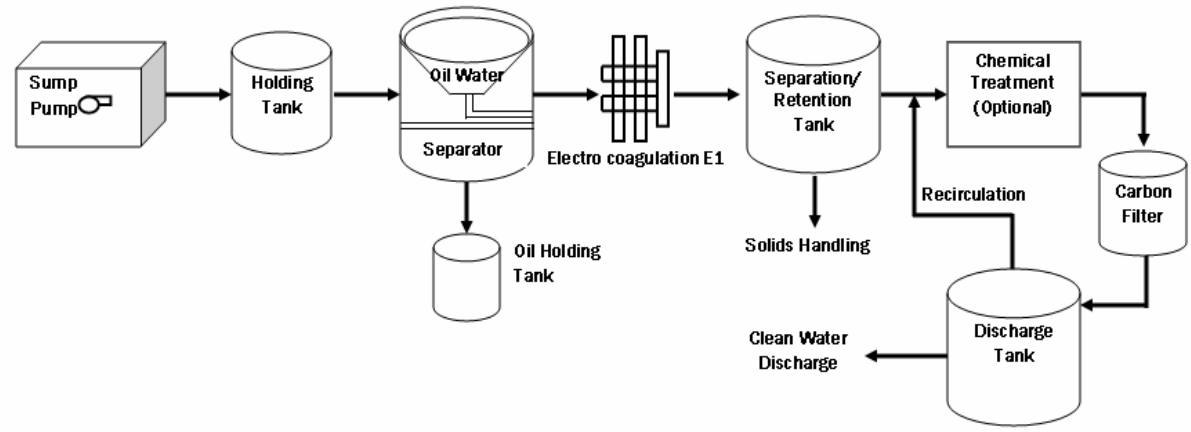

Figure 3-4: Bilge and Ballast Water Treatment Scheme

3.3.7 Municipal solid waste collection and treatment

MSW should be well segregated after collection and disposed at the facility provided. To plan a new MSW facility the following information is required.

- Expected number of ships for breaking
- Quantity of solid waste generated based on population and also on per ship basis
- Number of workers/population
- Waste generation rate
- Composition of waste

3.3.8 Hazardous waste disposal facility

Various materials historically used in the construction and operation of ships will become hazardous wastes after its life span. Of these hazardous materials asbestos, paints, thermocol, PCBs, glasswool, and other substances are or major importance. These materials will be released during ship-scraping process and therefore need an appropriate disposal facility. The hazardous waste facility can be well planned and designed with the availability of the following information.

- Expected number of ships coming for breaking
- Type of ship and corresponding expected type of hazardous waste
- Density of waste (Refer **Annexure V**)
- Quantities (Refer factors in Table 3-2 and 3-3) and quality of hazardous waste
- Volume of Waste
- Capacity of the existing hazardous waste facilities/cells, if any.
- In case of any existing facilities, free volumes available
- Additional incremental capacity requirement corresponding to the no. of expected ships, for specific periods.

3.3.9 Oily waste/residues collection, treatment and disposal

Oily waste should be collected separately for proper disposal. The general practice includes selling it to the waste oil/used oil recyclers or to use it as an auxiliary fuel in the common incineration facility.

Proper collection and disposal shall be ensured appropriately by studying the actual volume of the waste to be incinerated and the results may be further considered in setting up a dedicated incinerator in the vicinity, if the sufficient quantity is expected at the ship breaking yard. These results form the minimum cut-off capacity. The incinerator should be designed to handle the minimum cut-off capacity including elaborated tail gas treatment.

3.3.10 Truck parking facility

Truck parking facility can be provided for easy accessibility of vehicles for transporting scrap and other materials and to relieve the traffic congestion around the yards. The parking facility should have basic infrastructure like potable water, sanitation, resting, shops, eating joints, vehicle repair shops, fuelling stations, *etc*., the for drivers. It should also have accommodation for transporter companies/agents. To accommodate more number of vehicles the trucks can be parked angularly.

3.3.11 Community development infrastructure

In every ship breaking yard, considering the welfare of the ship-breaking workers, there is a need to establish community development infrastructure, in tune with the recommendations of the SCMC. The following task should be taken up, to establish proper housing facilities / township for workers and their families.

- Residential tenements for families, workers hostel accommodation on twin sharing basis and dormitory accommodation with mess facility
- Township with sanitation, water supply, medical and other basic facilities may be developed
- Commercial centers for workers

- One time waste removal, followed by a scheduled and systematic solid waste collection
- Collection of runoff water into drains along the roads
- Sanitation facilities (toilet and wash) at available land in existing settlements
- Tin shaded small commercial facilities
- Street lighting

In case housing cannot be provided for a certain time period, the proposed/existing slums could be upgraded to ensure a healthy atmosphere in the neighborhood.

3.3.12 Hospital management and medical infrastructure

The workmen population and the unhygienic conditions in the yard may not attract major hospital groups to set up their hospitals in the ship breaking area. In such situations, the following possibilities may be explored:

- Ensuring basic first-aid and out-patient services with few beds
- Setting up of Hospitals and Occupational Health and Safety (OHS) facilities
- Provision and proper maintenance of adequate number of ambulances to shift the patients to nearby town
- Establishing a trust hospital with orthopedic, general out-patient department, burns, maternity and OHS facilities to workers
- If there is any hospital in the village then that can be associated with the hospitals in the neighboring town for medical facilities
- Medical cards through registration may be provided to workers.
- The registered workers may be treated free-of-cost.
- Ensure availability of ambulances 24×7.

3.3.13 Greenbelt development and water harvesting

Greenbelt should be developed to ensure environmental management, land regeneration and open air recreation facilities. Treated water (bilge, ballast, sewage, *etc*) may be used for greenbelt. Water harvesting structures may be constructed to raise freshwater water-table and arrest sea water intrusion. Environmentally and aesthetically important activity may be taken up.

3.3.14 Safety health and environmental management cell operations

Establishment of an environmental management cell equipped with a small laboratory facility for analysis of conventional parameters to facilitate the breaking yard operators. Compliance to labour laws, factories act, occupational safety and environmental stipulations is mandatory and has to be integrated into day-to-day operation of the ship breaking yards. This would also include monitoring of safe collection and disposal of hazardous waste from the ship breaking yards.

- Competent authorities should formulate, implement and conduct audits periodically at the yards to ensure safe ship breaking operations.
- The authorities should enforce, inspect and monitor the relevant rules, laws and regulations at the yard that the ship-recyclers would follow
- Appropriate and periodic training on occupational health hazards may be provided to the workers at the yards

- Implement environmentally sound and economically viable practices/ technologies in order to mitigate environmental impacts
- An environmental monitoring programme in the lines of Supreme Court Committee shall be carried out to record the state of environment and to see the trends in order to apply appropriate interventions to safe guard the receiving environment.

3.3.15 Commercial centers

As the ship breaking yards are typically located away from the towns, the yard management may consider building commercial and recreational facilities for their workers within or nearer to the yard vicinity.

3.3.16 Vehicles

There should be enough number of vehicles like mobile cranes, barges, mobile asbestos removal chambers, waste collection trucks and tankers, *etc*. for handling the ships and for transportation of wastes to meet the demand of the yards. The Maritime Board can buy such huge equipment and can supply them on a rental basis to the yard operators. Exclusivity may be ensured by the Maritime board for sustenance and quality services in the yard.

3.3.17 Roads

Roads are a major concern as transportation needs are high in the yard. All the scrap and wastes which are temporarily stored in the yard have to be sent to appropriate disposal locations like scrap to the scrap dealing market while waste and hazardous wastes must be transported to the centralized disposal facility. The adequacy of the roads should be ensured and feasibility studies may be carried out to arrive at the requirements.

Suitable organizations like the Maritime Board can take up the road maintenance throughout the concession period and can get compensated by toll.

3.3.18 Fire fighting infrastructure

The workers in ship breaking yard are subjected to a high risk of injury and death from fire and explosions during ship-breaking and related activities as well as fire-fighting activities.

Many of the basic tasks involved in ship-breaking such as welding, grinding, and cutting metal with torches, provide an ignition source for fires. There are many combustible materials on vessels and in ship yards, including flammable fuels, cargo, wooden structures, building materials, and litter. The oxygen-enriched atmosphere in enclosed or confined spaces may cause the normally fire-resistant materials to catch fire when cutting torches are used. When fires occur, the confined or enclosed spaces of work make the escape difficult or almost impossible for the employees working in those areas. Fire in such confined or enclosed spaces may also result in atmospheres of combustible gases, toxic fumes, or oxygen-depleted air.

Workers in the ship breaking yards, therefore, face risk from fire, explosions, toxic gases, and fume that can result in burns, death, and asphyxia. Employees are also at special risk when fighting fires in ship breaking yards. Fighting fires at landside facilities in

shipyards can be similar to traditional firefighting at typical industrial manufacturing facilities.

Firefighting onboard is considerably different from structural firefighting. When traditional structural firefighting techniques are used on a vessel fire, the result can be ineffective and even catastrophic. The potential is much greater for serious injury to firefighting personnel when tactics do not reflect the unique nature of firefighting on ships.

It is important for the ship breaking yards to not only have a yard-specific Fire Safety Plan but also to have fire department trained adequately to handle on-vessel fires and fire accidents occurring in confined spaces.

The plan must provide for the routine inspection, maintenance, and replacement of this equipment and mandate training for new workers and refresher training for all shipyard employment workers. The plan must include procedures for the control of fire hazards, such as flammable and non-flammable compressed gases, ignition sources, combustible materials, welding and hot work operations, and must include procedures for evacuation.

Training programmes on fire prevention and emergency responses to fires in ship breaking yard and ships should be formulated in consultation with the Maritime Board and State Fire Department and the Directorate General, factory Advice Service and Labour Institutes (DGFASLI) and the District Administration.

3.3.19 Training infrastructure development and organizing capacity building and certification courses

The ship breaking yards must have training institutes and the workers must be trained on various topics regularly. However, a needs assessment on organizing trainings at different skill levels of the personnel is essential. Very important factor in this respect is to include the hands-on training and certification procedures.

It is also important that the workmen in crucial operations require training at regular intervals to ensure their effectiveness and also safety and health.

It is necessary to enhance the training infrastructure and organize knowledge development, skill development and the hands on training programmes for various target groups on the lines of ship breaking activities.

3.4 Summary of Applicable National Regulations

Codification of national & international laws/guidelines relating to ship breaking activities (SCMC) is annexed in **Annexure VI A**.

A comprehensive list of legal instruments applicable to ship breaking yard is annexed as **Annexure VI B**.

Also, the enforcing agencies based on each of the ship breaking activities are annexed in **Annexure VI C**.

3.4.1 Specific requirements

Asbestos concentrations

The permissible exposure limit (PEL) for fiber depends upon the type of asbestos. As per landmark Supreme Court judgment on Asbestos, Supreme Court directed to appoint a Committee of Experts to review the permissible exposure limit of 2 fibres per cubic centimetre (f/cm^3) and reduce it to 1 f/cm^3 for chrysotile, 0.5 f/cm^3 for amosite and for the time being 0.2 f/cm^3 for crocidolite type of fibers at par with International Standards.

The facility must ensure that workers are not exposed to air-borne asbestos concentrations in excess of either of the following limits.

- 0.1 f/cm^3 of air averaged over an eight-hour work shift. This PEL is called the time-weighted average (TWA) limit
- 1.0 f/cm^3 of air averaged over a sampling period of 30 minutes. This PEL is called the excursion limit.

PCB concentrations

Facility must ensure that workers are protected from exposure to airborne PCB concentrations. As per OSHA regulations, governing exposure to PCBs in the workplace include two time-weighted averages for chlorodiphenyl. These are:

- 1.0 mg/m^3 of workplace air over an eight-hour work shift for chlorodiphenyl containing 42% chlorine.
- 0.5 mg/m^3 of workplace air over an eight-hour work shift for chlorodiphenyl containing 54% chlorine.

A worker's exposure to PCBs in any eight-hour work shift of a 40-hour week cannot exceed these concentrations.

Paints

During paint removal activities, the facility must ensure that workers are not exposed to any listed contaminant in excess of the PELs. For lead, which is commonly found in paint, the PEL is 50 Fg/m3 of air averaged over an eight-hour work day. The action level is 30 Fg/m^3 of air, also based on an eight-hour work day. The action level triggers several requirements such as exposure monitoring, medical surveillance, and training and education.

Bilge and ballast water

The liquids, oils and fuels which are collected during ship breaking process and treated shall meet treated effluent standards as provided by CPCB.

Table 3-6: Treated Effluent Standards as per CPCB

S.No.	Parameter	Standard	
		Land for irrigation	Marine / Coastal Areas
1	Colour and odour	All efforts should be made to remove colour and unpleasant odour as far as practicable	All efforts should be made to remove colour and unpleasant odour as far as practicable
2	Suspended Solids mg/l, max	200	
3	Particle size of Suspended solids	-	Floatable solids max. 3 mm Settleable solids max. 856 microns
4	pH value	5.5 to 9.0	5.5 to 9.0
5	Temperature		Shall not exceed 5°C above receiving water temperature
6	Oil & Grease mg/l, max	10	20
7	Total residual Chlorine mg/l, max	-	1.0
8	Ammonical Nitrogen (as N) mg/l, max	-	50
9	Total Kjeldhal Nitrogen (as N) mg/l, max	-	100
10	Free Ammonia (as NH_3) mg/l, max	-	5.0
11	Biochemical Oxygen Demand (3 days at 27°C), mg/l, max	100	
12	Chemical Oxygen Demand mg/l, max	Not mentioned	250
13	Arsenic (as As) mg/l, max	0.2	0.2
14	Mercury (as Hg) mg/l, max	-	0.01
15	Lead (as Pb) mg/l, max	-	2.0
16	Cadmium (as Cd) mg/l, max	-	2.0
17	Hexavalent Chromium (as Cr^{+6}) mg/l, max	-	1.0
18	Total Chromium (as Cr) mg/l, max	-	2.0
19	Copper (as Cu) mg/l, max	-	3.0
20	Zinc (as Zn) mg/l, max	-	15
21	Selenium (as Se) mg/l, max		0.05
22	Nickel (as Ni) mg/l, max		5.0
23	Cyanide (as CN) mg/l, max	0.2	0.2
24	Fluoride (as F) mg/l, max	-	15
25	Sulphide (as S) mg/l, max	-	5.0
26	Phenolic compounds (as C_6H_5OH) mg/l, max		5.0
27	Radioactive materials		
	(a) Alpha emitters micro	10^{-8}	10^{-7}

S.No.	Parameter	Standard	
		Land for irrigation	Marine / Coastal Areas
	curie mg/l max		
	(b) Beta emitters micro curie mg/l max	10^{-7}	10^{-6}
28	Bio Assay Test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
29	Manganese	-	2 mg/l
30	Iron (as Fe)	-	3 mg/l
31	Vanadium (as V)	-	0.2 mg/l
32	Nitrate Nitrogen	-	20 mg/l

3.4.2 Pending & proposed regulatory requirements

Central government has published steel and steel products order 2007 in a recent notification and 17 steel products used for power distribution, health and safety, infrastructure and construction and storage and cooking of food products are brought under mandatory product certification.

3.4.2.1 Code of practice for ship breaking

Ministry of Steel is framing code of practice for Ship Breaking Industry as per the directive of Honorable Supreme Court.

4. OPERATIONAL ASPECTS OF EIA

Prior environmental clearance process has been revised in the new Notification issued on 14th September, 2006, into following four major stages *i.e.,* screening, scoping, public consultation and appraisal. Each stage has certain procedures to be followed. This section deals with all the procedural and technical guidance, for conducting objective-oriented EIA studies, their review and decision-making. Besides, the Notification classified projects into Category A and Category B which require prior environmental clearance from the MoEF and SEIAA/UTEIAA respectively.

Consistency with other requirements

- Clearance from other regulatory bodies is not a pre-requisite for obtaining the prior environmental clearance and all such clearances will be treated as parallel statutory requirements.
- Consent for establishment (CFE) and prior environmental clearance are two different legal requirements, a project proponent is required to obtain. Therefore, these two activities can be simultaneously initiated and proceeded with. The project proponent is required to take separate CRZ clearances from the concerned Authorities.
- Rehabilitation and resettlement (R&R) issues need not be dealt under the EIA Notification as other statutory bodies deal with these issues. However, socio-economic studies be considered while taking environmental decisions.

4.1 Coverage of Ship Breaking Yards under the Purview of Notification

All new ship breaking yard projects including expansion and modernization of existing yard requires prior environmental clearance. All ship breaking yards fall under the Category A projects.

The sequence of steps in the process of prior environmental clearance for Category A projects is shown in Figure 4.1. Each stage in the process of prior environmental clearance for the ship breaking yards is discussed in subsequent sections.

In case of Expansion or Modernization of the developmental Activity:

- Any ship breaking yard, which was issued EIA clearance (existing project), when undergoes expansion or modernization with increase in ship breaking capacity in respect of LDT of specific type of ships (such as war ships, oil tankers, cargo ships, *etc.*) as per issued clearance is required to submit new application for EIA clearance.
- Any change in LDT of specific type of ships in an existing ship breaking yard.

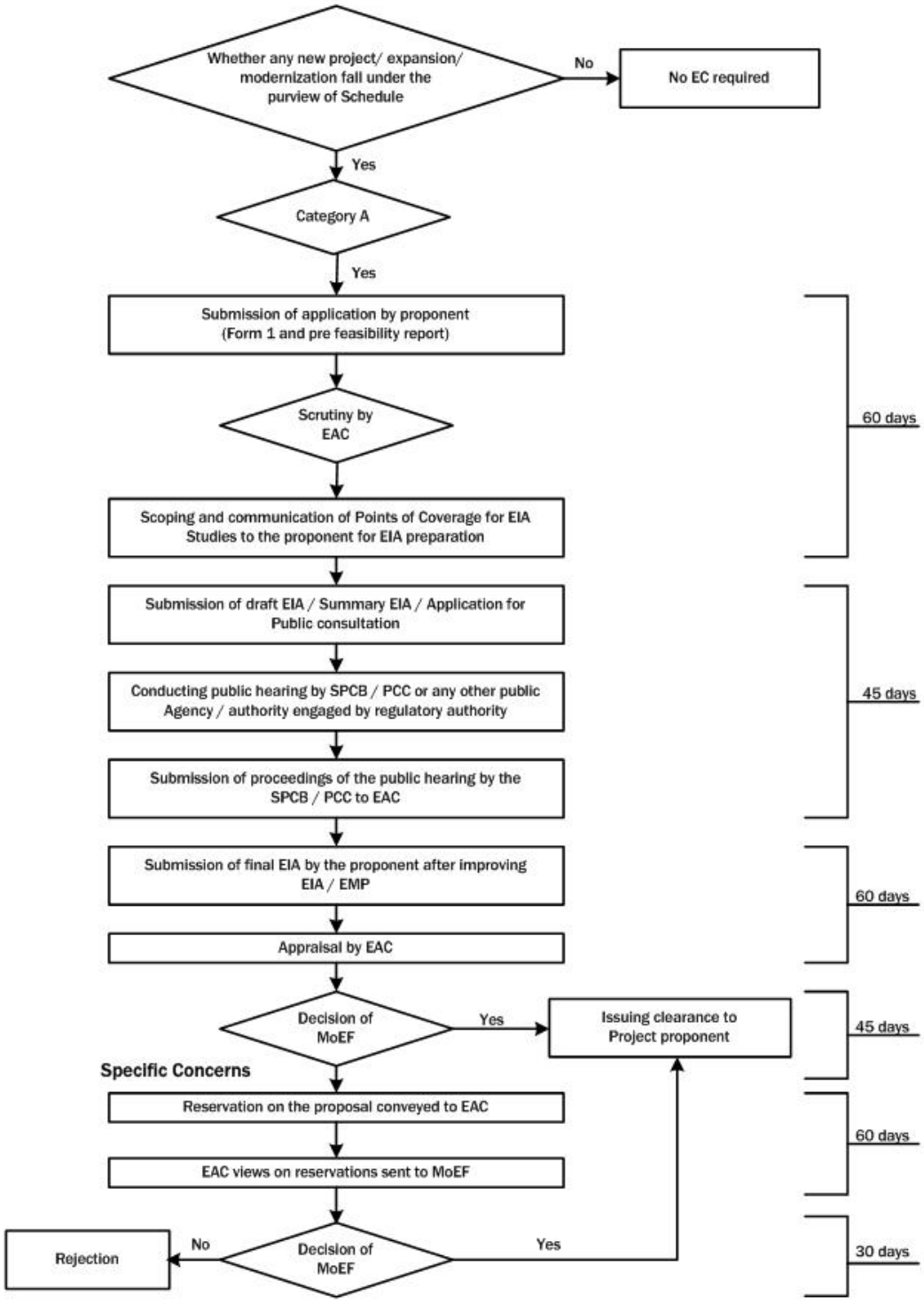

Figure 4-1: Prior Environmental Clearance Process for Activities Falling Under Category A

4.1.1 Application for prior environmental clearance

- The project proponent, after identifying the site and carrying out a pre-feasibility study, is required to apply for the prior environmental clearance using Form 1 given in **Annexure VII**. The proponent has to submit the filled in Form 1 along with the pre-feasibility report and draft ToR for EIA studies to the concerned Authority *i.e.,* the MoEF. Please refer subsequent sections for the information on how to fill the Form 1, contents of pre-feasibility report and sector-specific ToRs.
- Prior environmental clearance is required before any construction work, or preparation of land is started on the identified site/project or activity by the project management, except for securing the land.
- If the application is made for a specific developmental activity, which has an inherent area development component as a part of its project proposal and the same project also attracts the construction and area development provisions under 8a and 8b of the Schedule, then the project will be seen as a developmental activity other than 8a and 8b of the Schedule.

4.2 Scoping for EIA Studies

Scoping exercise is taken up soon after the project contours are defined. The primary purpose of scoping is to identify the concerns and issues which may affect the project decisions. Besides, scoping defines EIA study requirements and boundaries of the EIA study. The results of the scoping exercise form the basis for the rest of the EIA process.

Scoping refers to the process by which the EAC, including applications for expansion and/or modernization of existing projects, determine ToR for EIA studies addressing all relevant environmental concerns for the preparation of an EIA Report for a particular project.

- Project proponent shall submit the application (Form 1, pre-feasibility report and proposed ToR for EIA studies) to the MoEF. The MoEF consults the EAC to reply to the proponent. The EAC reviews the application form, pre-feasibility report and proposed draft ToR by the proponent and make necessary additions/deletions to make it a comprehensive ToR that suits the statutory requirements for conducting the EIA studies.
  - Precisely, the pre-feasibility report summarizes the project details and also the likely environmental concerns based on the secondary information, which will be availed for filling the Form 1.
  - From the pre-feasibility report and the Form 1, valued environmental components (VECs) may be identified for a given project (the receiving environment/social components, which are likely to get effected due to the project operations/activities).
  - Once the project details from the pre-feasibility report & Form 1; and VECs are identified, a matrix establishing the interactions which can lead to the effects/impacts could be developed (Qualitative analysis).

  - For each identified possible effect in the matrix, significance analysis could be conducted to identify the impacts, which needs to be further studied (quantitative analysis) in the subsequent EIA studies. All such points will become the part of the draft ToR to be proposed by the project proponent along with the application form.

  - The information to be provided in pre-feasibility report, guidelines for filling Form 1 and guidelines for developing draft ToR is summarized in the subsequent sections.

  - Authority consults the respective EAC to reply to the proponent. The EAC reviews the application form, pre-feasibility report and proposed draft ToR by the proponent and make necessary additions/deletions to make it a comprehensive ToR that suits the statutory requirements for conducting the EIA studies.

- A site visit by sub-committee of EAC will be planned, only if considered necessary by the EAC with the written approval of the Chairperson. Project proponent will facilitate such site visits of the sub-committee.
- EAC shall provide an opportunity to the project proponent for presentation and discussions on the proposed project and related issues as well as the proposed ToR for EIA studies. If the State Government desires to present its views on any specific project in the scoping stage, it can depute an officer for the same at the scoping stage to EAC, as an invitee but not as a member of EAC. However, non-appearance of the project proponent before EAC at any stage will not be a ground for rejection of the application for prior environmental clearance.
- In case of a new or expansion project in an identified problem area by the CPCB, the MoEF may present their views, if any at the stage of scoping, to the EAC.
- The final set of ToR for EIA Studies shall be conveyed to the proponent by the EAC within sixty days of the receipt of Form 1 and pre-feasibility report. If the finalized ToR for EIA studies are not conveyed to the proponent within sixty days of the receipt of Form 1, the ToR for EIA studies suggested by the proponent shall be deemed as the final and approved for the EIA studies.
- The final ToR for EIA Studies shall be displayed on the MoEF website.
- Applications for prior environmental clearance may be rejected by the concerned Authority based on the recommendations by the EAC at the scoping stage itself. In case of such rejection, the decision along with the reasons for rejection shall be communicated to the proponent in writing within sixty days of the receipt of the application.
- The final EIA report and the other relevant documents submitted by the applicant shall be scrutinized by the MoEF strictly with reference to the approved ToR for EIA studies.

4.2.1 Pre-feasibility report

The pre-feasibility report should include, but may not be limited to highlights of the proposed project information, considering the environmental sensitivities of the selected site, technology options, efficiency, availability, *etc*.

Purpose of the pre-feasibility studies

- Facilitates potential entrepreneurs in project identification for investment in ship breaking
- Forms the basis for important decision-making
- Provides overview of driving mechanisms of ship breaking yard
- Explains the dynamics of equilibrium of supply and demand of ships for the scrapping market
- Projects future volumes of ship scrapping under different scenarios based on historical developments

Environmental information in pre-feasibility report

The information required in pre-feasibility report varies from case-to-case even in the same sector depending upon the local environmental setting within which the ship breaking unit is located. However, the environmental information required in the pre-feasibility report may include:

- Description of the project, including in particular:
  - description of the physical characteristics of the whole project and the land-use requirements during the operational phases,
  - description of the main characteristics of the scrap materials for sale,
  - an estimate by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, *etc*.) resulting from the operation of the proposed project. Estimate of net residue and emissions after the installation of the proposed measures to reduce them.
- An outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects.
- A description of the aspects of the environment likely to be significantly affected by the proposed project, including, population, fauna, flora, soil, water, air, climatic factors, material assets, architectural and archaeological heritage, landscape and the inter-relationship between the above factors.
- A description of the likely significant effects of the proposed project on the environment resulting from:
  - the existence of the project
  - the emission of pollutants, nuisance creation, elimination of waste, and the description by the developer of the forecasting methods used to assess the effects on the environment.
- A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the marine and terrestrial environment.
- A non-technical summary of the information provided under the above headings.
- An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the developer in compiling the required information.

Besides, depending on the scope defined in the pre-feasibility report some pre-feasibility reports are based on various studies and data collection and addresses in detail the concern as technical & economical analysis and detailed feasibility level design of equipment, process optimization, transportation of products, economic, financial, social and environmental investigations, cost estimates with detailed bill of quantities (BOQ). The components identified here focuses on the requirements of Scoping for EIA study. **Annexure VIII** can be referred for preferable structure of the pre-feasibility report.

4.2.2 Guidance for Filling Information in Form 1

The information given in specifically designed pre-feasibility report for this developmental activity may also be availed for filling Form 1.

Form 1 is designed to help users identify the likely significant environmental effects of proposed projects during scoping. There are two stages for providing information under two columns:

- First - identifying the relevant project activities from the list given in column 2 of Form 1. Start with the checklist of questions set out below and complete Column 3 by answering:
  - Yes - if the activity is likely to occur during implementation of the project;
  - No - if it is not expected to occur;
  - May be - if it is uncertain at this stage whether it will occur or not.
- Second – For each activity for which the answer in Column 3 is "Yes" the next step is to refer to the fourth column which quantifies the volume of activity which could be judged as significant impact on the local environmental characteristics, and identify the areas that could be affected by that activity during construction /operation / decommissioning of the project. The Form 1 requires information within 15 km around the project, whereas actual study area for EIA studies will be as prescribed by respective EAC. Information will be needed about the surrounding VECs in order to complete this Form 1.

4.2.3 Identification of appropriate valued environmental components

VECs are the aspects (components/processes/ functions) of ecosystems, human health, and environmental welfare considered to be important and potentially at risk from human activity especially concerning this project. Value may be attributed for economic, social, environmental, aesthetic or ethical reasons. VECs represent the investigative focal point for further EIA process. The indirect and/or cumulative effects can be concerned with indirect, additive or even synergistic effects due to other projects or activities or even induced developments on the same environmental components as would be considered direct effects. But such impacts tend to involve larger scale VECs such as within entire region, river basins or watersheds; and, broad social and economic VECs such as quality of life and the provincial economy. Once VECs are identified then appropriate indicators may be selected to carry on impact assessments on the respective VECs.

4.2.4 Methods for identification of impacts

There are number of factors which will influence the approach adopted for the assessment of direct, indirect, cumulative impacts, *etc.,* for a particular project. The method should be

practical and suitable for the project given the data, time and financial resources available. However, the method adopted should be able to provide a meaningful conclusion from which it would be possible to develop, where necessary, mitigation measures and monitoring. Key points to consider when choosing the method(s) include:

- Nature of the impact(s)
- Availability and quality of data
- Availability of resources (time, finance and staff)

The method chosen should not be complex, but should aim at presenting the results in a way that can be easily understood by the developer, decision maker and the public. A comparative analysis of major impact identification methods is given in the following Table 4-1.

Table 4-1: Advantages and Disadvantages of Impact Identification Methods

	Description	Advantages	Disadvantages
Checklists	▪ Annotate the environmental features that need to be addressed when identifying the impacts of activities in the project	▪ Simple to understand and use ▪ Good for site selection and priority setting ▪ Simple ranking and weighting	▪ Do not distinguish between direct and indirect impacts ▪ Do not link action and impact ▪ The process of incorporating values can be controversial
Matrices	▪ Grid like table that identify the interaction between project activities (along one axis) and environmental characteristics (along other axis) ▪ Entries are made in the cells which highlights impact severity in the form of symbols or numbers or descriptive comments	▪ Link action to impact ▪ Good method for displaying EIA results	▪ Difficult to distinguish direct and indirect impacts ▪ Significant potential for double-counting of impacts
Networks	▪ Illustrate cause effect relationship of project activities and environmental characteristics ▪ Useful in identifying secondary impacts ▪ Useful for establishing impact hypothesis and other structured science based approaches to EIA	▪ Link action to impact ▪ Useful in simplified form for checking for second order impacts ▪ Handles direct and indirect impacts	▪ Can become very complex if used beyond simplified version
Overlays	▪ Maps the impacts spatially and display them pictorially ▪ Useful for comparing site and planning alternatives for routing linear developments ▪ Can address cumulative effects ▪ Information incentive	▪ Easy to understand ▪ Good to display method ▪ Good siting tool	▪ Address only direct impacts ▪ Do not address impact duration or probability
GIS	▪ Maps the impacts spatially and display them pictorially ▪ Useful for comparing site and planning alternatives for routing linear developments	▪ Easy to understand ▪ Good to display method ▪ Good siting tool ▪ Excellent for	▪ Do not address impact duration or probability ▪ Heavy reliance on knowledge and data

	Description	Advantages	Disadvantages
	▪ Can address cumulative effects ▪ Information incentive	impact identification and analysis	▪ Often complex and expensive
Expert System	▪ Assist diagnosis, problem solving and decision making ▪ Needs inputs from user by answering systematically developed questions to identify impacts and determine their mitigability and significance ▪ Information intensive, high investment methods of analysis	▪ Excellent for impact identification and analysis ▪ Good for experimenting	▪ Heavy reliance on knowledge and data ▪ Often complex and expensive

The project team made an attempt to construct an impact matrix considering major project activities (generic operations) and stage-specific likely impacts which is given in Table 4-2.

While the impact matrix is each project-specific, Table 4-2 may facilitate the stakeholders in identifying a set of components and phase-specific project activities for determination of likely impacts. However, the location-specific concerns may vary from case to case, therefore, the components even without likely impacts are also retained in the matrix for the location-specific reference.

Table 4-2: Matrix of Impacts

			PHASE I					PHASE II								
			Pre Commissioning Stage					Operation and Maintenance Stages								
								Stages					Issues			
ENVIRONMENT	Component	Project activities / Parameter/ Factor	Detailed Topographic Survey	Land Acquirement	Site Clearing	Burning of wastes, refuse and cleared vegetation	Site Preparation / Change in Topography	At Shore	Shore to Beach	Cutting and Breaking	Storage of chemicals/ flammables/hazardous materials	Transportation and Disposal of Wastes	Civil works such as earth moving and building of structures including temporary structures	Heavy Equipment operations	Generation of sewage	Influx of workers
Physical	Soil	Erosion Risks							*							
		Contamination						*	*	*	*		*			
		Soil Quality								*			*			
	Resources	Fuels/ Electricity														
		Construction material- stone, aggregates											*			
		Land especially undeveloped or agricultural land														
	Water	Interruption or Alteration of River Beds					*									
		Alteration of Hydraulic Regime														
		Alteration of surface run-off and interflow					*						*			

		Alteration of aquifers					*						*			
		Water quality						*	*		*	*	*			
	Air	Air quality				*			*	*	*	*	*	*		
		Noise							*	*		*	*	*		
Biological	Terrestrial Flora	Effect on grass & flowers														
		Effect on trees & shrubs		*	*	*	*									
		Effect on farmland														
		Endangered species						*	*	*	*	*				
	Aquatic Biota	Habitat removal							*	*						
		Contamination of habitats								*						
		Reduction of aquatic biota								*						
	Terrestrial Fauna	Fragmentation of terrestrial habitats										*				
		Disturbance of habitats by noise or vibration								*						
		Reduction of Biodiversity								*		*				
Social	Economy	Creation of new economic activities	*													
		Commercial value of properties		*			*									
		Conflict due to negotiation and/ compensation payments														
		Generation of temporary and permanent jobs						*	*	*	*	*				*

		Effect on crops			*	*							*			
		Reduction of farmland productivity			*											
		Income for the state and private sector		*					*	*						
	Education	Training in new technologies	*						*	*						
		Training in new skills to workers	*						*	*	*	*				
	Public Order	Political Conflicts		*	*	*	*								*	*
		Unrest, Demonstrations & Social conflicts		*												*
	Infrastructure and Services	Conflicts with projects of urban, commercial or Industrial development	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	Security and Safety	Increase in Crime								*						*
		Accidents caused						*	*	*	*	*				
	Health							*	*	*	*	*				
	Cultural	Land use		*						*						
		Recreation								*						
		Aesthetics and human interest						*	*	*	*	*				
		Cultural status														*

Note:

1. *The above table represents a model for likely impacts, which will have to be arrived case-to-case basis considering VECs and significance analysis (Ref Section. 2.9).*
2. *Project activities are shown as indicative for a given sector. However, in Form 1 (application for EIA Clearance), for any question for which answer is 'Yes', then the corresponding activity shall reflect in project activities. Similarly 'parameters'/'factors' will also be changed within a component in order to reflect the target species of prime concern.*

4.2.5 Testing the significance of impacts

The following set of conditions may be used as the checklist for testing the significance of the impacts and also to provide information in Column IV of Form 1.

- Will there be a large change in environmental conditions?
- Will new features be out-of-scale with the existing environment?
- Will the effect be unusual in the area or particularly complex?
- Will the effect extend over a large area?
- Will there be any potential for trans-frontier impact?
- Will many people be affected?
- Will many receptors of other types (fauna and flora, businesses, facilities) be affected?
- Will valuable or scarce features or resources be affected?
- Is there a risk that environmental standards will be breached?
- Is there a risk that protected sites, areas, features will be affected?
- Is there a high probability of the effect occurring?
- Will the effect continue for a long time?
- Will the effect be permanent rather than temporary?
- Will the impact be continuous rather than intermittent?
- If it is intermittent will it be frequent rather than rare?
- Will the impact be irreversible?
- Will it be difficult to avoid, or reduce or repair or compensate for the effect?

For each 'Yes' answer in column 3, the nature of effects and reasons for it should be recorded in column 4. The questions are designed so that the 'Yes' answer in column 3, will generally point towards the need for analyzing for the significance and requirement for conducting impact assessment for the effect.

4.2.6 Terms of reference for EIA studies

Ship breaking yard refers to group of individual ship breaking units. The expert committee suggested to consider only ship breaking yards for the purpose of EIA studies and thus this ToR is for ship breaking yards. ToR for EIA studies w.r.t ship breaking yards may include, but not limited to following:

- Executive summary of the project - giving a *prima facie* idea of the objectives of the proposal, use of resources, justification, *etc*. In addition, it should provide a compilation of EIA report, EMP and the post-project plan in brief.

Project description

- Backward and forward linkages of the project – sale and purchase of ships for scrapping, demand for scrapping, scrap market, availability of re-rolling mills, *etc*.
- Proposed ship dismantling plan and facilities management plan.
- Details of temporary storage facilities for wastes and scrap from vessels in the yard – storage for asbestos, PCBs, radioactive wastes, gas cylinders, administrative office building, workers' rest/changing room, storage facility for bilge and ballast water, storage facility for oil residues.
- Injuries, accidents and possible hazards during the ship breaking process.

- List of proposed personal protective equipments to be provided to safeguard health and safety of workers.
- Details of local amenities and infrastructural developmental activities - electricity, drinking water facilities, sewage facilities, roads, transportation, communication, housing, greenbelt.
- Details of the transportation system from the yard and the traffic density.
- Details of the provisions for treatment or disposal of all types of wastes generated by the ship breaking yard (locations and capacities of the provisions for hazardous waste, solid waste, radioactive waste, asbestos, *etc*.)
- Details regarding infrastructure facilities such as sanitation, fuel storage rooms, restrooms, *etc*. to be provided to the workmen during ship breaking operations.
- Any litigation pending against the project and /or any direction /order passed by any Court of Law against the project, if so, details thereof.
- In case of expansion projects, compliance to the issued EIA clearance conditions and consent for operation conditions for existing yard.

Description of the environment

- The study area shall be up to a distance of 5 km from the boundary of the proposed ship breaking yard.
- Geographic information of the site – Latitude/Longitude, total area envisaged for setting up of the industry, seismic zone classification.
- Land use of the proposed project area – notified industrial area, grazing, mangroves, no development area, national parks, sanctuary, marshes, fishing area, *etc*.
- Land use of study area should also include data about the residential/institutional/ nearest village/township/locality/housing society, *etc*., based on the satellite imagery.
- Baseline data of the study area w.r.t different components of environment viz. air, noise, water, land, and biology and socio-economic. (as per annexure 10 of this manual).
- Details of site and information related to environmental setting within a 5 km radius on the landward side – CRZ classification, LTL, HTL, bathymetric survey.
- CRZ map in 1:10000 scale in general cases and in 1:5000 scale for specific observations.
- Environmental parameters – temperature, sea level pressure, wind speed, mean relative humidity, visibility, salinity, density, rainfall, fog, frequency and intensity of cyclones, sediment transport, seismic characteristics, fresh water influx.
- Details on marine biological parameters – microbiological population, pathogenic bacteria, plankton distribution, fish spawning grounds in the adjoining waters, commercial fishery potential, vegetation including intertidal flora and fauna in the marine, benthal quality assessment for biological species and heavy metals and estuarine environment.
- Site-specific meteorological data of one season.
- Source of water and its availability. Proof regarding the availability of requisite quantity of water from the competent authority.

- Details of groundwater quality around the industry – groundwater samples to be collected from 7 to 10 locations.
- Details of stormwater management
- Ambient Air Quality (AAQ) data (except monsoon) of one complete season along with the monitoring dates. The parameters to be covered shall include SPM, RSPM, SO_2, NOx and Asbestos. The location of the monitoring stations should be within the proposed project area and at about 500m towards the land side.
  - Dust fall shall be monitored at each AAQ.
  - AAQ monitoring stations shall be located within the study area.
- Noise levels monitoring at three sides surrounding the yard and at sensitive/ commercial/residential locations within the study area.
- Sea water and sediments must be collected up to 500m from the site at multiple points depending on activities at beach.
- Soil sampling to be done from each AAQ station such that a relationship is developed between dust fall and soil quality.
- If any incompatible land use attributes fall within a 5 km radius of the project boundary, proponent shall describe the sensitivity (distance, area and significance) and propose the additional points based on significance for review and acceptance by the EAC. Incompatible land use attributes include:
  - Public water supply areas from rivers/surface water bodies, from ground water
  - Scenic areas/tourism areas/hill resorts
  - Religious places, pilgrim centers that attract over 10 lakh pilgrims a year
  - Protected tribal settlements (notified tribal areas where industrial activity is not permitted)
  - CRZ
  - Monuments of national significance, World Heritage Sites
  - Cyclone, Tsunami prone areas (based on last 25 years);
  - Airport areas
  - Any other feature as specified by the State or local government and other features as locally applicable, including prime agricultural lands, pastures, migratory corridors, *etc*.
- If ecologically sensitive attributes fall within a 5 km radius of the project boundary, proponent shall describe the sensitivity (distance, area and significance) and propose the additional points based on significance for review and acceptance by the EAC. Ecological sensitive attributes include:
  - National parks
  - Wild life sanctuaries Game reserve
  - Tiger reserve/elephant reserve/turtle nesting ground
  - Breeding grounds
  - Core zone of biosphere reserve
  - Habitat for migratory birds
  - Mangrove area
  - Areas with threatened (rare, vulnerable, endangered) flora/fauna
  - Protected corals
  - Wetlands
  - Zoological gardens
  - Gene banks
  - Reserved forests

- Protected forests
- Any other closed/protected area under the Wild Life (Protection) Act, 1972, any other area locally applicable

Anticipated environmental impacts and mitigation measures

- Anticipated environmental impacts that require specific studies for significance are given impact matrix. Tools as given in this manual shall be used for the assessment of environmental impacts.
- Impact on drainage of the area and the surroundings.
- Impact of the project on local infrastructure within the study area such as road network, *etc*.
- Measures that could be considered for the mitigation of impacts.
- Oil spill models may be used to predict the likely impacts, in case of eventuality.
- Proposed measures for occupational safety and health of the workers.

Analysis of alternative technologies

- Justification for selecting the proposed ship breaking yard (LDT, individual unit/plot size, infrastructure – type of ships, number of ships that can be accommodated).
- Comparison of alternate sites and dismantling methods (beaching, docking, berthing) and the reasons for selecting the same. Conformity of the site with the prescribed guidelines in terms of rivers, highways, *etc*.
- Details on better practices.

Environmental monitoring program

- Appropriate monitoring network has to be designed and proposed for regulatory compliance and to assess the residual impacts, if any.

Additional studies

- Detailed socio-economic status of the area (including migrated labor), homestead oustees, fishermen, reduction in fishing yields, project-affected people, *etc*.
- Points identified in the Public hearing (if applicable) and commitment of the project proponent to the same. Detailed action plan addressing the issues raised, and the details of necessary allocation of funds shall be provided.
- Proposed plan to handle the socio-economic influence on the local community. The plan should include quantitative dimension as far as possible.
- Risk assessment and mitigation measures, fire-fighting, emergency management plan and services.

Environmental management plan

- EMP devised to mitigate the adverse impacts of the project should be provided along with item-wise cost of its implementation.
- Proposed post-project monitoring programme to ensure compliance to the approved Management Plan including administrative and technical organizational structure.

Note:

Above points shall be adequately addressed in the EIA report at corresponding chapters, in addition to the contents given in the reporting structure (Table: 4-7).

4.3 Environmental Impact Assessment

The approach for accomplishing EIA studies is shown in Figure 4.3. Each stage is discussed, in detail in subsequent sections

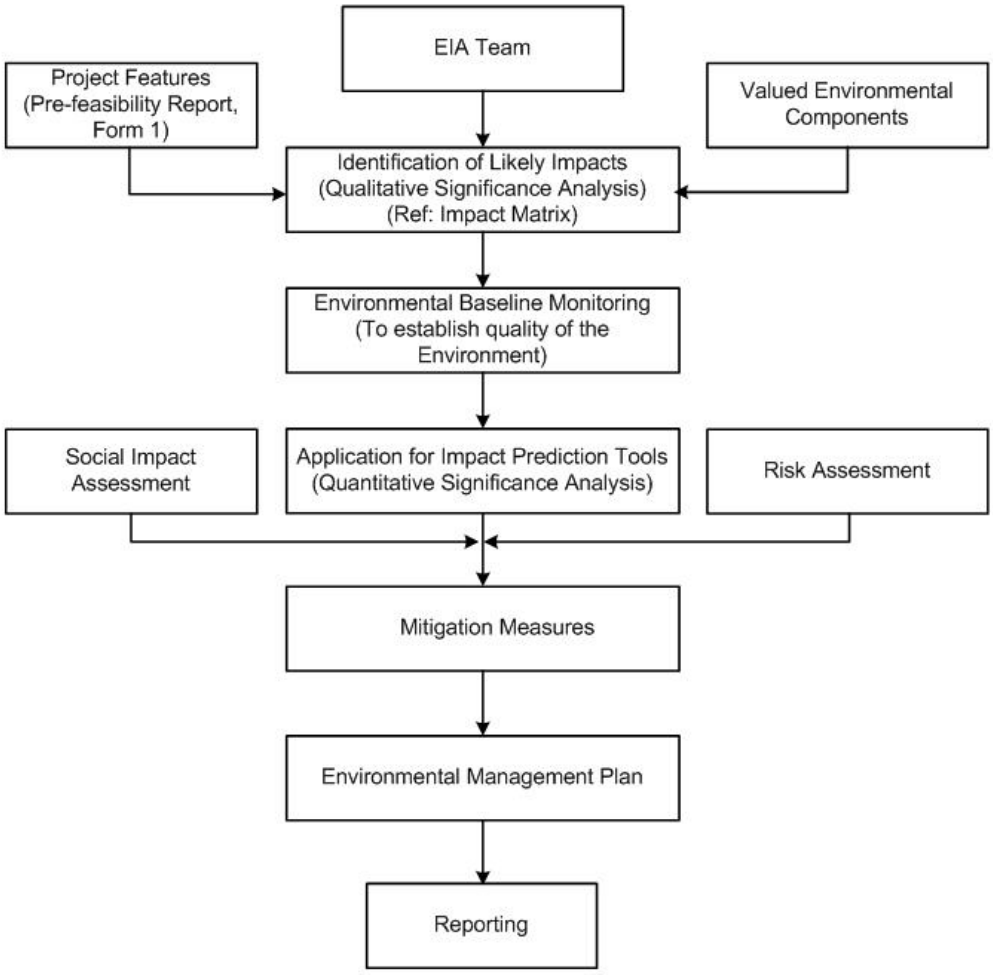

Figure 4-2: Approach for EIA Studies

4.3.1 EIA team

EIA is a multi-functional activity. Establishing the right team in the initial stages is important for the success of an EIA, and also for the assessment of all significant impacts (direct, indirect as well as cumulative impacts) associated with different environmental resources. It would be appropriate to supplement the in-house environmental skills with appropriate internal/external specialists to undertake assessments for certain topics or to coordinate and oversee the project.

The professional Team identified for a specific EIA study should consist of qualified and experienced professionals from various disciplines in order to address the critical aspects identified for the specific project. Based on the nature and the environmental setting, following professionals may be identified for EIA studies:

- Environmental management specialist/Regulator
- Air and noise quality expert
- Occupational health
- Geology/geo-hydrology
- Ecologist
- Transportation Specialist
- Safety and health specialist
- Social scientist
- Organic chemistry
- Radioactivity
- Chemical engineer
- Marine Biology, *etc*.

4.3.2 Baseline quality of the environment

EIA Notification 2006 specifies that an EIA Report should contain a description of the existing environment that would be or might be affected directly or indirectly by the proposed project. Environmental Baseline Monitoring (EBM) is a very important stage of EIA. On one hand EBM plays a very vital role in EIA while on the other it provides feedback about the actual environmental impacts of the proposed project. EBM, during the operational phase, helps in judging the success of mitigation measures in protecting the environment. Mitigation measures, in turn, are used to ensure compliance with environmental standards, and to facilitate the needed project design or operational changes.

The description of the existing environment should include the natural, cultural, socio-economic systems and their interrelationships. The intention is not to describe all baseline conditions, but to focus the collection and description of baseline data on those VECs that are important and are likely to be affected by the proposed ship breaking activity.

4.3.2.1 Objective of EBM in the EIA context

The term ‘baseline’ refers to conditions existing before development. EBM studies are carried out to:

- identify environmental conditions which might influence project design decisions (e.g., site layout, structural or operational characteristics)
- identify sensitive issues or areas requiring mitigation or compensation
- provide input data to analytical models used for predicting effects
- provide baseline data against which the results of future monitoring programs can be compared

At this stage of EIA process, the EBM is primarily discussed in the context of first purpose wherein the feedback from EBM programs may be used to:

- determine the available assimilative capacity of different environmental components within the designated impact zone and whether more or less stringent mitigation measures are needed; and
- improve the predictive capability of EIAs.

There are many institutional, scientific, quality control, and fiscal issues that must be addressed in the implementation of an environmental monitoring program. Careful consideration of these issues in the design and planning stages will help in avoiding many pitfalls associated with environmental monitoring programs.

4.3.2.2 Environmental monitoring network design

Monitoring refers to the collection of data using a series of repetitive measurements of environmental parameters (or, more generally, to a process of systematic observation). The environmental quality monitoring programme design will be dependent upon the monitoring objectives specified for the selected area of interest. Types of monitoring and network design considerations are discussed in **Annexure IX**.

4.3.2.3 Baseline data generation

List of important physical environmental components and indicators of EBM are given in Table 4-3.

Table 4-3: List of Important Physical Environment Components

Environmental Component	Environmental Indicators
Climatic variables	▪ Rainfall patterns – mean, mode, seasonality ▪ Temperature patterns ▪ Extreme events ▪ Climate change projections ▪ Prevailing wind - direction, speed, anomalies ▪ Stability conditions and mixing height
Geology	▪ Underlying rock type ▪ Geologic structures (faults, *etc*.) ▪ Geologic resources (minerals, *etc*.)
Topography	▪ Slope form ▪ Landform and terrain analysis ▪ Specific landform types
Coastal dynamics and morphology	▪ Wave patterns ▪ Currents ▪ Shoreline morphology – near shore, foreshore ▪ Sediment – characteristics and transport
Soil	▪ Type and characteristics ▪ Porosity and permeability ▪ Sub-soil permeability ▪ Run-off rate ▪ Effective depth (inches/centimeters) ▪ Inherent fertility ▪ Suitability for method of sewage disposal
Drainage	▪ Surface hydrology ▪ Drainage network ▪ Rainfall runoff relationships ▪ Hydrogeology ▪ Groundwater characteristics – springs, *etc*.

Environmental Component	Environmental Indicators
Water quality	▪ Terrestrial - rivers, lakes, ponds, gullies ▪ Coastal/Marine water
Air quality	▪ Ambient ▪ Respirable ▪ Airshed importance ▪ Odour levels
Noise	▪
Hazardous Waste	▪ Asbestos ▪ Paints ▪ PCBs ▪ Toxic Metals
Marine Biological Parameters	▪ Benthal quality ▪ Microbiological population ▪ Pathogenic bacteria ▪ Flora and fauna in the marine environment

Guidance for assessment of baseline components and attributes describing sampling network, sampling frequency, method of measurement is given in **Annexure X**.

Infrastructure requirements for EBM

In addition to devising a monitoring network design and monitoring plans/program, it is also necessary to ensure adequate resources in terms of staffing, skills, equipment, training, budget, *etc*., for its implementation. Besides assigning institutional responsibility, reporting requirements, QA/QC plans and its enforcement capability are essential. A monitoring program that does not have an infrastructural support and QA/QC component will have little chance of success.

Defining data statistics/analyses requirements

The data analysis to be conducted is dictated by the objectives of the environmental monitoring program. The statistical methods used to analyze the data should be described in detail prior to data collection. This is important because repetitive observations are recorded in time and space. Besides, the statistical methods could also be chosen so that uncertainty or error estimates in the data can be quantified. For e.g., statistical methods useful in an environmental monitoring program include: 1) frequency distribution analysis; 2) analysis of variance; 3) analysis of covariance; 4) cluster analysis; 5) multiple regression analysis; 6) time series analysis; 7) the application of statistical models (ADB-Green, 1979).

Use of secondary data

The EBM program addresses temporal and/or spatial variations limited to a limited extent because of cost implications and time limitations. Therefore analysis of all available information or data is essential to establish the regional profiles. So all the relevant secondary data available for different environmental components should be collated and analyzed.

To facilitate stakeholders, IL&FS Ecosmart Ltd., made an attempt to compile the list of information required for EIA studies. Respective sources of secondary data are provided in **Annexure XIA**, and **Annexure XIB**.

4.3.3 Impact prediction tools

The scientific and technical credibility of an EIA relies on the ability of the EIA practitioners to estimate the nature, extent, and magnitude of change in environmental components that may result from project activities. Information about predicted changes is needed for assigning impact significance, prescribing mitigation measures, and designing and developing EMPs and monitoring programs. The more accurate the predictions, the more confident the EIA practitioner will be in prescribing specific measures to eliminate or minimize the adverse impacts of development project.

Choice of models/methods for impact predictions in respect of each of air, noise, water, land and biological environment are precisely tabulated in **Annexure XII**.

4.3.4 Significance of the impacts

Evaluating the significance of environmental effects is perhaps the most critical component of impact analysis. More than other components, the interpretation of significance is also a contentious process. The interpretation of significance bears direct relation to the subsequent EIA process and also during EC on project approvals and condition setting. At an early stage, it also enters into screening and scoping decisions like the level of assessment required and the kind of impacts and issues to be addressed.

Impact significance is also a key to the choice of alternatives. In total, the attribution of significance continues throughout the EIA process, from scoping to EIS review, in a gradually narrowing "cone of resolution" in which one stage sets up the next. But at this stage it is the most important as better understanding and quantification of impact significance is required.

One common approach is based on determination of the significance of predicted changes in the baseline environmental characteristics and compares these with reference to the regulatory standards, objective criteria and similar 'thresholds' as eco-sensitivity, cultural /religious values. These are often outlined in guidance manuals. A better test proposed by the CEAA (1995) is to determine if 'residual' environmental effects are adverse, significant, and likely (given under). But at this stage, the practice of formally evaluating the significance of residual impacts, *i.e.,* after predicting the nature and magnitude of impacts based on before-versus-after-project comparisons, and identifying measures to mitigate these effects is not being followed in a systematic way.

Step 1: Are the environmental effects adverse?

Criteria for determining the adversity of the effects include:

- effects on biota health
- effects on rare or endangered species
- reductions in species diversity
- habitat loss
- transformation of natural landscapes
- effects on human health
- effects on current use of lands and resources for traditional purposes by aboriginal persons; and
- foreclosure of future resource use or production

Step 2: Are the adverse environmental effects significant?

Criteria for determining the significance is to judge if the impacts:

- are extensive over space or time
- are intensive in concentration or proportion to assimilative capacity
- exceed environmental standards or thresholds
- do not comply with environmental policies, land use plans, sustainability strategy
- adversely and seriously affect ecologically sensitive areas
- adversely and seriously affect heritage resources, other land uses, community lifestyle and/or indigenous peoples traditions and values

Step 3: Are the significant adverse environmental effects likely?

Criteria for determining 'likelihood' include:

- probability of occurrence, and
- scientific uncertainty

4.4 Social Impact Assessment

Social impact assessment (SIA) is an instrument used to analyze social issues and solicit stakeholder views for the design of projects. SIA helps in making the project responsive to social development concerns, including the options that enhance benefits for poor and vulnerable people while mitigating risk and adverse impacts. It analyzes distributional impacts of intended project benefits on different stakeholder groups, and identifies differences in assets and capabilities to access the project benefits.

The scope and depth of the SIA should be determined by the complexity and importance of the issues studied, taking into account the skills and resources available. However, SIA may include following:

Description of the socio-economic, cultural and institutional profile

Conduct a rapid review of available sources of information to describe the socio-economic, cultural and institutional interface in which the project operates.

Socio-economic and cultural profile: Describe the most significant social, economic and cultural features that differentiate social groups in the project area. Describe their different interests in the project, and their levels of influence. In particular, explain any particular effects the project may have on the poor and underprivileged. Identify any known conflicts among groups that may affect project implementation.

Institutional profile: Describe the institutional environment; consider both the presence and function of public, private and civil society institutions relevant to the operation. Are there important constraints within existing institutions e.g. disconnect between institutional responsibilities and the interests and behaviors of personnel within those institutions? Or are there opportunities to utilize the potential of existing institutions, e.g. private or civil society institutions, to strengthen implementation capacity

Legislative and regulatory considerations

To review laws and regulations governing the project's implementation and the access of poor and excluded groups to goods, services and opportunities provided by the project. In addition, review the enabling environment for public participation and development planning. SIA should build on strong aspects of the legal and regulatory systems to facilitate program implementation and identify weak aspects while recommending alternative arrangements.

Key social issues

SIA provides the baseline information for designing the social development strategy. The analysis should determine what the key social and Institutional issues are in relation to project objectives; identify the key stakeholder groups in this context and determine how relationships between stakeholder groups will affect or be affected by the project; and identify expected social development outcomes and actions proposed to achieve those outcomes.

Data collection and methodology

Describe the design and methodology for the social analysis. In this regard:

- Build on existing data;
- Clarify the units of analysis for the SIA: intra-household, household level, as well as communities/settlements and other relevant social aggregations on which data is available or will be collected for analysis;
- Choose appropriate data collection and analytical tools and methods, employing mixed methods wherever possible; mixed methods include a mix of quantitative and qualitative methods.

Strategy to achieve social development outcomes

Identify the likely social development outcomes of the project and propose a Social development strategy, including recommendations for institutional arrangements to achieve them, based on the findings of the social assessment. The social development strategy could include measures:

- that strengthen social inclusion by ensuring that both poor and excluded groups and intended beneficiaries are included in the benefit stream and in access to opportunities created by the project
- that empower stakeholders through their participation in the design and implementation of the project, their access to information, and their increased voice and accountability (*i.e.,* a participation framework); and
- that enhance security by minimizing and managing likely social risks and increasing the resilience of intended beneficiaries and affected persons to socioeconomic shocks

Implications for analysis of alternatives

Review the proposed approaches for the project, and compare them in terms of their relative impacts and social development outcomes. Consider what implications the findings of the social assessment might have on those approaches. Should some new components be added to the approach, or other components reconsidered or modified?

If the SIA and consultation process indicate that alternative approaches are likely to have better development outcomes, such alternatives should be described and considered, along with the likely budgetary and administrative effects these changes might have.

Recommendations for project design and implementation arrangements

Provide guidance to project management and other stakeholders on how to integrate social development issues into project design and implementation arrangements. As much as possible, suggest specific action plans or implementation mechanisms to address relevant social issues and potential impacts. These can be developed as integrated or separate action plans, for example, as Resettlement Action Plans, Indigenous Peoples Development Plans, Community Development Plans, *etc*.

Developing a monitoring plan

Through the SIA process, a framework for monitoring and evaluation should be developed. To the extent possible, this should be done in consultation with key stakeholders, especially beneficiaries and affected people.

The framework shall identify expected social development indicators, establish benchmarks, and design systems and mechanisms for measuring progress and results related to social development objectives. The framework shall identify organizational responsibilities in terms of monitoring, supervision, and evaluation procedures. Wherever possible, participatory monitoring mechanisms shall be incorporated. The framework should establish:

- a set of monitoring indicators to track the progress achieved. The benchmarks and indicators should be limited in number, and should combine both quantitative and qualitative types of data. The indicators should include outputs to be achieved by the social development strategy; indicators to monitor the process of stakeholder participation, implementation and institutional reform;
- indicators to monitor social risk and social development outcomes; and indicators to monitor impacts of the project's social development strategy. It is important to suggest mechanisms through which lessons learned from monitoring and stakeholder feedback can result in changes to improve the operation of the project. Indicators should be of such a nature that results and impacts can be disaggregated by gender and other relevant social groups;

Define transparent evaluation procedures. Depending on context, these may include a combination of methods, such as participant observation, key informant interviews, focus group discussions, census and socio-economic surveys, gender analysis, Participatory Rural Appraisal (PRA), Participatory Poverty Assessment (PPA) methodologies, and other tools. Such procedures should be tailored to the special conditions of the project and to the different groups living in the project area; Estimate resource and budget requirements for monitoring and evaluation activities, and a description of other inputs (such as institutional strengthening and capacity building) needed to carry it out.

4.5 Risk Assessment and Disaster Management Plan

4.5.1 Risk assessment

Formal risk management techniques have had their foremost application as decision-making tools within the industry. Recently, these risk management techniques have been applied in various industries and this application has enhanced yard safety through modifications in yard design and operation.

Hence, Quantitative Risk Assessment (QRA) is an invaluable method for making informed risk-based process safety and environmental impact planning decisions, as well as being fundamental to any facility-setting up decision-making.

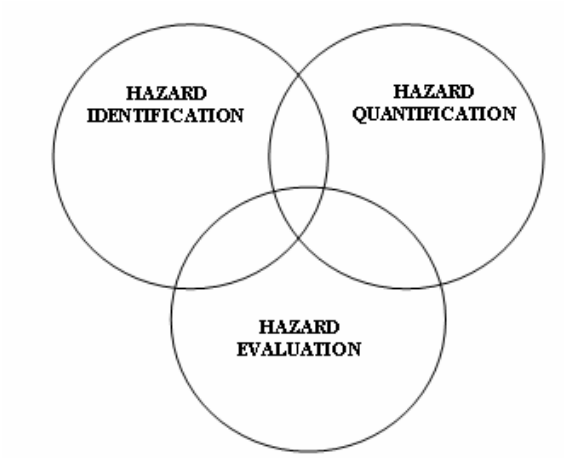

Figure 4-3: Risk Assessment: Conceptual Framework

The steps for QRA are depicted in Figure 4.6 (Comprehensive Risk Assessment) and the QRA assessment study covers the following:

- Identification of potential hazardous areas
- Identification of representative failure cases
- Visualization of the resulting scenarios in terms of fire
- Assessment of the overall damage potential of the identified hazardous events and the impact zones from the accidental scenarios
- Assessment of the overall suitability of the site from hazard minimization and disaster mitigation points of view
- Preparation of recommendations to minimize the worst case accident scenarios and
- Preparation of broad DMP, On-site and Off-site Emergency Plan and Occupational Health and safety plan

Predictive methods for estimating risk should cover all the design intentions and operating parameters to quantify risk in terms of probability of occurrence of hazardous events and magnitude of its consequence. The ranges of predicted models are listed in the following tables.

Table 4-4: Choice of Methods for Impact Prediction: Risk Assessment

Name	Application	Remarks
EFFECT WHAZAN	Consequence Analysis for Visualization of accidental chemical release scenarios & its consequence Consequence Analysis for Visualization of accidental chemical release scenarios & its consequence	Heat load, press wave & toxic release exposure neutral gas dispersion
DEGADIS	Consequence Analysis for Visualization of accidental chemical release scenarios & its consequence	Dense gas dispersion
HAZOP and Fault Tree Assessment	For estimating top event probability	Failure frequency data is required
Pathways reliability and protective system hazard analysis	For estimating reliability of equipments and protective systems	Markov models

Vulnerability Exposure models	Estimation of population exposure	Uses probit equation for population exposure
F-X and F-N curves	Individual / Societal risks	Graphical Representation

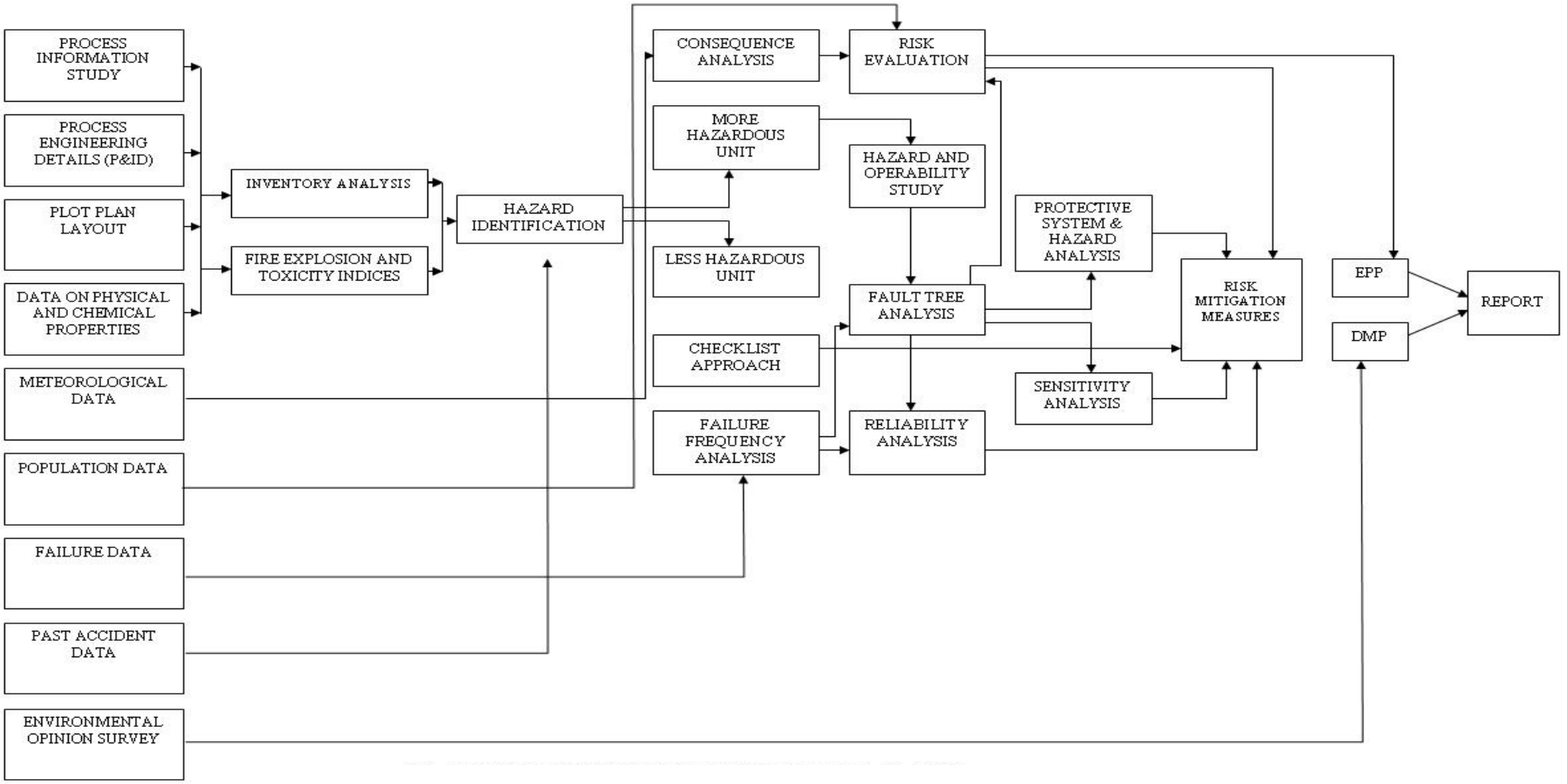

Figure 4-4: Comprehensive Risk Assessment at a Glance

A. Storage and handling of hazardous materials

During the ship breaking process, hazardous and non-hazardous materials need to be temporarily accommodated in necessary units placed within yard in line with the safety, health and environmental standards. The size of these temporary units would depend on the quantity of waste and type of ship for scrapping. Hazardous materials like asbestos, PCB, oils, fuels, bilge water, ballast water, *etc*., with appropriate storage capacities are placed in the yard following Hazardous Waste Management and Handling Rules. Damaged ACM pieces cannot be sold and will go to TSDF after proper packaging inside a centralized land base ventilated enclosure with dress change and bathing facilities. Radioactive wastes are handled based on Rules for Management of Radioactive Waste under AERB. Also, gas cylinders must be stored in the yard following the Gas cylinders Rules under Explosives Act. Later, these materials are disposed off at the centralized disposal facility with utmost care following safety norms. Every yard should be facilitated with fire hydrant system to handle fire hazards.

B. Hazard identification

Hazard is the characteristic of any system or process which has the potential for accident. Identification of hazards during ship breaking process is of primary significance in the analysis, quantification and cost effective control of accidents involving chemicals and process.

Hence, all the components of a system need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident.

The typical methods for hazard identification employed are:

- Identification of major hazardous units based on Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989 of Government of India (as amended in 2000); and
- Identification of hazardous units and segments of plants and storage units based on relative ranking technique, viz. Fire Explosion and Toxicity Index (FE&TI).

Hazardous substances may be classified into three main classes namely Flammable substances, unstable substances and Toxic substances. Flammable substances require interaction with air for their hazard to be realized. Under certain circumstances the vapours arising from flammable substances when mixed with air may be explosive, especially in confined spaces. However, if present in sufficient quantity such clouds may explode in open air also. Unstable substances are liquids or solids, which may decompose with such violence so as to give rise to blast waves. Besides, toxic substances are dangerous and cause substantial damage to life when released into the atmosphere. The ratings for a large number of chemicals based on flammability, reactivity and toxicity have been given in NFPA Codes 49 and 345 M.

C. Hazard assessment and evaluation

A preliminary hazard analysis shall be carried out to identify the major hazards associated with storages in the facility. This is followed by consequence analysis to quantify these hazards. Finally the vulnerable zones are plotted for which risk reducing measures are deduced and implemented.

Frequent causes of accidents

- Fire and explosion: explosives, flammable materials
- Being struck by falling objects
- Caught in or compressed
- Snapping of cables, ropes, chains, slings
- Handling heavy objects
- Access in progressively dismantled vessels floors, stairs, passageways)
- Electricity (electrocution)
- Poor illumination
- Falls from height inside ship structures or on the ground
- Struck by moving objects
- Slipping on wet surfaces
- Sharp objects
- Oxygen deficiency in confined spaces
- Lack of PPEs, housekeeping practices, safety signs
- Shackles, hooks, chains
- Cranes, winches, hoisting and hauling equipment;

Hazardous substances and wastes

- Asbestos fibres, dusts
- Heavy and toxic metals (lead, mercury, cadmium, copper, zinc, *etc*.)
- Organometallic substances (tributyltin, *etc*.)
- Lack of hazard communication (storage, labelling, material safety data sheets)
- Batteries, fire-fighting liquids
- PCBs and PVC (combustion products)
- Welding fumes
- Volatile organic compounds (solvents)
- Inhalation in confined and enclosed spaces
- Physical hazards
- Noise
- Extreme temperatures
- Vibration
- Radiation (UV, radioactive materials)

Physical hazards

- Noise
- Extreme temperatures
- Vibration
- Radiation (UV, radioactive materials)

Mechanical hazards

- Trucks and transport vehicles
- Scaffolding, fixed and portable ladders
- Impact by tools, sharp-edged tools
- Power-driven hand tools, saws, grinders and abrasive cutting wheels
- Failure of machinery and equipment
- Poor maintenance of machinery and equipment
- Lack of safety guards in machines
- Structural failure in the ship

Biological hazards

- Toxic marine organisms
- Risk of communicable diseases transmitted by pests, vermin, rodents, insects and other animals that may infest the ship
- Animal bites
- Vectors of infectious diseases (TB, malaria, dengue fever, hepatitis, respiratory infections, others)

Ergonomic and psychosocial hazards

- Repetitive strain injuries, awkward postures, repetitive and monotonous work, excessive workload
- Long working hours, shift work, night work, temporary employment
- Mental stress, human relations (aggressive behaviour, alcohol and drug abuse, violence)
- Poverty, low wages, minimum age, lack of education and social environment

General concerns

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

4.5.2 Disaster management plan

A disaster is a catastrophic situation in which suddenly, people are plunged into helplessness and suffering and, as a result, need protection, clothing, shelter, medical and social care and other necessities of life.

The DMP is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of the DMP, it should be widely circulated and a personnel training is to be provided through rehearsals/drills.

To tackle the consequences of a major emergency inside the plant or immediate vicinity of the plant, a DMP has to be formulated and this planned emergency document is called the DMP

The objective of the Industrial DMP is to make use of the combined resources of the plant and the outside services to achieve the following:

- Effect the rescue and medical treatment of casualties
- Safeguard other people
- Minimize damage to property and the environment
- Initially contain and ultimately bring the incident under control
- Identify any dead
- Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected area

- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the Emergency.

In effect, it is to optimize operational efficiency to rescue rehabilitation and render medical help and to restore normalcy.

The DMP should include the following:

A. Emergency preparedness plan

Incidents, accidents and emergency preparedness should be accounted during ship breaking process. This shall be a part of Emergency Management System. Emergency Preparedness Plan (EPP) should be prepared following the national environmental emergency plan and OSHA guidelines. According to these guidelines, an environmental emergency plan would essentially provide the following information:

- Assignment of the duties and responsibilities among the authorities, participating agencies, the response team and coordinators and/or those responsible for the pollution incident
- Relationship with other emergency plans
- A reporting system that ensures rapid notification in the event of a pollution incident
- The establishment of a focal point for co-ordination and directions connected to the implementation of the plan
- Response operations; should always cover these four phases
  - Discovery and alarm
  - Evaluation, notification and plan invocation
  - Containment and countermeasures
  - Cleanup and disposal
- Identification of expertise and response resources available for assistance for the implementation of the plan
- Directions on the necessary emergency provisions applicable to the handling, treatment or disposal of certain pollutants
- Link to the local community for assistance, if necessary
- Support measures, such as procedures for providing public information, carrying out surveillance, issuing post incident reports, review and updating of the plan, and periodic exercising of the plan

B. Emergency response

Dismantling activities at the ship breaking facilities may result in several incidents and accidents, which may cause several types of damage. For e.g., oil residues and vapors may represent a fire/explosion hazard during cutting, and falling objects may result in a variety of cutting injuries. Therefore, a survey of potential incidents and accidents is to be carried out. Based on this, a plan for response to incidents, injuries and emergencies should be prepared. Response to emergencies should ensure that:

- The exposure of workers should be limited as much as possible during the operation
- Contaminated areas should be cleaned and if necessary disinfected
- Limited impact on the environment at the extent possible.

Written procedures for different types of emergencies should be prepared and the entire workforce should be trained in emergency response. All relevant emergency response equipment should also be readily available.

With regard to dangerous spills, associated clean-up and fire-fighting operations should be carried out by specially allocated and trained personnel.

C. Response team

It is important to setup an Emergency Organization. A senior executive who has control over the affairs of the plant would be heading the Emergency Organization. He would be designated as Site Controller. Manager (Safety) would be designated as the Incident Controller. In the case of stores, utilities, open areas, which are not under the control of the Production Heads, Senior Executive responsible for maintenance of utilities would be designated as Incident Controller. All the Incident Controllers would be reporting to the Site Controller.

Each Incident Controller organizes a team responsible for controlling the incidence with the personnel under his control. Shift In-charge would be the reporting officer, who would bring the incidence to the notice of the Incidence Controller and Site Controller.

Emergency Coordinators would be appointed who would undertake the responsibilities like fire fighting, rescue, rehabilitation, transport and provide essential and support services. For this purposes, Security In-charge, Personnel Department, Essential services personnel would be engaged. All these personnel would be designated as Key personnel.

In each shift, electrical supervisor, electrical fitters, pump house in-charge, and other maintenance staff would be drafted for emergency operations. In the event of power or communication system failure, some of staff members in the office/facility would be drafted and their services would be utilized as messengers for quick passing of communications. All these personnel would be declared as essential personnel.

D. Response to injuries

Based on a survey of possible injuries, a procedure for response to injuries or exposure to hazardous substances should be established. All staff should have a minimum of training to such response and the procedure ought to include the following:

- Immediate first aid, such as eye splashing, cleansing of wounds and skin, and bandaging
- Immediate reporting to a responsible designated person
- If possible, retention of the item and details of its source for identification of possible hazards
- Rapid additional medical care from medical personnel
- Medical surveillance
- Recording of the incident
- Investigation, determination and implementation of remedial action

It is vital that incident reporting should be straightforward so that reporting is actually carried out.

E. Emergency communication

Whoever notices an emergency situation such as fire, growth of fire, leakage, *etc*., would inform his immediate superior, Emergency Control Center and local authorities. Also, there must be a provision for alarm system. The person on duty in the Emergency Control Center, would appraise the Site Controller. Site Controller verifies the situation from the Incident Controller of that area or the Shift In-charge and takes a decision about an impending On-site Emergency. This would be communicated to all the Incident Controllers, Emergency Coordinators. Simultaneously, the emergency warning system would be activated on the instructions of the Site Controller. Further, emergency control centre would alert the ambulances and medical assistance group.

F. Emergency responsibilities

The responsibilities of the key personnel should be defined for the following:

- Site controller
- Incident controller
- Emergency coordinator - rescue, fire fighting
- Emergency coordinator-medical, mutual aid, rehabilitation, transport and communication
- Emergency coordinator - essential services
- Employers responsibility

G. Emergency facilities

- Emergency Control Center – with access to important personnel, telephone, fax, telex facility, safe contained breathing apparatus, hand tools, emergency shut down procedures, duties and contact details of key personnel and government agencies, emergency equipments, *etc*.
- Assembly Point – with minimum facilities for safety and rescue
- Emergency Power Supply – connected with diesel generator, flame proof emergency lamps, *etc*.
- Fire-fighting Facilities – first aid fire fighting equipments, fire alarms, *etc*.
- Location of wind Stock – located at appropriate location to indicate the direction of wind for emergency escape
- Emergency Medical Facilities – Stretchers, gas masks, general first aid, emergency control room, breathing apparatus, other emergency medical equipment, ambulance

H. Emergency actions

- Emergency Warning
- Evacuation of Personnel
- All Clear Signal
- Public information and warning
- Coordination with local authorities
- Mutual aid
- Mock drills
- Periodic maintenance and testing of safety equipments

4.6 Mitigation Measures

The purpose of mitigation is to identify measures that safeguard the environment and the community affected by the proposal. Mitigation is both a creative and practical phase of the EIA process. It seeks to find the best ways and means of avoiding, minimizing and remedying impacts. Mitigation measures must be translated into action in the correct way and at the right time, if they are to be successful. This process is referred to as impact management and takes place during project implementation. A written plan should be prepared for this purpose, and includes a schedule of agreed actions. Opportunities for impact mitigation will occur throughout the project cycle.

4.6.1 Important considerations for mitigation methods

The responsibility of project proponents to 'internalize' the full environmental costs of development proposals is now widely accepted under "Polluter Pay" principle. In addition, many proponents have found that good design and impact management can result in significant savings applying the principles of cleaner production to improve their environmental performance.

- The predicted adverse environmental as well as social impacts for which mitigation measures are required should be identified and briefly summarized along with cross-referencing them to the significance, prediction components of the EIA report or other documentation.
- Each mitigation measure should be briefly described with reference to the impact of significances to which it relates and the conditions under which it is required (for example, continuously or in the event of contingencies). These should also be cross-referenced to the project design and operating procedures which elaborate on the technical aspects of implementation of various measures.
- Cost and responsibilities for mitigation and monitoring should be clearly defined, including arrangements for coordination between various authorities responsible for mitigation.
- The proponent can use the EMP to develop environmental performance standards and requirements for the project site as well as supply chain. An EMP can be implemented through EMS for the operational phase of the project *etc*.

Before selecting the mitigation plans it is appropriate to study the mitigation alternatives for cost-effectivity, technical and socio-political feasibility. Such mitigation measures could include:

- avoiding eco/otherwise-sensitive areas e.g., fish spawning areas, dense mangrove areas or areas known to contain rare or endangered species
- adjusting work schedules to minimize disturbance
- engineered structures such as berms and noise attenuation barriers
- emission criteria need to be met
- recycling or reuse of waste materials *etc*.

Other generic measures

- Extend education facility and vocational training to the children of the neighbouring villages.

- Extend hospital facilities for adjacent villages and provide community with water supply.
- Develop community projects to improve rural economy, health and sanitation standards, animal husbandry, *etc*.
- Conduct mass awareness programmes for villagers, township residents and employees about the chemicals / raw materials being used in the yard, emergency preparedness of the industry, *etc*.
- Develop infrastructure like roads, power supply, transport, *etc*.
- Adopt accredited Environment Management Systems: ISO 14001, OHSAS – 18001.

4.6.2 Hierarchy of elements of mitigation plan

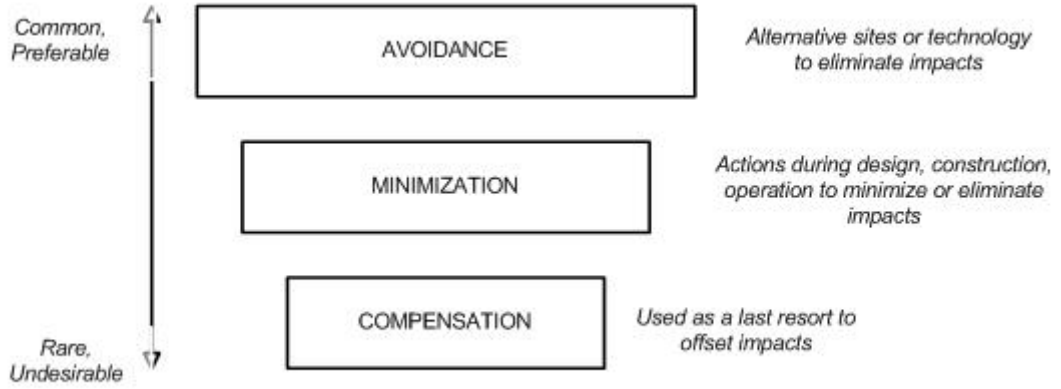

Figure 4-5: Hierarchy of Elements of Mitigation Plan

Good EIA practice requires relevant technical understanding of the issues and the measures that work in the circumstances. The priority of selection of mitigation measures should be in the order:

Step one: impact avoidance

This step is most effective when applied at an early stage of project planning. It can be achieved by:

- not undertaking certain projects or elements that could result in adverse impacts
- avoiding areas that are environmentally sensitive; and
- putting in place the preventative measures to stop adverse impacts from occurring, for example, release of water from a reservoir to maintain a fisheries regime

Step two: impact minimization

This step is usually taken during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts. It can be achieved by:

- scaling down or relocating the proposal
- redesigning elements of the project and
- taking supplementary measures to manage the impacts

Step three: impact compensation

This step is usually applied to remedy unavoidable residual adverse impacts. It can be achieved by:

- rehabilitation of the affected site or environment. For e.g., by habitat enhancement and restocking fish;
- restoration of the affected site or environment to its previous state or better,
- replacement of the same resource values at another location, for e.g., by wetland engineering to provide an equivalent area to that lost to drainage, infill, *etc*.

Important compensation elements

Resettlement Plans: Special considerations apply to mitigation of proposals that displace or disrupt people. Certain types of projects, such as reservoirs and irrigation schemes and public works, are known to cause involuntary resettlement. This is a contentious issue because it involves far more than rehabilitating the people in houses; in addition, income sources and access to common property resources are likely to be lost. Almost certainly, a resettlement plan will be required to ensure that no one is worse off than before, which may not be possible for indigenous people whose culture and lifestyle is tied to a locality. This plan must include the means for those displaced to reconstruct their economies and communities and should include an EIA of the receiving areas. Particular attention should be given to indigenous, minority and vulnerable groups who are at higher risk from resettlement.

In-kind compensation

When significant or net residual loss or damage to the environment is likely, in-kind compensation is appropriate. As noted earlier, environmental rehabilitation, restoration or replacement have become standard practices for many proponents. Now, increasing emphasis is given to a broader range of compensation measures to offset impacts and assure the sustainability of development proposals. These include impact compensation 'trading', such as offsetting CO_2 emissions by planting forests to sequester carbon.

4.6.3 Typical mitigation measures

Table 4-5: Mitigation Measures for Operation and Maintenance Phase

Impacts	Mitigation steps
Environmental Impacts	
Soil Pollution	▪ Use concrete payment in the recycling unit before the start of activities ▪ Adequate containment methods in collecting the liquid waste ▪ Cutting and breaking operations in a systematic way
Dust pollution	▪ Wetting of roadways to reduce traffic dust and reentrained particles ▪ Installation of windscreens to breakup the wind flow
Noise pollution	▪ Heavy duty muffler systems on heavy equipment
Water pollution and issues	▪ Channeling and retention of water to reduce erosion and situation ▪ Collection and treatment of sewage and organic waste ▪ Appropriate disposal of solids ▪ Construct liners of ponds and solids waste disposal ▪ Dilute water at point of discharge

Impacts	Mitigation steps
Chemical discharges and spills	▪ Develop spill prevention plans ▪ Develop traps and containment system and chemically treat discharges on site
Biological	▪ Installation of systems to discourage nesting or perching of birds in dangerous environments ▪ Increased employee awareness to sensitive areas
Disruption of traffic	▪ Develop traffic plan that minimizes road use by workers ▪ Upgrade roads and intersections
Health Impacts	
Worker exposure to dust	▪ Provide dust collector equipment ▪ Maintain dust levels less than 10 mg/m^3 ▪ Provide dust masks when levels are exceeded
Worker exposure to toxic gases	▪ Monitor concentrations within the permissible levels ▪ Regular monitoring for flammable and combustible gases by competent persons
Workers exposure to toxic materials	▪ Use of Personnel Protective Equipments (PPE) ▪ Adequate training in handling toxic materials ▪ Maintaining hygiene conditions in the yard
Worker exposure to excessive noise	▪ Maintain noise levels from below 90 DBA ▪ Provide ear protection if in excess
Electric Shocks, Burns, Injuries, Falls and Accidents	▪ Following safety measures ▪ Use of Personnel Protective Equipments (PPE) ▪ Checking for toxic gases and flammable substances in confined spaces ▪ Adequate training in use of safety equipments ▪ Using safe and accessible ladders/scaffolds ▪ Material should not be moved when workers are using access ladders
Fires and Explosions	▪ Regular monitoring for toxic gases and flammable substances in confined spaces and regularly available spaces ▪ Proper handling and storage of hazardous materials as per prescribed norms
Other Impacts	
Induced secondary development puts increased demand on infrastructure	▪ Provide infrastructure plan and financial support for increased demands ▪ Construct facilities to reduce demands
Living standards of the workers/Status/Culture	▪

Implementation of mitigation measures would reduce or eliminate the use of costly/complicated procedures. Mitigation measures against the hazards from ship breaking activities shall be formulated to ensure safe and healthy working conditions to the workers. These measures must include the inventory of best practices during ship dismantling. The following are some of the preventive measures.

- Preventing waste generation – cutting and breaking operations in an organized manner
- Minimization of wastes – reuse and recycle the materials where ever possible
- Disposal of wastes in a controlled manner – Centralized TSDF /Incineration
- Use of highly sophisticated technologies
  - Identification of materials through inventory and prevention of releases
  - Management of waste at ship dismantling stage
  - Operational procedures for ship dismantling

- Following sound management practices during ship dismantling that meets the technical, institutional and legal conditions
- Preventing the direct contact of waste materials with the media of contamination
- Emergency preparedness
- Preparing ship-dismantling plan which may be approved by the Board to monitor its compliance.

Disposal of waste in a controlled manner

As ship-breaking process generates different types of wastes it is important to handle and store these wastes temporarily in the yard. Temporary facilities may be provided in the yard for different types of waste (as discussed in detail in Chapter 3) and later sent to centralized disposal facility based on the type of waste. The waste should be disposed in a safe and environmentally sound manner.

As the quantity of waste differs based on the type of ship, the yard should be provided with a minimum disposal area to accommodate the waste. **Annexure III** shows the various disposal options based on type of waste.

Table 4-6: Rules to be followed for Handling Waste

Types of waste/Items	Rules to be Followed during Handling, Storage and Disposal
Asbestos Paints PCB	▪ Hazardous Waste (Management and Handling) Rules, 1989 amended 2000 and 2003 ▪ Manufacture Storage and Import of Hazardous Chemicals Rules, 1989 amended 2000 ▪ Batteries (Management and Handling) Rules, 2001
Bilge and Ballast water	▪ Water Act, ▪ CPCB Guidelines
Radioactive Wastes	▪ Rules for Management of Radio-active wastes, AERB
Gas Cylinders	▪ Gas Cylinder Rules

The environmental, health and safety measures with respect to the following major pollutants in ship breaking activities are annexed in **Annexure XIII**.

- Asbestos
- Polychlorinated biphenyls (PCBs)
- Bilge and ballast water
- Oil and fuel
- Paint

4.7 Environmental Management Plan

A typical EMP shall be composed of the following:

1) summary of the potential impacts of the proposal
2) description of the recommended mitigation measures
3) statement of their compliance with relevant standards
4) allocation of resources and responsibilities for plan implementation
5) schedule of the actions to be taken
6) programme for surveillance, monitoring and auditing

7) contingency plan when impacts are greater than expected

Each of the above components is precisely discussed below:

Summary of impacts: The predicted adverse environmental and social impacts for which mitigation measures are identified in the earlier sections to be briefly summarized with cross referencing to the corresponding sections in the EIA report.

Description of mitigation measures: Each mitigation measure should be briefly described with reference to the impact to which it relates and the conditions under which it is required. These should be accompanied by, or referenced to, project design and operating procedures which elaborate on the technical aspects of implementing the various measures.

Description of monitoring programme: Environmental monitoring refers to compliance monitoring and residual impact monitoring. Compliance monitoring refers to meeting the industry-specific statutory compliance requirements (Ref. Applicable National regulations as detailed in Chapter 3).

Residual impact monitoring refers to monitoring of identified sensitive locations with adequate number of samples and frequency. The monitoring programme should clearly indicate the linkages between impacts identified in the EIA report, measurement indicators, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions.

Institutional arrangements: Responsibilities for mitigation and monitoring should be clearly defined, including arrangements for co-ordination between the various actors responsible for mitigation. Details should be provided w.r.t the deployment of staff (detailed organogram), monitoring network design, parameters to be monitored, analysis methods, associated equipments, *etc*.

Implementation schedule and reporting procedures: The timing, frequency and duration of mitigation measure should be specified in an implementation schedule, showing links with overall project implementation. Procedures to provide information on the progress and results of mitigation and monitoring measures should also be clearly specified.

Cost estimates and sources of funds: These should be specified for both the initial investment and recurring expenses for implementing all measures contained in the EMP, integrated into the total project costs, and factored into loan negotiation.

The EMP should contain commitments that are binding on the proponent in different phases of project implementation *i.e.*, pre-construction or site clearance, construction, operation, decommissioning.

4.8 Reporting

Structure of the EIA report for ship breaking yards is given in the following table. Each task prescribed in ToR shall be incorporated appropriately in the contents in addition to the contents described in the table below.

Table 4-7: Generic Structure of EIA Document

S.NO	EIA STRUCTURE	CONTENTS
1.	Introduction	▪ Purpose of the report ▪ Identification of project & project proponent ▪ Brief description of nature, size, location of the project and its importance to the country, region ▪ Scope of the study – details of regulatory scoping carried out (As per ToR)
2.	Project Description	▪ Condensed description of those aspects of the project (based on project feasibility study), likely to cause environmental effects. Details should be provided to give clear picture of the following: ▪ Type of project ▪ Need for the project ▪ Location (maps showing general location, specific location, project boundary & project site layout) ▪ Size or magnitude of operation (incl. Associated activities required by or for the project) ▪ Proposed schedule for approval and implementation ▪ Technology and process description ▪ Project description including drawings showing project layout, components of project, *etc*. Schematic representations of the feasibility drawings which give information important for EIA purpose ▪ Description of mitigation measures incorporated into the project to meet environmental standards, environmental operating conditions, or other EIA requirements (as required by the scope) ▪ Assessment of New & untested technology for the risk of technological failure
3.	Description of the Environment	▪ Study area, period, components & methodology ▪ Establishment of baseline for VECs, as identified in the scope ▪ Base maps of all environmental components
4.	Anticipated Environmental Impacts & Mitigation Measures	▪ Details of Investigated Environmental impacts due to project location, possible accidents, project design, project construction, regular operations, final decommissioning or rehabilitation of a completed project ▪ Measures for minimizing and / or offsetting adverse impacts identified ▪ Irreversible and Irretrievable commitments of environmental components ▪ Assessment of significance of impacts (Criteria for determining significance, Assigning significance) ▪ Mitigation measures
5.	Analysis of Alternatives (Technology & Site)	▪ Incase, the scoping exercise results in need for alternatives: ▪ Description of each alternative ▪ Summary of adverse impacts of each alternative ▪ Mitigation measures proposed for each alternative and selection of alternative
6.	Environmental Monitoring Program	▪ Technical aspects of monitoring the effectiveness of mitigation measures (incl. Measurement methodologies, frequency, location, data analysis, reporting schedules, emergency procedures, detailed

S.NO	EIA STRUCTURE	CONTENTS
		budget & procurement schedules)
7.	Additional Studies	▪ Public Consultation ▪ Risk assessment ▪ Social Impact Assessment, R&R Action Plans
8.	Project Benefits	▪ Improvements in the physical infrastructure ▪ Improvements in the social infrastructure ▪ Employment potential –skilled; semi-skilled and unskilled ▪ Other tangible benefits
9.	Environmental Cost Benefit Analysis	▪ If recommended at the Scoping stage
10.	EMP	▪ Description of the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored, after approval of the EIA
11.	Summary & Conclusion (This will constitute the summary of the EIA Report)	▪ Overall justification for implementation of the project ▪ Explanation of how, adverse effects have been mitigated ▪ Implementation of Clean Development Mechanism to conserve natural resources
12.	Disclosure of Consultants engaged	▪ The names of the Consultants engaged with their brief resume and nature of Consultancy rendered

4.9 Public Consultation

Public consultation refers to the process by which the concerns of local affected people and others who have plausible stake in the environmental impacts of the project or activity are ascertained.

- Public consultation is not a decision taking process, but is a process to collect views of the people having plausible stake. If the SPCB/Public agency conducting public hearing is not convinced with the plausible stake, then such expressed views need not be considered.
- All Category A projects require public hearing except the following:
  - All building/ construction projects/ area development projects/townships
  - All projects concerning national defense and security or involving other strategic considerations as determined by the Central Government
- Public consultation involves two components, one is public hearing, and other one is inviting written responses/objections through Internet/by post, *etc*., by placing the summary of EIA report on the web site.
- Public hearing shall be carried out at the site or in its close proximity, district-wise, for ascertaining concerns of local affected people.
- Project proponent shall make a request through a simple letter to the Member-Secretary of the SPCB or UTPCC to arrange public hearing.
- Project proponent shall enclose with the letter of request, at least 10 hard copies and 10 soft copies of the draft EIA report including the summary EIA report in English and local language prepared as per the approved scope of work, to the concerned Authority.
- Simultaneously, project proponent shall arrange to send, one hard copy and one soft copy, of the above draft EIA report along with the summary EIA report to the following Authorities within whose jurisdiction the project will be located:

  - District magistrate(s)
  - Zilla parishad and municipal corporation
  - District industries office
  - Concerned regional office of the MoEF/SPCB
- Above mentioned Authorities shall arrange to widely publicize the draft EIA report within their respective jurisdictions. They shall also make draft EIA report for inspection electronically or otherwise to the public during normal hours till the public hearing is over.
- Concerned regulatory Authority (MoEF) shall display the summary of EIA report on its website and also make full draft EIA report available for reference at a notified place during normal office hours at their head office.
- SPCB or UTPCC concerned shall make arrangements for giving publicity about the project within the State/UT and make available the summary of draft EIA report for inspection in select offices, public libraries. They shall also additionally make available a copy of the draft EIA report to the above five authorities/offices as mentioned.
- The Member-Secretary of the concerned SPCB or UTPCC shall finalize the date, time and exact venue for the conduct of public hearing within seven days of the date of the receipt of the draft EIA report from the project proponent and advertise the same in one major National Daily and one Regional vernacular Daily.
- A minimum notice period of 30 (thirty) days shall be provided to the public for furnishing their responses.
- No postponement of the date, time, venue of the public hearing shall be undertaken, unless some untoward emergency situation occurs and only then on the recommendation of the concerned District Magistrate the postponement shall be notified to the public through the same National and Regional vernacular dailies and also prominently displayed at all the identified offices by the concerned SPCB or UTPCC
- In the above exceptional circumstances fresh date, time and venue for the public consultation shall be decided by the Member –Secretary of the concerned SPCB or UTPCC only in consultation with the District Magistrate and notified afresh as per the procedure.
- The District Magistrate or his or her representative not below the rank of an Additional District Magistrate assisted by a representative of SPCB or UTPCC, shall supervise and preside over the entire public hearing process.
- The SPCB or UTPCC shall arrange to video film the entire proceedings. A copy of the videotape or a CD shall be enclosed with the public hearing proceedings while forwarding it to the Regulatory Authority concerned.
- The attendance of all those who are present at the venue shall be noted and annexed with the final proceedings
- There shall be no quorum required for attendance for starting the proceedings
- Every person present at the venue shall be granted the opportunity to seek information or clarifications on the project from the Applicant. The summary of the public hearing proceedings accurately reflecting all the views and concerns expressed shall be recorded by the representative of the SPCB or UTPCC and read over to the audience at the end of the proceedings explaining the contents in the vernacular language and the agreed minutes shall be signed by the District Magistrate or his or her representative on the same day and forwarded to the SPCB/UTPCC concerned.

- A statement of the issues raised by the public and the comments of the proponent shall also be prepared in the local language and in English and annexed to the proceedings.
- The proceedings of the public hearing shall be conspicuously displayed at the office of the Panchayats within whose jurisdiction the project is located, office of the concerned Zilla Parishad, District Magistrate, and the SPCB or UTPCC. The SPCB or UTPCC shall also display the proceedings on its website for general information. Comments, if any, on the proceedings, may be sent directly to the concerned regulatory authorities and the Applicant concerned.
- The public hearing shall be completed within a period of 45 (forty five) days from date of receipt of the request letter from the Applicant. Therefore the SPCB or UTPCC concerned shall send the public hearing proceedings to the concerned regulatory authority within 8(eight) days of the completion of the public hearing. The proponent may also directly forward a copy of the approved public hearing proceedings to the regulatory authority concerned along with the final EIA report or supplementary report to the draft EIA report prepared after the public hearing and public consultations.
- Upon receipt of the same, the Authority will place executive summary of the report on the website to invite responses from other concerned persons having a plausible stake in the environmental aspects of the project or activity.
- If SPCB/UTPCC is unable to conduct the public hearing in the prescribed time, the Central Government at the request of the project proponent can engage a public agency for conducting the public hearing process within a further period of 45 days. The respective governments shall pay the appropriate fee to the public agency for conducting public hearing.
- A public agency means a non-profit making institution/ body such as technical/academic institutions, government bodies not subordinate to the concerned Authority.
- If SPCB/Public Agency authorized for conducting public hearing informs the Authority, stating that it is not possible to conduct the public hearing in a manner, which will enable the views of the concerned local persons to be freely expressed, then Authority may consider such report to take a decision that in such particular case, public consultation may not have the component of public hearing.
- Often restricting the public hearing to the specific district may not serve the entire purpose, therefore, NGOs who are local and registered under the Societies Act in the adjacent districts may also be allowed to participate in public hearing, if they so desire.
- Confidential information including non-disclosable or legally privileged information involving intellectual property right, source specified in the application shall not be placed on the website.
- The Authority shall make available on a written request from any concerned person the draft EIA report for inspection at a notified place during normal office hours till the date of the public hearing.
- While mandatory requirements will have to be adhered to, utmost attention shall be given to the issues raised in the public hearing for determining the modifications needed in the project proposal and the EMP to address such issues.
- Final EIA report after making needed amendments, as aforesaid, shall be submitted by the applicant to the concerned Authority for prior environmental clearance.

Alternatively, a supplementary report to draft EIA and EMP addressing all concerns expressed during the public consultation may be submitted.

4.10 Appraisal

Appraisal means the detailed scrutiny by the EAC of the application and the other documents like the final EIA report, outcome of the public consultation including public hearing proceedings submitted by the applicant for grant of environmental clearance.

- The appraisal shall be made by EAC concerned to the Central Government and the SEIAA respectively.
- Project proponent either personally or through consultant can make a presentation to the EAC for the purpose of appraising the features of the project proposal and also to clarify the issues raised by the members of the EAC.
- On completion of these proceedings EAC shall make categorical recommendations to the respective Authority, either for grant of prior environmental clearance on stipulated terms & conditions, if any, or rejection of the application with reasons.
- In case EAC needs to visit the site or obtain further information before being able to make categorical recommendations, EAC may inform the project proponent accordingly. In such an event, it should be ensured that the process of environmental clearance is not unduly delayed to go beyond the prescribed timeframe.
- Upon the scrutiny of the final report, if EAC opines that ToR finalized at the scoping stage has not been covered by the proponent, then the project proponent may be asked to provide such information. If such information is declined by the project proponent or is unlikely to be provided early enough so as to complete the environmental appraisal within prescribed time of 60 days, the EAC may recommend for rejection of the proposal with the same reason.
- Appraisal shall be strictly in terms of ToR finalized at the scoping stage and the concerns expressed during public consultation.
- This process of appraisal shall be completed within 60 days from the receipt of the updated EIA report and EMP report, after completing public consultation.
- The EIA report will be typically examined for following:
  - Project site description supported by topographic maps & photographs – detailed description of topography, land use and activities at the proposed project site and its surroundings (buffer zone) supported by photographic evidence.
  - Clarity in description of drainage pattern, location of eco-sensitive areas, vegetation characteristics, wildlife status - highlighting significant environmental attributes such as feeding, breeding and nesting grounds of wildlife species, migratory corridor, wetland, erosion and neighboring issues.
  - Description of the project site – how well the interfaces between the project related activities and the environment have been identified for the entire project cycle *i.e.,* construction, operation and decommissioning at the end of the project life.
  - How complete and authentic are the baseline data pertaining to flora and fauna and socio economic aspects?

- Citing of proper references, with regard to the source(s) of baseline data as well as the name of the investigators/ investigating agency responsible for collecting the primary data.

- How consistent are the various values of environmental parameters with respect to each other?

- Is a reasonable assessment of the environmental and social impact made for the identified environmental issues including project affected people (PAS)?

- To what extent the proposed environmental plan will mitigate the environmental impact and at what estimated cost, shown separately for construction, operation and closure stages and also separately in terms of capital and recurring expenses along with details of agencies that will be responsible for the implementation of environmental plan/ conservation plan.

- How well are the concerns expressed/highlighted during the Public hearing have been addressed and incorporated in the EMP giving item wise financial provisions and commitments (in quantified terms)?

- How far the proposed environmental monitoring plan will effectively evaluate the performance of the EMP? Are details for environmental monitoring plan provided in the same manner as the EMP?

- Identification of hazard and quantification of risk assessment and whether appropriate mitigation plan has been included in the EMP?

- Does the proposal include a well formulated time bound green belt development plan for mitigating environmental problems such as fugitive emission of dust, gaseous pollutants, noise, odour, *etc*.

- Does EIA makes a serious attempt to guide the project proponent for minimizing the requirement of natural resources including land, water energy and other non renewable resources?

- How well the EIA statement has been organized and presented so that the issues, their impact and environmental management strategies emerge clearly from it and how well organized was the power point presentation made before the expert committee?

- Is the information presented in the EIA adequately and appropriately supported by maps, imageries and photographs highlighting site features and environmental attributes?

4.11 Decision-making

The Chairperson reads the sense of the Committee and finalizes the draft minutes of the meeting, which are circulated by the Secretary to all the core members and sectoral experts invited to the meeting. Based on the response from the members, the minutes are finalized and signed by the Chairperson. This process for finalization of the minutes should be so organized that the time prescribed for various stages is not exceeded.

Approval / rejection / reconsideration

The Authority shall consider the recommendations of concerned appraisal Committee and convey its decision within 45 days of the receipt of recommendations.

- If the Authority disagrees with the recommendations of the Appraisal Committee, then reasons shall be communicated to concerned Appraisal Committee and applicant within 45 days from the receipt of the recommendations. The Appraisal Committee concerned shall consider the observations of the Authority and furnish its views on the observations within further period of 60 days. The Authority shall take a decision with in the next 30 days based on the views of appraisal Committee.
- If the decision of the Authority is not conveyed within the time, then the proponent may proceed as if the environmental clearance sought has been granted or denied by the regulatory authority in terms of the final recommendation of the concerned appraisal Committee. For this purpose, the decision of the Appraisal Committee will be public document, once the period specified above for taking the decision by the Authority is over.

If approved

- The MoEF will issue an Environmental Clearance for the project.
- The project proponent should make sure that the award of Environmental Clearance is properly publicized in at least two local newspapers of the district or state where the proposed project is located. For instance, the executive summary of the Environmental Clearance may be published in the newspaper along with the information about the location (website/office where it is displayed for public) where the detailed Environmental Clearance is made available. The MoEF shall also place the Environmental Clearance in the public domain on Government Portal. Further copies of the environmental clearance shall be endorsed to the Heads of local bodies, Panchayats and Municipal bodies in addition to the relevant offices of the Government.
- The Environmental Clearance will be valid from the start date to actual commencement of the production of the developmental activity.

4.12 Post Clearance Monitoring Protocol

The MoEF will monitor and take appropriate action under the EP Act, 1986.

The project proponent must submit half-yearly compliance reports in respect of the stipulated prior environmental clearance terms and conditions in hard and soft copies to the regulatory authority concerned, on 1st June and 1st December of each calendar year.

All such compliance reports submitted by the project management shall be public documents. Copies of the same shall be given to any person on application to the concerned regulatory authority. The latest such compliance report shall also be displayed on the web site of the concerned regulatory authority.

The SPCB shall incorporate EIA clearance conditions into consent conditions in respect of Category A and Category B projects and in parallel monitor and enforce the same.

5. STAKEHOLDERS' ROLES AND RESPONSIBILITIES

Prior environmental clearance process involves many stakeholders *i.e.,* Central Government, State Government, EAC, Public Agency, SPCB, the project proponents and the public.

- The roles and responsibilities of the organizations involved in different stages of prior environmental clearance are given in Table 5-1.
- Organization-specific functions are listed in Table 5-2.

In this Chapter, constitution, composition, functions, *etc*., of the Authorities and the Committees are discussed in detail.

Table 5-1: Roles and Responsibilities of Stakeholders Involved in Prior Environmental Clearance

Stage	MoEF	EAC	Project Proponent	EIA Consultant	SPCB/ Public Agency	Public and Interest Group
Screening	Receives application and takes advise of EAC	Advises the MoEF	Submits application (Form 1) and provide necessary information	Advises and assists the proponent by providing technical information		
Scoping	Approves the ToR and communicates the same to the project proponent and places the same in the web-site	Reviews ToR and visits the proposed site, if required and recommends the ToR to the MoEF	Submits the draft ToR to EAC and facilitates the visit of the sub-committee members to the project site	Prepares ToR		
EIA Report & Public Hearing	Reviews and forwards copies of the EIA report to SPCB /public agency for conducting public hearing Places the summary of EIA report in the web-site Conveys objections to the project proponent for update, if any		Submits detailed EIA report as per the finalized ToR Facilitates the public hearing by arranging presentation on the project, EIA and EMP – takes note of objections and updates the EMP accordingly	Prepares the EIA report Presents and appraises the likely impacts and pollution control measures proposed in the public hearing	Reviews EIA report and conducts public hearing in the manner prescribed Submits proceedings and views of SPCB, as well, to the Authority and the project proponent as well	Participates in public hearings and offers comments and observations. Comments can be sent directly to MoEF through Internet in response to the summary placed in

Stage	MoEF	EAC	Project Proponent	EIA Consultant	SPCB/ Public Agency	Public and Interest Group
						the website
Appraisal and Clearance	Receives updated EIA Takes advise of EAC, and takes decision (Clearance with required conditions or re-examination/rejection	Critically examines the reports, presentation of the proponent and appraises MoEF (recommendations are forwarded to MoEF)	Submits up-dated EIA, EMP reports to MoEF. Presents the overall EIA and EMP including public concerns to EAC	Provides technical advise to the project proponent and if necessary presents the proposed measures for mitigation of likely impacts (terms and conditions of clearance)		
Post Clearance Monitoring			Implements environmental protection measures prescribed and submits periodic monitoring results	Conducts periodic monitoring	Incorporates the clearance conditions into appropriate consent conditions and ensures implementation	

Table 5-2: Organization-specific Functions

Organization	Functions
Central Government	▪ Constitutes the EAC ▪ Receives application from the project proponent ▪ Communicates the ToR finalized by the EAC to the project proponent ▪ Receives EIA report from the project proponent and soft copy of summary of the report for placing in the website ▪ Summary of EIA report will be placed in website. Forwards the received responses to the project proponent ▪ Engages other public agency for conducting public hearing in case where the SPCB does not respond within time ▪ Receives updated EIA report from project proponent incorporating the considerations from the proceedings of public hearing and responses received through other media ▪ Forwards updated EIA report to the EAC for appraisal ▪ Either accepts the recommendations of EAC or asks for reconsideration of specific issues for review by the EAC. ▪ Takes the final decision – acceptance/rejection of the project proposal and communicates the same to the project proponent
EAC	▪ Reviews Form 1 and its attachments ▪ Visits site(s), if necessary ▪ Finalizes ToR and recommend to the Central Government, which in turn communicates the finalized ToR to the project proponent if not exempted by the Notification ▪ Reviews EIA report, proceedings and appraises their views to the Central government

Organization	Functions
	▪ If the Central Government has any specific views, then the EAC reviews again for appraisal
SPCB	▪ Receives request from project proponent and conducts public hearing in the manner prescribed. ▪ Conveys proceedings to MoEF and project proponent
Public Agency	▪ Receives request from the respective Governments to conduct public hearing ▪ Conducts public hearing in the manner prescribed. ▪ Conveys proceedings to the MoEF and the Project proponent

5.1 EAC

EAC is an independent Committee to review each developmental activity and offer its recommendations for consideration of the Central Government.

A. Constitution

- EAC shall be constituted by the Central Government comprising a maximum of 15 members including a Chairperson and Secretary.
- The Central Government will notify committee.
- The Chairperson and the non-official member shall have a fixed term of three years, from the date of Notification by the Central Government.
- The Chairperson shall be an eminent environmental expert with understanding on environmental aspects and environmental impacts.

B. Composition

- Secretary to EAC shall invite sectoral professionals/experts with the approval of the Chairperson.
- The Secretary of each EAC shall be an officer of the level equivalent to or above the level of Director, the MoEF, GoI.
- The suggested model recommended for appraisal committees is a composition of Core expert members and joined by sectoral experts. This means, core group expert members will be common to all the developmental projects in a group, whereas the sectoral experts join the core group when specific sectoral project is being appraised.
- The desired composition of state or central appraisal committee for this sector include following:
  - Environmental management specialist/regulator
  - Steel expert
  - Air and noise quality expert
  - Occupational health
  - Geology/geo-hydrology
  - Ecologist
  - Transportation specialist
  - Safety and health specialist
  - Social scientist
  - Organic chemistry
  - Radioactivity

- Chemical engineer
- Marine Biology, *etc*.

C. Decision-making

The Chairperson reads the recommendations of the Committee and finalizes the draft minutes of the meeting, which are circulated by the Secretary to all the core members and sectoral experts invited to the meeting. Based on the response from the members, the minutes are finalized and signed by the Chairperson. This process for finalization of the minutes should be so organized that the time prescribed for various stages is not exceeded.

D. Operational issues

- Secretary may deal with all correspondence, formulate agenda and prepare agenda notes. Chairperson and other members may act only for the meetings.
- Chairperson of EAC shall be one among the core group having considerable professional experience with proven credentials.
- EAC shall meet at least once every month or more frequently, if so needed, to review project proposals and to offer recommendations for the consideration of the Authority.
- EAC members may inspect the site at various stages *i.e.,* during screening, scoping and appraisal, as per the need felt and decided by the Chairperson of the Committee.
- The MoEF through the Secretary of the Committee may pay/reimburse the participation expenses, honorarium *etc*., to the Chairperson and members.

i. Tenure of EAC

The tenure of Authority/Committee(s) shall be for a fixed period of three years. At the end of the three years period, the Authority and the committees need to be re-constituted. However, staggered appointment dates may be adopted to maintain continuity of members at a given point of time.

ii. Qualifying criteria for nomination of a member to EAC

While recommending nominations and while notifying the members of the Authority and Expert Committees, it shall be ensured that all the members meet the following three criteria:

- Professional qualification
- Relevant experience/Experience interfacing with environmental management
- Absence of conflict of interest

a) Professional qualification

The person should have at least

- 5 years of formal University training in the concerned discipline leading to a MA/MSc Degree, or

- in case of Engineering/Technology/Architecture disciplines, 4 years formal training in a professional training course together with prescribed practical training in the field leading to a B.Tech/B.E./B.Arch. Degree, or
- Other professional degree (e.g. Law) involving a total of 5 years of formal University training and prescribed practical training, or
- Prescribed apprenticeship/articleship and pass examinations conducted by the concerned professional association (e.g. MBA/IAS/IFS).

In selecting the individual professionals, experience gained by them in their respective fields will be taken note of.

b) Relevant experience

- Experience shall be related to professional qualification acquired by the person and be related to one or more of the expertise mentioned for the members of the Core group or the Sectoral Experts. Such experience should be a minimum of 15 years.
- When the experience mentioned in the foregoing sub-paragraph interfaces with environmental issues, problems and their management, the requirement for the length of the experience can be reduced to a minimum of 10 years.

c) Absence of conflict of interest

For the deliberations of the EAC to be independent and unbiased, all possibilities of potential conflict of interests have to be eliminated. Therefore, serving government officers; persons engaged in industry and their associations; persons associated with the formulation of development projects requiring environmental clearance, and persons associated with environmental activism shall not be considered for membership of EAC.

iii. Age

Below 70 years for the members and below 72 years for the Chairperson of the EAC. The applicability of the age is at the time of the Notification of the EAC by the Central Government.

Summary regarding the eligibility criteria for Chairperson and Members of the EAC is given in Table 5-4.

Table 5-3: EAC: Eligibility Criteria for Chairperson/ Members / Secretary

S. No.	Attribute		Requirement		
			Core Members/Sectoral Expert members	Secretary	Chairperson
1	Professional qualification as per the Notification		Compulsory	Compulsory	Compulsory
2	Experience (Fulfilling any one of a, b, c)	a	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification + 15 years of experience in one of the expertise area mentioned in the Appendix VI

S. No.	Attribute		Requirement		
			Core Members/Sectoral Expert members	Secretary	Chairperson
		b	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in the Appendix VI	Professional Qualification +PhD+10 years of experience in one of the expertise area mentioned in Appendix VI
		c	Professional Qualification +10 years of experience in one of the expertise area mentioned in the Appendix VI + 5 years interface with environmental issues, problems and their management	Professional Qualification +10 years of experience in one of the expertise area mentioned in the Appendix VI + 5 years interface with environmental issues, problems and their management	----------
3	Test of independence (conflict of interest) and minimum grade of the Secretary of the Committees		Shall not be a serving government officer Shall not be a person engaged in industry and their associations Shall not be a person associated with environmental activism	In case of EAC, not less than a Director from the MoEF, Government of India	Shall not be a serving government officer Shall not be a person engaged in industry and their associations Shall not be a person associated with environmental activism
4	Age		Below 67 years at the time of Notification of the Committee	As per state Government Service Rules	Below 72 Years at the time of the Notification of the Committee
5	Membership in Core committees		Only one other than this nomination is permitted	Shall not be a member in other SEIAA/EAC/SEAC	Shall not be a member in any other SEIAA/EAC/SEAC
6	Membership of Sectoral Experts		Only three other than this nomination is permitted	Shall not be a member in other SEIAA/EAC/SEAC	
7	Tenure of earlier appointment (continuous)		Only one term before this in continuity is permitted	Not applicable	Only one term before this in continuity is permitted
8	Eminent environmental expertise with understanding on environmental aspects and impacts		Desirable	Not applicable	Compulsory

NOTES:

1. Core members are the members in EAC/SEAC, who are common for all the types of developmental activities, whereas, sectoral expert members will join for the specific developmental sectors. Core members may be limited to about 12.

2. Sectoral expert members: Sectoral Expert members are the members who join the EAC/SEAC, when corresponding sector is being reviewed/appraised. At a given sectoral review, a maximum of three sectoral expert members may join. Therefore the total number of expert members in EAC does not exceed 15.
3. A member after continuous membership in two terms (six years) shall not be considered for further continuation. His/her nomination may be reconsidered after a gap of one term (three years), if other criteria meet.
4. Chairperson/Member (core or sectoral expert) once notified may not be removed prior to the tenure of 3 years with out cause and proper enquiry. A member after continuous membership in two terms (6 years) shall not be considered for further continuation. The same profile may be considered for nomination after a gap three years, i.e., one term if other criteria are meeting.

Other conditions

- Sectoral experts/invitees (not being a member in a Committee) can have membership in not more than four states.
- An expert member of a Committee shall not have membership continuously in the same committee for more than two terms *i.e.,* six years. They can be nominated after a gap of three years, *i.e.,* one term.
- When a member of Committee has been associated with any development project, which comes for environmental clearance, he/she may not participate in the deliberations and the decisions in respect to that particular project.
- At least four members shall be present in each meeting to fulfill the quorum
- If a member does not consecutively attend six meetings, without prior intimation to the Committee his/her membership may be terminated by the Notifying Authority. Prior information for absence due to academic pursuits, career development and national/state-endorsed programmes may be considered as genuine grounds for retention of membership.

ANNEXURE I
Elements in Ship Breaking Process

Elements Involved in Ship Breaking Process

Activity	Process	Permissions	Methods/Procedures	Remarks	Rules/Regulations
Before coming to Shore	Inspection for hazardous materials and other residues based on type of ship	Desk review by Maritime Board and PCB	Hazardous waste Inventory – Hazardous waste handling and disposal plan	Ship owner/ recycler submits ship related documents to Maritime Board 15 days before arrival of the ship	**Guidelines:** 1) International Labor Organization (ILO), 2) International Maritime Organization (IMO), 3) Basel Convention, 4) Supreme Court (SC) **Regulatory Framework:** 1) Hazardous Waste (M & H) Rules for Waste Management, 1989 2) Air (Prevention & Control of Pollution) Act, 1981 3) Water (Prevention & Control of Pollution) Act, 1972 4) Factory Act for Safety and Health related aspects, 5) Explosive Act for Gas Free for Hot Work Conditions, 6) AERB Rules for
At Shore	1) Pilot brings the ship at full speed onto shore and towed in front of appropriate plot based on high tide 2) Pumping out all bilge water and oils into a collection tank for onward transmission for treatment 3)Blocking all intakes and valves 4) Everything that is not fixed or that can be easily removed is extracted by general buyur 5) Ballast water is collected through out the ship breaking process	1) Approval for anchoring from Maritime Board 2) NOC from Customs	1) Operational work procedures/training 2) Plan for removing oil and other sedimants from tanks and cleaning 3) Effect of ballast water at preparation, dismantling and waste stream management phase	1) Operations such as biodegradation of liquid or sludge discards in soils, deposit into landfills, release into water bodies etc, which do not lead to the possibility of recycling, reclamation, direct reuse or alternative uses. 2) Bilge and oil waste water collected through tankers are sent to common incinerators and later sold to processors to separate water and oil 3) Inventory on movable hazardous waste	
Shore to Beach (Inter - tidal zone/Beaching)	1) At every high tide the ship is further moved towards the beach by cranes as it gradually becomes lighter and smaller 2) Scrapping Plan is drawn – determines the structural aspects and the order in which individual parts of the ship are demolished 3) Transportable parts of the ship are stripped and cut/separated into sections from hull 4) Removing all non metal objects	1) Joint inspection by Maritime Board in consultation with PCB, Customs, Explosives department and AERB 2) Clearance for beaching for ships of special concern	1) Material handling equipment 2) Personal Protection equipment 3) Fire fighting equipments in working condition 4) Workers protection from toxic fumes and injuries	1) Recycler submits Ship recycling plan (Ship recycling facility management plan and dismantling plan) and details of plot 2) Ship is still in the sediment flat (far away from beach) in this phase and high tide can move it. 3) The ship must not break apart nor must tilt nor	

	together with potentially explosive materials			topple over. Therefore ships in principle dismantled symmetrically with load bearing parts tackled last. 4) Within four weeks ship losses one third to one half of its volume	Management of Radio Active Wastes, 7) Workers Compensation Act, Labor Laws, 8) GMB Ship Recycling Regulations - 2003, 9) Hon'ble SC's directions – Procedures for Anchoring, Beaching and Breakings and DMP (as per the Draft Convention) 10) Coastal Regulation Zone (CRZ) rules, 1991
Breaking & Cutting	1) The removed material is cut into managable sizes and then extracted and sorted 2) The panels and sections of the ships are cut into small pieces as required using manually operated acetylene cutters 3) The paint chips, which fall inside the ships are packed which can be later sent to the secured landfill for disposal.	1) Decontamination, Hot work and Gas free certification from Department of Explosives, Maritime Board 2) No Objection Certificate from AERB/Naval department in case of war ships, naval ships and large passenger vessels 3) NOC from SPCB for breaking	1) Identification of non breathable places and hazardous waste by DISH 2) Scheme for handling, treating, removing Asbestos, 3) Policy framework focusing on workers safety and protection of environment 4) Dismantling Plan in preparation, dismantling and waste stream management phases 5) Emergency Management Plan	1) Recycler applies for decontamination certificate by submitting dismantling plan and fees 2) Trained workers use masks and eye protection equipment to do the cutting. 3) The cutting of steel plates is done from inside the vessel using gas cutters after scraping of paints along the line of cutting from inside. 4) There is no facility for collection of paint chips on the outer side of the ship which fall on the beach at the time of cutting. 5) Ship is allowed to beach when the breadth of the ship is less than 5 meters of the width of the plot	
Disposal, Recycling, Reuse	1) Storage of solid/ liquid/ hazardous waste 2) Sorted materials are transported to reprocessing facilities /markets, Disposal methods **Disposal:**	1) Estimation of quantities of PCBs and other materials 2) NOC from Maritime Board	1) All type of wastes shold have BIS mark 2) Environmental Management Plan 3) Centralized TSDF 4) Decontamination standards	1) All the hazardous waste generated is transported to Processing facilities provided by Maritime Board and other waste to markets 2) Vehicles should be	

	1) The material extracted and removed from the ship are disposed off at the facilities depending upon its nature and composition of the material 2) Landfillable hazardous waste is sent to the respective landfill and Incinerable wastes are taken to an incineration facility **Remanufacturing/Reprocessing:** A comprehensive part of the waste stream is reprocessed rather than recycled prior to sale such as steel (undamaged plating), oil (lubricating oils), mineral (insulation material), copper (damaged cabling, non – sealable cabling), etc. **Recycling:** Waste obtained from ship dismantling is used as a raw material for steel works and for rolling facilities **Reuse/Resale:** 1) The cables are removed carefully so that they can be reused. 2) The reusable ACMs panels etc which are removed by trained workers (Gudadiwalas) are sent for reuse.			available at work site for transportation of waste, rescue services in case of emergency, etc. 3)Quality of end product in recycling would depend on quality of available scrap, sorting and recycling process	
Monitoring	1) Monitoring should be done at various stages of ship dismantling and 2) Ship recycling operation progress reports should be prepared 3) Performance at various phases	Done by competant authorities - MB/PCB/DISH (Safety officers)	1) Roles and Responsibilities performed by supervisors, contractors and workers 2) Emergency preparedness and response Plan		

	of work 4) Report about emissions, discharges and accidents which cause damage to human health and environment				

Source:

1) Impact & Challenges of a Large Coastal Industry, ASSBY – UNESCO,
2) Steel and Toxic wastes for Asia – Greenpeace
3) SCMC guidelines
4) Report on National and International Framework applicable to Ship Recycling Activities at ASSBY, Gujarat – by Claruslaw Associates
5) Sectoral Activities Programme – An Issue Paper, Workers Safety in Ship Breaking Industries – International Labor Office, Germany
6) Safety and Health in Ship Breaking: Guidelines for Asian Countries andTurkey – Indian Labor Organization (ILO)
7) Comprehensive Code on Ship Recycling Regulation – Supreme Court , September 2007

ANNEXURE II
List of Hazardous Materials and Substances that are Applicable to Ship Breaking

List of Hazardous Materials and Substances that are Applicable to Ship Recycling

Source: "Report of the Committee of Technical Experts on Ship Breaking Activities", Writ Petition No.657 of 1995, MoEF, Supreme Court Monitoring Committee.

Table 1: Hazardous Materials that may be inherent in the Ship Structure

Materials	Possible Location on the Ship
Metal and metal-bearing materials	
Metals consisting of alloys of any of the following:	
Antimony *	alloys with lead in lead-acid storage batteries, solder
Beryllium *	hardening agent in alloys, fuel containers, navigational systems
Cadmium *	bearings
Lead	connectors, couplings, bearings
Mercury	thermometers, bearing pressure sensors
Tellurium *	in alloys
Any of the following:	
Antimony; antimony compounds *	fire retardation in plastics, textiles, rubber etc.,
Cadmium; cadmium compounds	batteries, anodes, bolts and nuts
Lead; lead compounds	batteries, paint coatings, cable insulation
Arsenic; arsenic compound	Paints on the ships' structure
Mercury; mercury compounds	thermometers, light fittings, level switches
Hexavalent chromium compounds	paints (lead chromate) on the ships' structure
Zinc residues, containing lead and cadmium in concentrations sufficient to exhibit-characteristics exceeding norms of Schedule-2 of HW (M & H) Rules.	anodes (Cu, Cd, Pb, Zn)
Lead-acid batteries, whole or crushed	batteries: emergency, radio, fire alarm, start up, lifeboats
** Electrical and electronic assemblies or scrap containing components such as accumulators and other batteries mercury-switches, glass from cathode-ray tubes and other –activated glass and PCB-capacitors, or contaminated with ł constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in HW (M&H) Rules, Schedule-2	level switches, light tubes and fittings (capacitors), electrical cables
Materials containing principally inorganic constituents, which may contain metals and organic materials	
Glass from cathode-ray tubes and other activated glasses	TV and computer screens
Asbestos (dusts and fibres)	thermal insulation, surfacing material, sound insulation

Materials containing principally organic constituents, which may contain metals and inorganic materials	
Mineral oils unfit for their originally intended use	hydraulic fluids, oil sump (engine, lub. oil, gear, separator, etc.), oil tank, residuals (cargo residues)
Non-halogenated organic solvents	antifreeze fluids
Substances and articles containing, consisting of or contaminated with polychlorinated biphenyl (PCB), polychlorinated terphenyl (PCT), polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds, at a concentration level of 50 mg/kg or more	capacitors in light fittings, PCB in oil residuals, gaskets, couplings, wiring (plastics inherent in the ships' structure)
Materials containing either inorganic or organic constituents	
Materials from the production, formulation and use of biocides and phytopharmaceuticals, including pesticides and herbicides which are off-specification, outdated, or unfit for their originally intended use, oils/water, hydrocarbons/water mixtures, emulsions.	paints and rust stabilizers, tin-based anti fouling coatings on ships' bottoms sludge, chemicals in water, tank residuals, bilge water
Materials from the production, formulation and use of inks, dyes, pigments, paints, lacquers, varnish	paints and coatings on the ships' structure
Materials of explosive nature as per HW (M&H) Rules, l989, Schedule-3	compressed gases (acetylene, propane, butane), cargo residues (cargo tanks)
Packages and containers containing substances in concentrations sufficient to exhibit characteristics as per HW (M&H) Rules, Schedule-2	cargo residues

Notes:

* *For specification of wastes, refer Hazardous Waste (Management & Handling) Rule, 1989 and further amendments made in the year 2000 & 2003, notified by MoEF, GoI.*

** *If the component is present it is most likely bound in an alloy or present at a very low concentration.*

Table 2: Hazardous Materials and Substances that may be on Board the Ship

Materials	Product where waste may be found
Unsorted batteries constituents to an extent to render them hazardous	portable radios, torches
Materials non-halogenated organic solvents	solvents and thinners
Materials halogenated organic solvents	solvents and thinners
Materials from the production, preparation and use of pharmaceutical products	miscellaneous medicines
Materials from the production, formulation and use of biocides and phytopharmaceuticals, including waste pesticides and herbicides which are off-specification, outdated, or unfit for their originally intended use.	insecticide sprays
Materials from the production, formulation and use of	paints and coatings

inks, dyes, pigments, paints, lacquers, varnish	
Materials consisting of or containing off specification or outdated chemicals corresponding to categories and exhibiting hazard characteristics as per HW (M&H) Rules, 1989	consumables

Table 3: Other Hazardous Materials that are Relevant to Ship Recycling

Potentially hazardous materials not covered by List A in the Basel Convention	Ship component
CFC (R12 - dichlorodifluoromethane, or R22 - chlorodifluoromethane)	Refrigerants, Styrofoam
Halons	Fire fighting equipment
Radioactive material	Liquid-level indicators, smoke detectors,
	Emergency signs
Microorganisms/ sediments	ballast water systems (incl. tanks)
Fuel oil, diesel oil, gas oil	

ANNEXURE III
Main Items of Ships and Substances of Concern with Disposal Options

Main Items of Ships and Substances of Concern with Disposal Options

Sl. No.	Main items of ship that may contain substances of concern	Substances of Concern	Appropriate Disposal Option (Reuse /Recycle/Incineration/ Treatment & Disposal to secured landfill) of substances of concern
(a)	(b)	(c)	(d)
1.	Electric equipment e.g. transformer, batteries, accumulators	Dielectric fluids containing PCBs	Incineration/Disposal in Secured Landfill after stabilization /solidification
		Lead/electrolyte in unusable batteries	Recycling of Lead through registered recyclers; treatment and disposal of electrolyte
2.	Air conditioners and Refrigeration machines	Residual refrigerants as ODSs	Recovery through authorized units -
		Evaporator dosing /descaling acids	Recovery or treatment and disposal through authorized units /facilities
3.	Tanks	Fuels, lubricants	Reuse, Rerefining/Recycling through Registered recyclers /re-refiners
		Sludge	Recycling by registered recyclers and disposal of residue in authorized facilities
		Oil and grease	Reuse; treatment and disposal of bilge water
		Foreign aquatic organisms in ballast tank sediments	Exchange of ballast water in high seas
4.	Partition walls	ACMs	Reuse;
		Paints containing PCBs, Lead	Disposal in an authorized secured landfill after solidification / stabilization
		Broken pieces containing ACMs	Disposal in an authorized secured landfill after solidification / stabilization
5.	Cables	Cables containing PCBs in insulation	Reuse; disposal of waste cable insulation in an authorized secured landfill after stabilization /solidification
6.	Heat exchangers	Asbestos insulation on surfaces	Disposal of asbestos in an authorized secured landfill after solidification / stabilization
7.	Storage facilities for chemicals	Residues of toxic chemicals / reagents	Incineration/disposal in a secured landfill after treatment.

8.	Stored solvents and other chemical stocks	Residues of toxic chemicals, solvents, thinners, kerosene, white spirit, water treatment chemicals	Incineration; disposal in a secured landfill in case of water treatment chemicals after treatment / stabilization
		Acetylene/ propane/ butane	Incineration
		Miscellaneous medicines	Incineration of unusable medicines
9.	Paint scrap	PCBs, TBT, Lead	Disposal of paint scrap in a secured landfill
10.	Sacrificial anodes	Heavy metals	Disposal in a secured landfill after pre-treatment / for immobilization.
11.	Fire extinguishing and fire fighting equipment	Halons	Recovery and Banking for recycling through authorized facilities
		CO_2 cylinders	Recycle/Reuse
12.	Piping, valves and fittings	Asbestos as insulation/ gaskets	Disposal to SLF after Solidification/stabilization
13.	Pumps and compressors	Asbestos in gaskets	Disposal to SLF after Solidification / Stabilization
14.	Engines and generators	Asbestos insulation	Disposal to SLF after Solidification/stabilization
		Residues of lubricants/ oils/ coolants	Incineration; disposal to SLF after treatment for coolants.
		..... compounds	Treatment and disposal to SLF
15.	Oil sumps	Sediments	Disposal to SLF
16.	Hydraulic system	Residual fluids, Anti freeze fluids	Rerefining through registered/authorized units
17.	Light fittings and fixtures	PCBs	Waste material to SLF
18.	Instruments	Mercury	Recovery by distillation; reuse of recovered mercury, and residue to SLF
		Radioactive materials	Disposal as per AERB norms

Note: Except as specified in Column (d), all items in Column (b) may be recycled / reused.

ANNEXURE IV
Preventive Measures for Environmental Elements of Concern

Preventive Measures for Environmental Elements of Concern

Elements of Concern in repect of Environmental Impacts	Media of Impact	Pathways	Preventive Measures
Asbestos	▪ Air ▪ Water	▪ Both within the yards while handling materials containing asbestos	▪ Wet methods for Extraction, ▪ Consolidation for volume reductions in enclosed chambers, ▪ Removal methods (glove bags, mini enclosures and masks), ▪ Inspection procedures, training requirements ▪ Solidification and stabilization followed by final disposal in secured Landfill
PCB	▪ Air ▪ Soil	▪ Within the yard while handling materials containing PCBs ▪ Within the yard while handling liquid PCBs	▪ Identifying and labeling suspect materials and equipment ▪ Carefully removing all PCB containing materials, and transporting to dedicated area ▪ Disposing in controlled manner ▪ PCB containing materials shall be carefully removed, without use of heat inducing equipment (such as torches) ▪ Keeping fire-extinguishing equipment nearby
Paints	▪ Air ▪ Surface water	▪ Inhalation stripping/removal of particulates ▪ Runoff	▪ Create a separate area for paint-removal operations, with impermeable floor ▪ Collect and contain all solid wastes resulting from paint removal process ▪ Provide adequate storage/disposal facilities ▪ Provide adequate storm water discharge facilities, to avoid contamination of storm water runoff ▪
Metals	▪ Soil	▪ Within the yard and ▪ Marine Environment	▪ Concrete pavement with collection system
	▪ Ground water / Surface water	▪ GW – Seeps in the yard ▪ SW - through runoff	▪ Concrete pavement with collection system
Bilge and Ballast water	▪ Soil ▪ Marine water	▪ Within the yard - Leakage in tanks containing ballast water	▪ Determining pollutant concentrations prior to removal of the water ▪ Adequate containment and pumping equipment

Elements of Concern in repect of Environmental Impacts	Media of Impact	Pathways	Preventive Measures
	▪ Ground and Surface water ▪ Air	▪ Marine Environment ▪ Seepage in the yard and through runoff ▪ ▪ Release of toxic gases into air	▪ Adequate transfer operations facilities ▪ Adequate storage and treatment facilities ▪ Spill cleanup and notification procedures ▪ Spill containment boom ▪ Spill cleanup equipment ▪ Change of ballast water ▪ Use of respiratory equipment (PPEs) ▪ Avoiding the uptake and discharge of ballast water in areas that may directly effect marine environment, ▪ Maintaining clean ballast water tanks, ▪ Disposing sediments on regular basis, ▪ Good housekeeping
Oils and Fuels	▪ Soil ▪ Marine water ▪ Ground and Surface water ▪ Air	▪ Oil spills ▪ Inhalation of toxic gases	▪ Adequate containment and pumping equipment ▪ Adequate Oil transfer facilities ▪ Adequate storage and disposal facilities ▪ Oil spill cleanup and notification procedures ▪ Oil spill containment boom ▪ Oil spill cleanup equipment ▪ Storing oils and fuels in tanks which are free from corrosion, leaks, spills
Radioactive material			

ANNEXURE V
Densities for Different Types of Waste

Densities for Different Types of Waste

Description of waste	Density	Specific Gravity
Asbestos	350	0.35
Glasswool	58	0.06
Sludge residue & Contaminated Materials	1000	1.00
Plastics and cables (with Paint chips)	830	0.83
Rubber	480	0.48
Fiberglass	1600	1.60
Rexene	560	0.56
Iron Scales	7000	7.00
Chicken mesh	1750	1.75
Cardboard and packing material	690	0.69
Glass	2400	2.40
Cement tiles	1450	1.45
Thermacole	19	0.02
MSW landfill	500	0.50

ANNEXURE VI
Legal Instruments

Annexure VI A: Codification of National & International laws/Guidelines relating to Ship Breaking Activities (SCMC)

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
1.0.	**General Provisions**									
1.1	Application/ Scope		Preamble, Ch.1		Ch.I-1	68.H of GFR	Cl.1	1;2	1.2	2.4
1.2	Introduction/ Industry Characteristics/ Background		-do-		-	-	Cl.1	1	2	2.2; 3.4
1.3	Definition/ Glossary		-do-		Ch.I-2	68.H-2 of GFR		3	73-75	Appendix A
1.4	Acronyms		-			-	-			Appendix A
1.5	Reference/ Bibliography		-			-	-		73-80	8/p..95; Appendix C
1.6	Current Practice and Standards on Ship Breaking		-		Ch.II-V	-	Cl. 4 & 5			3.4.2 – 3.4.6
2.0	**Role of Stakeholders & other bodies**									
2.1	Role of Flag State	SMB(GMB)						9.2		
2.2	Role of port state	SMB(GMB)						9.3		
2.3	Role of recycling State	SMB(GMB)						9.4		

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
2.4	Role of National Competent Authority	SMB(GMB)/SPCB/Factory Inspectorate		Ch.XI-FA 112, 113	Ch.VI		Cl. 9		3.1; 3.2	
2.5	Duties of Labour Inspector	DISH		Ch.II 9, FA					3.3	
2.6	Responsibilities of Employers	DISH/ SMB(GMB)		Ch.IV-FA,40 B	Ch.VIII	68-H-23 (as amended in April 2003) GFR	9.9	3.4; 3.9		
2.7	Duties & rights of Workers	SMB(GMB)		Ch.XI-FA, 111A		~~Ch.XI-FA, 111A~~		3.5; 3.6		
2.8	Responsibilities & rights of Contractors	SMB(GMB)						3.8; 3.9		
2.9	Role of the Shipping Indus.	SMB(GMB)					9.8		2.3/pp. 18-19	
2.10	Role of the Ship Recycling Industry	SMB(GMB)/ DISH			Ch.II-V, VII-IX	68 H-3 to 22 GFR	9.9			
5.0	**Preparation of Ship Recycling**									
5.1	Selection of Recycling facilities	SPCB		Ch.IV A – FA 41A			Cl. 1, 3	8.1	2.3.5	
5.2	Ship recycling sale & purchase contracts							9.8.2		3.4.1/pp. 30-31
5.3	Delivery of the ship to recycling facility	SMB(GMB)						8.2		

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
5.4	Ship Recycling Plan	SMB						8.3.2; MEPC / Circ.419	2.3.5.1; 4.3; 7.1.1; 7.1.3 – 7.1.4; 7.1.9; 7.2	
5.5	Preparation of a ship for recycling to prevent pollution	SPCB			Ch. VII		Cl. 6	8.3.1; 8.3.3	7.2.2; 7.3.5	4.1; 5.2
5.6	Preparation of a ship for recycling to protect occupational health and safety	SMB/SPCB				68-H GFR 3-6	Cl. 7	8.3.1; 8.3.4	2.3.5; 7.2.2	4.1; 5.2
6.0.	**OHS in ship scrapping operation**									
6.1	Sequential chain of ship breaking operation	SMB(GMB)							7.1; 7.2	3.4; 4.1
6.2	Disposal and recycling	SPCB	Ch. V – Cl. 24-26 HW (M&H) Rules, 3(8), 5 to 10/ Batteries (Management & Handling) Rule 2001/ ODS (Reg. & Control) Rules	Ch.III-12 FA			Cl.6,			3.4

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
			2000							
6.3	Hazard identification & risk assessment, exposure assessment	DISH, SPCB	MSIHC Rules, Schedule-1				Cl. 8	4.2; 4.4.1	4.4; 7.3	4.2; 4.4
6.4	Review of risk assessment	GMB & DISH (on site)/District Authorities (off-site)					Cl. 8		4.3; 7.4	
6.5	Preventive and protective measures	SPCB, DISH	Ch.V, 24-26 Chp. IV – 22, 22A			Schedule XVII GFR (for asbestos)	Cl. 8		4.4; 7.5; 8	4.4
6.6	Occupational Hazards	DISH							2.4; 7.3	
6.7	Potentially hazardous materials	SPCB	HW (M&H) Rules, 3(14)					Appendix 1; Appendix 2	2.3.2; 7.2.2; 9 Annex IV, p.173 IMO Inventory	4.2
6.8	Processes of removing metals, oil & fuel, bilge and ballast water, paints and coatings, asbestos, PCBS, other waste streams	SPCB. DISH				Sch. XVII GFR (Asbestos)	Cl. 6			4.2; 4.1

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
	and other chemicals									
6.9	OHS Management system	DISH, SPCB					Cl. 7		4	
6.10	Reporting, recording and notification of work related injuries and diseases, ill health and incidents	DISH	MSIHC Rules 4, 5						5	4.5
6.11	Occupational Health Service	DISH							6	
6.12	General preventive and protective measures : Means of access and egress : means of escape in case of fire or other dangers :roadways' quays, yards and other places: housekeeping: scaffolds and ladders :precautions against the fall of persons and materials: fire prevention and fire fighting: signs, notices and colour	DISH	MSIHC Rules, 10		Ch. II-IX				7.1.7; 7.1.8; 7.2.1.2; 7.2.26; 8.2; 8.3; 8.4; 8.5; 8.6; 8.7; 8.8; 8.10	4.1.3

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
	codes: prevention of unauthorized entry									
6.13	Safe working practices and procedures of hat work (hot work safe certification), entry into enclosed spaces onboard ships (gas free certificate) and for avoiding accidental structural collapses	Dept. of Explosives or authorized agency; DISH			Ch. V	68-H 3 to 23 - GFR		9.4.3.2	7.2.2.6; 7.2.3,8.9; 4.2.1;13. 4	4.2.1
6.14	Recommendation for entering enclosed spaces aboard ships	DISH, SMB						Appendix 5	7.2.2.7; 8.9;	4.1
6.15	General provision for the management and assessment of hazardous substances	SPCB	HW (M&H) Rules, 3(x)							4.2;
6.16	Monitoring in the work place for chemical hazard	DISH	MSIHC Rules, Sch.3						9.3	4.3;4.4
6.17	Preventive and protective measures against chemical hazards	DISH	CA (EP, P&R) Rules						9.4	4.4

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
6.18	Chemical safety data sheets	DISH	MSIHC Rules Sch. 9	FA – Ch. IVA – 41F					9.5	
6.19	Workers health surveillance	SMB		FA-Ch. IV A – 41C; Ch. IX – 91A					6.5; 7.1.3; 9.6;10.2. 6;10.3.3; 10.4.2;10 .5.2;10.6	4.1.3
6.20	Surveillance of work environment	SMB, SPCB		Ch. IX – 91;			Cl. 9		6.6; 7.1.5	
6.21	Measures against physical hazards: noise, vibration, optical radiation, heat stress & wet condition, lighting, electricity	DISH							10; 10.2; 10.3; 10.4; 10.5; 10.6; 10.7	4.3
6.22	Measures against biological hazards	SPCB							11	4.2
6.23	Ergonomics and psychological hazards	SMB, DISH							12	
6.24	Safety requirements for tools, machines and equipment; hand and electrical tools, flame cutting and other hot work,	DISH		Ch. IV, FA – 21 to 26; 28 to 40					6.7; 13.1; 13.2; 13.3; 13.4; 13.5; 13.6;	

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
	gas cylinder, power generators, lifting appliances and gear, lifting ropes, transport facilities								13.7; 13.8; 13.9	
6.25	Competence and training; qualification of manager, supervisor, worker, contractor and other third party	SMB				GFR Amendment Rule 2002			8.8; 10.7.7; 11; 14; 14.2; 14.3; 14.4	
6.26	Personal protective equipment and clothing	DISH, SMB			Circular Gmb/Env/23/ Alang-GM/ 11940 dated 17-03-2006				15	5.2
6.27	Contingency and emergency preparedness, first aid, rescue	SMB	MSIHC Rules 13, 14, 15, 16, 17				Cl. 8		4.6; 16	4.5
6.28	Special protection, employment & social insurance, working Hours, night work, child labour,alcohol & drug related	SMB		FA – Ch. VI; Ch. VII					17; 17.2; 17.3; 17.4; 17.5; 17.6	

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
	problem, HV/AIDS									
6.29	Welfare : Drinking water, sanitary & washing facilities, cloak room, shelters and facili-ties for food and drink, housing	SMB		FA – Ch. V	Ch. IX				18	
7	**Environmentally Sound Management (ESM) at ship scrapping facilities**									
7.1	Waste stream	SPCB							7.2.4	2;3.3;3.4; 4.2
7.2	Hazardous substances and other substances of general concern to the environment (types of release)	SPCB								4.2; appendix B
7.3	Monitoring programme for the surrounding ground / groundwater, seawater / sediments and air, noise and vibrations	SPCB								4.3
7.4	Achieving environmentally sound management	SMB & SPCB						9.5.1		6;7.2

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
	ESM									
7.5	Gap analysis and recommendations	SMB & SPCB								7
8	**Design, construction and operation of ship scrapping facilities**									
8.1	Principle types of ship dismantling facilities	SMB								3;4.1;5.1
8.2	Model ship-breaking yard, ship-breaking facility zones and associated activities and hazards	SMB							7.2	1;3;
8.3	Principle hazards and their recurrence and prevention	SMB, SPCB								3.3; 4.2; 5.1; 5.2
8.4	Measures for the prevention or reduction of identified hazards due to oil and fuels, bilge and ballast water, paints and coatings, asbestos, PCBs	SMB, SPCB						9.4.4.2		4.2.2; 5.2
8.5	Design and construction of ship-breaking facility	SMB								5.3

S. No.	Recognized action	Enforcement & Monitoring	Central Law		State Law		CPCB Guidelines	IMO	ILO	BC
			Under EP Act/ Water Act/ Air Act	Factory Act, 1948	GMB Regulations	Gujarat Factories Rules, 1963				
	zones									
8.6	Possible environmental, health and safety problems for ship breaking facility zones	SMB							7.2.4	5.3;

SMB : State Maritime Board
SPCB : State Pollution Control Board
DISH : Directorate of Industrial Safety & Health
GMB : Gujarat Maritime Board
HW (M & H) Rules : Hazardous Waste (Management & Handling) Rules
FA : Factory Act, 1948
MISHC : Manufacture, Storage and Import of Hazardous Chemicals Rules
GFR : Gujarat Factory Rules
ODS : Ozone Depleting Substances

Annexure VI B: A Compilation of Legal Instruments (CPCB)

SL. NO.	LEGAL INSTRUMENT (TYPE, REFERENCE, YEAR)	RESPONSIBLE MINISTRIES OR BODIES	CHEMICAL USE CATEGORIES/ POLLUTANTS	OBJECTIVE OF LEGISLATION	RELEVANT ARTICLES/PROVISIONS
1	Air (Prevention and Control of Pollution) Act, 1981 amended 1987	Central Pollution Control Board and State Pollution Control Boards	Air pollutants from chemical industries	The prevention, control and abatement of air pollution	Section 2: Definitions Section 21: Consent from State Boards Section 22: Not to allow emissions exceeding prescribed limits Section 24: Power of Entry and Inspection Section 25: Power to Obtain Information Section 26: Power to Take Samples Section 37-43: Penalties and Procedures
2	Air (Prevention and Control of Pollution) (Union Territories) Rules, 1983	Central Pollution Control Board and State Pollution Control Boards	Air pollutants from chemical industries	The prevention, control and abatement of air pollution	Rule 2: Definitions Rule 9: Consent Applications
3	Water (Prevention and Control of Pollution) Act, 1974 amended 1988	Central Pollution Control Board and State Pollution Control Boards	Water Pollutants from water polluting industries	The prevention and control of water pollution and also maintaining or restoring the wholesomeness of water	Section 2: Definitions Section 20: Power to Obtain Information Section 21: Power to Take Samples Section 23: Power of Entry and Inspection Section 24: Prohibition on Disposal Section 25: Restriction on New Outlet and New Discharge Section 26: Provision regarding existing discharge of sewage or trade effluent Section 27: Refusal or withdrawal of consent by state boards Section 41-49: Penalties and Procedures
4	Water (Prevention and Control of Pollution) Rules, 1975	Central Pollution Control Board and State Pollution Control Boards	Water Pollutants from water polluting industries	The prevention and control of water pollution and also maintaining or restoring the wholesomeness of water	Rule 2: Definitions Rule 30: Power to take samples Rule 32: Consent Applications

SL. NO.	LEGAL INSTRUMENT (TYPE, REFERENCE, YEAR)	RESPONSIBLE MINISTRIES OR BODIES	CHEMICAL USE CATEGORIES/ POLLUTANTS	OBJECTIVE OF LEGISLATION	RELEVANT ARTICLES/PROVISIONS
5	The Environment (Protection) Act, 1986, amended 1991	Ministry of Environment and Forests, Central Pollution Control Board and State Pollution Control Boards	All types of environmental pollutants	Protection and Improvement of the Environment	Section 2: Definitions Section 7: Not to allow emission or discharge of environmental pollutants in excess of prescribed standards Section 8: Handing of Hazardous Substances Section 10: Power of Entry and Inspection Section 11: Power to take samples Section 15-19: Penalties and Procedures
6	Environmental (Protection) Rules, 1986 (Amendments in 1999, 2001, 2002, 2002, 2002, 2003, 2004)	Ministry of Environment and Forests, Central Pollution Control Board and State Pollution Control Boards	All types of Environmental Pollutants	Protection and Improvement of the Environment	Rule 2: Definitions Rule 3: Standards for emission or discharge of environmental pollutants Rule 5: Prohibition and restriction on the location of industries and the carrying on process and operations in different areas Rule 13: Prohibition and restriction on the handling of hazardous substances in different areas Rule 14: Submission of environmental statement
7	Hazardous Waste (Management and Handling) Rules, 1989 amended 2000 and 2003	MoEF, CPCB, SPCB, DGFT, Port Authority and Customs Authority	Hazardous Wastes generated from industries using hazardous chemicals	Management & Handling of hazardous wastes in line with the Basel convention	Rule 2: Application Rule 3: Definitions Rule 4: Responsibility of the occupier and operator of a facility for handling of wastes Rule 4A: Duties of the occupier and operator of a facility Rule 4B: Duties of the authority Rule 5: Grant of authorization for handling

SL. NO.	LEGAL INSTRUMENT (TYPE, REFERENCE, YEAR)	RESPONSIBLE MINISTRIES OR BODIES	CHEMICAL USE CATEGORIES/ POLLUTANTS	OBJECTIVE OF LEGISLATION	RELEVANT ARTICLES/PROVISIONS
					hazardous wastes Rule 6: Power to suspend or cancel authorization Rule 7: Packaging, labeling and transport of hazardous wastes Rule 8: Disposal sites Rule 9: Record and returns Rule 10: Accident reporting and follow up Rule 11: Import and export of hazardous waste for dumping and disposal Rule 12: Import and export of hazardous waste for recycling and reuse Rule 13: Import of hazardous wastes Rule 14: Export of hazardous waste Rule 15: Illegal traffic Rule 16: Liability of the occupier, transporter and operator of a facility Rule 19: Procedure for registration and renewal of registration of recyclers and re-refiners Rule 20: Responsibility of waste generator
8	Manufacture Storage and Import of Hazardous Chemicals Rules, 1989 amended 2000	Ministry of Environment & Forests, Chief Controller of Imports and Exports, CPCB, SPCB, Chief Inspector of Factories, Chief Inspector of Dock Safety, Chief Inspector of Mines, AERB, Chief Controller of Explosives, District Collector or District Emergency Authority,	Hazardous Chemicals - Toxic, Explosive, Flammable, Reactive	Regulate the manufacture, storage and import of Hazardous Chemicals	Rule 2: Definitions Rule 4: responsibility of the Occupier Rule 5: Notification of Major Accidents Rule 7-8: Approval and notification of site and updating Rule 10-11: Safety Reports and Safety Audit reports and updating Rule 13: Preparation of Onsite Emergency Plan Rule 14: Preparation of Offsite Emergency Plan Rule 15: Information to persons likely to get affected

SL. NO.	LEGAL INSTRUMENT (TYPE, REFERENCE, YEAR)	RESPONSIBLE MINISTRIES OR BODIES	CHEMICAL USE CATEGORIES/ POLLUTANTS	OBJECTIVE OF LEGISLATION	RELEVANT ARTICLES/PROVISIONS
		CEES under DRDO			Rule 16: Proprietary Information Rule 17: Material Safety Data Sheets Rule 18: Import of Hazardous Chemicals
9	Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996	CCG, SCG, DCG, LCG and MAH Units	Hazardous Chemicals - Toxic, Explosive, Flammable, Reactive	Emergency Planning Preparedness and Response to chemical accidents	Rule 2: Definitions Rule 5: Functions of CCG Rule 7: Functions of SCG Rule 9: Functions of DCG Rule 10: Functions of LCG
10	EIA Notification, 1994	MoEF, SPCB	Chemicals/pollutants expected to be generated from industrial activities	Requirement of environmental clearance before establishment of or modernization / expansion of certain type of industries/ projects.	Rule 2: Requirements and procedure for seeking environmental clearance of projects
11	Batteries (Management and Handling) Rules, 2001.	SPCB, CPCB and MoEF	Lead Acid Batteries	To control the hazardous waste generation (lead waste) from used lead acid batteries	Rule 2: Application Rule 3: Definitions Rule 4: Responsibilities of manufacturer, importer, assembler and re-conditioner Rule 5: Registration of Importers Rule 7: Responsibilities of dealer Rule 8: Responsibilities of recycler Rule 9: Procedure for registration / renewal of registration of recyclers Rule 10: Responsibilities of consumer or bulk consumer Rule 11: Responsibilities of auctioneer Rule 14: Computerization of Records and Returns
12	Public Liability Insurance Act, 1991 amended 1992	Ministry of Environment & Forests, District Collector	Hazardous Substances	To provide immediate relief to persons affected by accident involving hazardous substances	Section 2: Definitions Section 3: Liability to give relief in certain cases on principle of no fault Section 4: Duty of owner to take out

SL. NO.	LEGAL INSTRUMENT (TYPE, REFERENCE, YEAR)	RESPONSIBLE MINISTRIES OR BODIES	CHEMICAL USE CATEGORIES/ POLLUTANTS	OBJECTIVE OF LEGISLATION	RELEVANT ARTICLES/PROVISIONS
					insurance policy Section 7A: Establishment of Environmental Relief Fund Section 14-18: Penalties and Offences
13	Public Liability Insurance Rules, 1991 amended 1993	Ministry of Environment & Forests, District Collector	Hazardous Substances	To provide immediate relief to persons affected by accident involving hazardous substances and also for Establishing an Environmental Relief fund	Rule 2: Definitions Rule 6: Establishment of administration of fund Rule 10: Extent of liability Rule 11: Contribution of the owner to environmental relief fund
14	Factories Act, 1948	Ministry of Labour, DGFASLI and Directorate of Industrial Safety and Health/Factories Inspectorate	Chemicals as specified in the Table	Control of workplace environment, and providing for good health and safety of workers	Section 2: Interpretation Section 6: Approval, licensing and registration of factories Section 7A: General duties of the occupier Section 7B: General duties of manufacturers etc., as regards articles and substances for use in factories Section 12: Disposal of wastes and effluents Section 14: Dust and fume Section 36: Precautions against dangerous fumes, gases, etc. Section 37: Explosion or inflammable dust, gas, etc. Chapter IVA: Provisions relating to Hazardous processes Section 87: Dangerous operations Section 87A: Power to prohibit employment on account of serious hazard Section 88: Notice of certain accident Section 88A: Notice of certain dangerous occurrences Chapter X: Penalties and procedures

SL. NO.	LEGAL INSTRUMENT (TYPE, REFERENCE, YEAR)	RESPONSIBLE MINISTRIES OR BODIES	CHEMICAL USE CATEGORIES/ POLLUTANTS	OBJECTIVE OF LEGISLATION	RELEVANT ARTICLES/PROVISIONS
15	The Explosives Act, 1884	Ministry of Commerce and Industry (Department of Explosives)	Explosive substances as defined under the Act	To regulate the manufacture, possession, use, sale, transport, export and import of explosives with a view to prevent accidents	Section 4: Definition Section 6: Power for Central government to prohibit the manufacture, possession or importation of especially dangerous explosives Section 6B: Grant of Licenses
16	The Explosive Rules, 1983	Ministry of Commerce and Industry and Chief Controller of Explosives, port conservator, customs collector, railway administration	Explosive substances as defined under the Act	To regulate the manufacture, possession, use, sale, transport, export and import of explosives with a view to prevent accidents	Rule 2: Definition Chapter II: General Provisions Chapter III: Import and Export Chapter IV: Transport Chapter V: Manufacture of explosives Chapter VI: Possession sale and use Chapter VII: Licenses
17	The Gas Cylinder Rules, 2004	Ministry of Commerce and Industry and Chief Controller of Explosives, port conservator, customs collector, DGCA, DC, DM, Police (sub inspector to commissioner)	Gases (Toxic, non toxic and non flammable, non toxic and flammable, Dissolved Acetylene Gas, Non toxic and flammable liquefiable gas other than LPG, LPG	Regulate the import, storage, handling and transportation of gas cylinders with a view to prevent accidents	Rule 2: Definition Chapter II: General Provisions Chapter III: Importation of Cylinder Chapter IV: Transport of Cylinder Chapter VII: Filling and Possession
18	The Custom Act, 1962	CBEC, Ministry of Finance	Hazardous Goods	To prevent entry of illegal hazardous goods or banned goods including hazardous or banned chemicals	Section 2: definitions Section 11: Power to Prohibit Importation or Exportation of Goods
19	The Merchant Shipping Act, 1958 amended in 2002 and 2003	Ministry of Shipping, Road Transport and Highways	All packaged cargo including Dangerous and hazardous goods as defined in the rules	For safe handling and transportation of cargo including dangerous goods to prevent accident	Section 3: Definitions Section 331: Carriage of Dangerous Goods
20	Merchant Shipping	Ministry of Shipping,	All packaged cargo	For safe handling and	

SL. NO.	LEGAL INSTRUMENT (TYPE, REFERENCE, YEAR)	RESPONSIBLE MINISTRIES OR BODIES	CHEMICAL USE CATEGORIES/ POLLUTANTS	OBJECTIVE OF LEGISLATION	RELEVANT ARTICLES/PROVISIONS
	(carriage of Cargo) Rules 1995	Road Transport and Highways	including Dangerous and hazardous goods as defined in the rules	transportation of cargo including dangerous goods to prevent accident	
21	The Indian Port Act, 1908	Ministry of Shipping, Road Transport and Highways	All Chemicals - handling and storage	For control of activities on ports including safety of shipping and conservation of ports	Section 2: Definitions Chapter IV: Rules for the safety of shipping and the conservation of ports Chapter VII: Provisions with respect to penalties
22	The Dock Workers, (Safety, Health and Welfare) Act, 1986	Ministry of Labour, DGFASLI and Directorate of Dock Safety	All Chemicals termed as dangerous goods	Safety of Dock workers including handling of dangerous goods	
23	The Dock Workers, (Safety, Health and Welfare) Rules, 1990	Ministry of Labour, DGFASLI and Directorate of Dock Safety	All Chemicals termed as dangerous goods	Safety of Dock workers including handling of dangerous goods	

Annexure VI C: Ship Breaking Activities and Enforcing Agencies (SCMC)

S. No.	Activity	Enforcement Authority/ Implementing agency
1.	**Assessment of Hazardous Wastes/Substances for Consideration of Anchoring Permission:**	
	a) Ships of Special Concern: In addition to identification of types of hazardous wastes and materials and their locations, a fair judgment of quantities involved (including residual radiation level in case of nuclear powered ships) also to be provided for desk review.	SMB, SPCB, Customs, AERB where necessary
	b) Other ships: Identification of types of hazardous wastes and materials and their location in the ship	SMB, SPCB, Customs
2.	**Activities During Pre-recycling Phase:**	
	Recommended procedure as per Fig. 3.1. to be followed for granting permission for anchoring, beaching/docking and breaking.	SMB, SPCB, Customs, DoE
	Verification of hazardous materials/wastes by way of inspection of the ship at anchoring	SMB, SPCB, Customs
	Gas Free and Fit for Hot Working Certificate: (a) In case of oil tankers, certificate in respect of oil cargo tanks and slop tanks to be provided before beaching (b) for others, certificate covering all storage tanks to be provided after beaching and prior to breaking	DoE or an agency duly authorized/recognized
	In addition to other documents as required at present, ship dismantling plan and recycling facility management plan also to be submitted after beaching and before dismantling	SMB
	Authorization of the Ship recycling facility at the plot	SMB
	Personnel involved in ship recycling processes are trained and aware of HSE (health, safety and environmental) hazards	SMB
	Adequate emergency response procedures in place and to be verified	SPCB, DISH
	All hazardous materials are marked by the recycler and verified after beaching and prior to breaking	SMB, SPCB
	Verification of non-breathable spaces identified	SMB, DISH
	Availability of material handling equipment and PPEs to be ensured	SMB/ DISH.
	Procedures for handling of hazardous wastes and other wastes must be approved	SPCB
3.	**Occupational Safety & Health (OSH) Management Practices:**	
	Establishment of Occupational Safety and Health (OSH) management system and implementation of appropriate preventive and protective measures to reduce hazards and	

	risks to the minimum practicable level in conformity with the Factories Act	SMB, DISH
	Specifications to be laid down for PPEs	Bureau of Indian Standards (BIS)
	Adequate and competent supervision of work and work practices by engaging a qualified safety officer.	SMB, DISH
	Instruction of appropriate OSH education and training to workers at regular intervals.	SMB
	Issuing of separate work permits for risky jobs	SMB
	Workers showing radiological abnormalities suggestive of asbestosis to be subjected to HRCT	SMB
4.	**Institutional Issues:**	
	Review Role and Functioning of SMB (Internally)	SMB
	(i) Constitute 'Ship Breaking Industry Review Committee' under the aegis of SMB with participation of stake holders, SPCB, Customs and other Inspecting Authorities, (ii) evolve an alternate management structure with the help of a Management Institute and (iii) implement alternate management structure	SMB, SPCB
	Progressively encourage ship breaking yards to obtain ISO 9000 & 14000 Certification and OSHA 18000	Ship Recycler
	SPCB to evolve scheme of incentives for reduced number of inspections for ISO/OSHA certified recyclers	SPCB
	Development of Training Modules for ship breaking activities in association with DG shipping	SMB
	Training of SMB/SPCB personnel and others responsible for overseeing/supervising ship breaking	SMB, SPCB
	Recycler to provide PPEs to inspectors and personnel of SMB/SPCB visiting ship breaking yards	Ship Recycler
	Induction of Professionals with experience in ship breaking/ship repairs for approval and ensuring compliance with ship breaking plans.	SMB
	Number of DISH inspectors to be increased to three	Department of Labour
	A few scientists of SPCB to be trained in use of radiation survey instruments	SPCB
	Setting up of an inter-departmental Committee at the State level to follow up on recommendations of IMC	Government of Gujarat
5.	**Handling of Hazardous Material and Hazardous Wastes:**	
	Exchange of ballast water at high seas	Master of vessel
	Land based or mobile oil water separation facility (centralized) for treatment of bilge water	SMB
	Oil sediment removal system using detergents and high pressure jets	Ship Recycler/Private Service Provider
	On shore enclosures for removal of asbestos as per BIS Specifications	Ship Recycler/ Service Provider
	Removal of asbestos waste on board from ships of special concern where asbestos/ACMs quantities are the Special Concern, using enclosed chambers under negative pressure	Ship Recycler/Service Provider

	and providing masks under positive pressure to workers (or masks/respirators as per BIS Specifications); On board removal of asbestos for other ships may be done by wetting surfaces.	
	Centralized Facility for removal of paints and coatings from the surfaces	SMB/Ministry of Steel/Private Investor
	Manifest system for disposal of hazardous waste in Secured Landfill	SPCB/Ship recycler
6.	**Environmental Monitoring:**	
	Ambient Air Quality Monitoring:	
	a) Air Quality Monitoring to be done at two locations as per NAMP protocol with additional parameters - Volatile Organic Compounds (VOCs), metals (Pb, Sn, and Cd in particulates & gaseous form), and asbestos fibres to be monitored once a month for a period of one year.	SPCB
	Monitoring of Sea water and sediment quality:	
	a) Monitoring of seawater quality every quarter for toxic organic parameters, namely, PAH and PCBs in addition to pH, Colour, Odour, Suspended solids, turbidity, Oil & Grease, DO, BOD, Heavy metals, Pb, Cd, Zn, Ni, Cr, Dissolved Iron, Dissolved Manganese, Fecal Coliform up to a distance of five KMs in grid size of 1 KM X 1 KM for a period of one year	SPCB
	b) To assess every quarter bioaccumulation in locally available sea fish for PCBs, PAH, Hg and Pb for a period of one year	SPCB
	c) Sediment to be analyzed every quarter for additional parameters namely, PAH, PCBs and biocides (TBT) besides metals for a period of one year.	SPCB
	Ground Water Monitoring	
	The groundwater samples should be collected every quarter at a minimum of five locations and analyzed for pH, Colour, SS, TDS, DO, BOD, COD, O & G, metals (Pb, Cd, Cu, Zn, Cr, Hg, Ni), CN, F, As and Mn for a period of one year.	SPCB
7.	**Workers' Welfare Issues**	
	To provide on rental basis to workers housing facilities with provision for drinking water, sanitation, electricity and shopping	SMB/Agency Authorized by SMB
	Adequate urinals, WCs, bathing places, rest rooms and supply of drinking water at individual plots.	Recyclers
	Development of OHS centre with facility of burn wards and maintenance of health register and availability of medicines and life saving drugs	SMB/Service Provider
	Health awareness and education programmes for workers and studies to be undertaken to assess correlation between occupational risk factors and health status of workers	SMB
	Registration System and linked facilities/benefits to workers and maintenance of database.	SMB/Service Provider

Note:

Immediate : within three months
Short-Term : within six months
Medium-Term : within two years
Long-Term : within five years

ANNEXURE VII
Form 1 (Application Form for Obtaining EIA Clearance)

FORM 1

(I) BASIC INFORMATION

S. No.	Item	Details
1.	Name of the project/s	
2.	S.No. in the schedule	
3.	Proposed capacity/area/length/tonnage to be handled/command area/lease area/number of wells to be drilled	
4.	New/Expansion/Modernization	
5.	Existing Capacity/Area etc.	
6.	Category of Project i.e., 'A' or 'B'	
7.	Does it attract the general condition? If yes, please specify.	
8.	Does it attract the specific condition? If yes, Please specify.	
9.	Location	
	Plot/Survey/Khasra No.	
	Village	
	Tehsil	
	District	
	State	
10.	Name of the applicant	
11.	Registered Address	
12.	Address for correspondence:	
	Name	
	Designation (Owner/Partner/CEO)	
	Address	
	Pin Code	
	E-mail	
	Telephone No.	
	Fax No.	
13.	Details of alternative Sites examined, if any location of these sites should be shown on a toposheet.	Village-District-State 1. 2. 3.

S. No.	Item	Details
14.	Interlined Projects	
15.	Whether separate application of interlined project has been submitted	
16.	If yes, date of submission	
17.	If no, reason	
18.	Whether the proposal involves approval/clearance under: The Forest (Conservation) Act, 1980 The Wildlife (Protection) Act, 1972 The C.R.Z. Notification, 1991	
19.	Forest land involved (hectares)	
20.	Whether there is any litigation pending against the project and/or land in which the project is propose to be set up Name of the Court Case No. Orders/directions of the Court, if any and its relevance with the proposed project.	

(II) ACTIVITY

1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)		
1.2	Clearance of existing land, vegetation and buildings?		
1.3	Creation of new land uses?		
1.4	Pre-construction investigations e.g. bore houses, soil testing?		
1.5	Construction works?		

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.6	Demolition works?		
1.7	Temporary sites used for construction works or housing of construction workers?		
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations		
1.9	Underground works including mining or tunneling?		
1.10	Reclamation works?		
1.11	Dredging?		
1.12	Offshore structures?		
1.13	Production and manufacturing processes?		
1.14	Facilities for storage of goods or materials?		
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?		
1.16	Facilities for long term housing of operational workers?		
1.17	New road, rail or sea traffic during construction or operation?		
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?		
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?		
1.20	New or diverted transmission lines or pipelines?		
1.21	Impoundment, damming, culverting, realignment or other changes to the hydrology of watercourses or aquifers?		
1.22	Stream crossings?		
1.23	Abstraction or transfers of water form ground or surface waters?		
1.24	Changes in water bodies or the land surface affecting drainage or run-off?		
1.25	Transport of personnel or materials for construction, operation or decommissioning?		

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.26	Long-term dismantling or decommissioning or restoration works?		
1.27	Ongoing activity during decommissioning which could have an impact on the environment?		
1.28	Influx of people to an area in either temporarily or permanently?		
1.29	Introduction of alien species?		
1.30	Loss of native species or genetic diversity?		
1.31	Any other actions?		

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S.No.	Information/checklist confirmation	Yes/No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)		
2.2	Water (expected source & competing users) unit: KLD		
2.3	Minerals (MT)		
2.4	Construction material – stone, aggregates, sand / soil (expected source – MT)		
2.5	Forests and timber (source – MT)		
2.6	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)		
2.7	Any other natural resources (use appropriate standard units)		

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S.No	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)		
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)		
3.3	Affect the welfare of people e.g. by changing living conditions?		
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,		
3.5	Any other causes		

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes		
4.2	Municipal waste (domestic and or commercial wastes)		
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)		
4.4	Other industrial process wastes		
4.5	Surplus product		
4.6	Sewage sludge or other sludge from effluent treatment		
4.7	Construction or demolition wastes		
4.8	Redundant machinery or equipment		

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.9	Contaminated soils or other materials		
4.10	Agricultural wastes		
4.11	Other solid wastes		

5. Release of pollutants or any hazardous, toxic or noxious substances to air (kg/hr)

S.No	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources		
5.2	Emissions from production processes		
5.3	Emissions from materials handling including storage or transport		
5.4	Emissions from construction activities including plant and equipment		
5.5	Dust or odours from handling of materials including construction materials, sewage and waste		
5.6	Emissions from incineration of waste		
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)		
5.8	Emissions from any other sources		

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers		
6.2	From industrial or similar processes		
6.3	From construction or demolition		
6.4	From blasting or piling		
6.5	From construction or operational traffic		
6.6	From lighting or cooling systems		
6.7	From any other sources		

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S.No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials		
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)		
7.3	By deposition of pollutants emitted to air into the land or into water		
7.4	From any other sources		
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?		

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S.No	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances		
8.2	From any other causes		
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?		

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

S. No.	Information/Checklist confirmation	Yes/No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.1	Lead to development of supporting facilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: ▪ Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) ▪ housing development ▪ extractive industries ▪ supply industries ▪ other		
9.2	Lead to after-use of the site, which could have an impact on the environment		
9.3	Set a precedent for later developments		
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects		

(III) ENVIRONMENTAL SENSITIVITY

S.No.	Areas	Name/ Identity	Aerial distance (within 15 km.) Proposed project location boundary
1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value		
2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests		
3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration		
4	Inland, coastal, marine or underground waters		
5	State, National boundaries		
6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas		
7	Defence installations		
8	Densely populated or built-up area		
9	Areas occupied by sensitive man-made land uses *(hospitals, schools, places of worship, community facilities)*		
10	Areas containing important, high quality or scarce resources *(ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)*		
11	Areas already subjected to pollution or environmental damage. *(those where existing legal environmental standards are exceeded)*		
12	Areas susceptible to natural hazard which could cause the project to present environmental problems (*earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions*)		

(IV) PROPOSED TERMS OF REFERENCE FOR EIA STUDIES

"I hereby given undertaking that the data and information given in the application and enclosure are true to the best of my knowledge and belief and I am aware that if any part of the data and information submitted is found to be false or misleading at any stage, the project will be rejected and clearance give, if any to the project will be revoked at our risk and cost.

Date:_____
Place:_____

Signature of the applicant
With Name and Full Address
(Project Proponent / Authorized Signatory)

NOTE:

1. The projects involving clearance under Coastal Regulation Zone Notification, 1991 shall submit with the application a C.R.Z. map duly demarcated by one of the authorized, agencies, showing the project activities, w.r.t. C.R.Z. and the recommendations of the State Coastal Zone Management Authority. Simultaneous action shall also be taken to obtain the requisite clearance under the provisions of the C.R.Z. Notification, 1991 for the activities to be located in the CRZ.
2. The projects to be located within 10km of the National Parks, Sanctuaries, Biosphere Reserves, Migratory Corridors of Wild Animals, the project proponent shall submit the map duly authenticated by Chief Wildlife Warden showing these features vis-à-vis the project location and the recommendations or comments of the Chief Wildlife Warden thereon."

ANNEXURE VIII
Pre-Feasibility Report

PRE-FEASIBILITY REPORT

Environmental Aspects

- Details of ecologically-sensitive areas like tropical forests, biosphere reserves, national park, sanctuaries, important lakes, endangered species of flora & fauna and distance from site *etc*.
- Places of archaeological importance, river, streams, estuary, sea, hills/mountains *etc*.
- Places of historical, cultural, religious or tourist importance, defense installation.
- Location details
  - State/District/Village ,
  - Longitude & Latitude
  - Nearest town & distance, nearby industries (cement, power, *etc*)
  - Approach to Site
  - Rail: Nearest Rail Head & Distance
  - Road: Existing Highway/roads distance from site
  - Distance from nearest airport (existing/proposed)
  - Distance from big cities.
  - Distance from nearest waterways
  - Constraints if any to approach site particularly for construction materials, plants and equipments, *etc*. and indicate requirement of bridges, *etc*.
- Land Availability
  - Extent of land available for ship-scrapping, temporary storage facilities and disposal of materials from scrapping, *etc*.
  - Land use pattern (agricultural, barren, forest, *etc*).
  - Land ownership (Govt. Pvt., tribal, non-tribal, *etc*.)
  - Prevailing land cost details
  - Estimation of population affected, Homestead Oustees, Land Ownership Details
  - Description of model facility in the yard

Project Details

- General
- Topography of the area
- Ground profile and levels Permanent features
- Soil Condition Soil investigation results
- Site Data: Whether the site is flood prone & HFL of the site
- Existence of mines and present & future development activity/proposal
- Drainage patterns
- Water Information to be furnished by owner
- Source of Circulating/Consumptive water
- Location in relation to River/Canal/Dam, water availability and quality
- Opportunity rationale – Availability of ships for scrapping
- Project description in brief
- Proposed Business Legal Status
- Project Capacity and Rationale – Capacity or the number of ships in Ship breaking site and number of plots in the site

- Project Investment – Rough estimates on project cost, capital costs running costs and recurring costs
- Output products – Based on the type of ship
- Rejects Management (Provision of waste disposal options for all kinds of waste like hazardous waste, bilge and ballast water, *etc*.)
- Recommended project parameters – Capacity of the site, workforce, financial analysis, technology, site selection,
- Proposed location – tidal difference, stable weather conditions, labor cost, infrastructure, natural calamities, *etc*.
- Approved water allocation quota (Drinking, Irrigation and Industrial use) and surplus availability
- Inter-State Issue, if any
- Transportation arrangement contemplated: Fuel Transportation
- Source of potable water
- Source of availability of construction material like sand, brick, stone chips, borrow earth, *etc*.
- Proximity to infrastructure facilities (Hospital, Schools, Residential accommodation) available nearby
- Location & vicinity plan identifying the areas proposed for hazardous waste disposal

Techno-Economic Feasibility Aspects

- Land availability & its development
- General Layout
- Rehabilitation & Resettlement issue
- Access to site for Transportation of equipments/construction machinery, wastes, scrap material, *etc*
- Water availability for drinking
- Fuel availability for transportation of waste and scrap
- Environmental and forest aspects
- Ultimate yard capacity, which could be set up

Technical Profile of the Project

- Technical parameters of the yard & equipment.
- Meteorological data like temp., humidity, rainfall, wind pressure & wind direction.
- Seismological studies of project specific design seismic parameters.
- Project implementation schedule showing various activities.
- Environmental, health and safety measures

Justification of the Project

- Current Demand Scenario for scrapping
- Alternatives to meet the demand and
- Post Project scenario on Residual Demand

Project(s) Capacity

- Number of ships that can be accommodated in the yard for scrapping
- Sustainability of the yard
- Optimization of yard capacity

Site Selection

- Options considered for sites
- Basis of site selection and analysis
- Infrastructure availability at selected site
- Scope of Geo-technical studies/bathymetric studies

Future Prospects

- Ascertain the costs and benefits of the proposed activity
- Technical and logistic constraints/ requirements of project sustainability

Project Design/Technology

- Document broad specifications for the proposed ship breaking yard including but not limited to:
  - Ship breaking Outputs - Scrap, steel, hazardous and non-hazardous waste
  - Equipment used in handling huge parts of the ship,
  - Equipment used for cutting and breaking operations
  - General layout of the ship breaking unit
  - Facilities in each individual unit
  - Safety measures during operation
- Details of Socio-economic Consequences
- Corporate Responsibility
- Employment and infrastructure added in the district
- Status of land availability, current and post-project land use variation
- Socio-economic impact analysis

Project Schedule

- Outline project implementation and procurement arrangement including contract packaging and a project implementation schedule.

Crucial Factors in Decision-making for Investment

- Demand for steel and other reusable items
- Running costs
  - Labor costs
  - Waste disposal costs
  - Costs implied by regulation
  - Import duties, levies and taxes
  - Capital costs
  - Infrastructure
  - Exchange rates

Sector and Industry Analysis

- Demand and supply

- Supply – Future earning potential, cost of keeping the ship in operation, age profile of existing fleet, size of the current fleet, regulatory issues
- Demand – Sale of Steel and other reusable items, running cost, capital cost

Market Information

- Market dynamics - freight rates, phase-out schemes, fluctuations in steel prices, health, safety and environment regulation, market interactions
- Global ship breaking market

Ship Breaking Process

- Acquisition of the vessel based on LDT
- Beaching
- Scrapping
- Products obtained after scrapping
- Problems and hazards in ship breaking
- Guidelines and preventive measures
- Machinery and equipment

The above listing is not exhaustive. Thus the proponent may provide additional necessary information, felt appropriate, to include in the pre-feasibility study report in support of selecting the site for the proposed developmental activities. The EAC during scrutiny, may specifically ask for any additional information/ data required to substantiate the requirement to prescribe the ToR for EIA studies. However, it is to make clear that all the required further information by EAC shall be mentioned in one single letter, within the prescribed time.

ANNEXURE IX
Types of Monitoring and Network Design Considerations

TYPES OF MONITORING AND NETWORK DESIGN CONSIDERATIONS

A. Types of Monitoring

Monitoring refers to the collection of data using a series of repetitive measurements of environmental parameters (or, more generally, to a process of systematic observation). The environmental quality monitoring programme design will be dependent upon the monitoring objectives specified for the selected area of interest. The main types of EIA monitoring activities are:

- Baseline monitoring is the measurement of environmental parameters during the pre-project period for the purpose of determining the range of variation of the system and establishing reference points against which changes can be measured. This leads to the assessment of the possible (additional available) assimilative capacity of the environmental components in pre-project period w.r.t. the standard or target level.
- Effects monitoring is the measurement of environmental parameters during project construction and implementation to detect changes which are attributable to the project to provide the necessary information to:
  - verify the accuracy of EIA predictions; and
  - determine the effectiveness of measures to mitigate adverse effects of projects on the environment.
  - Feedback from environmental effect monitoring programs may be used to improve the predictive capability of EIAs and also determine whether more or less stringent mitigation measures are needed
- Compliance monitoring is the periodic sampling or continuous measurement of environmental parameters to ensure that regulatory requirements and standards are being met.

Compliance and effects monitoring occurs during the project construction, operation, and abandonment stages. The resources and institutional set-up should be available for the monitoring at these stages. All large-scale construction projects will require some construction stage monitoring. To control the environmental hazards of construction as specified in the EIA, a monitoring program should be established to ensure that each mitigation measure is effectively implemented. There are numerous potential areas for monitoring during operations.

The scope of monitoring topics discussed in this chapter is limited to Baseline and Effects monitoring. In addition, this chapter will also discuss the Compliance monitoring during the construction phase. Post-project monitoring requirements are discussed in the EMP.

Before any field monitoring tasks are undertaken there are many institutional, scientific, and fiscal issues that must be addressed in the implementation of an environmental monitoring program. Careful consideration of these issues in the design and planning stages will help avoid many of the pitfalls associated with environmental monitoring programs. Although these issues are important but the discussions here are confined to the monitoring network design component.

B. Network Design

Analysis of Significant Environmental Issues

At the outset of planning for an environmental monitoring network, the EIA manager may not know exactly what should be monitored, when monitoring should begin, where it should monitor, which techniques should be employed, and who should take responsibility for its conduct. Because there are usually a number of objective decisions associated with network design to be made, it is important to start with an analysis of environmental issues. The scoping phase of an EIA is designed to identify and focus on the major issues. Scoping should provide a valuable source of information on the concerns that need to be addressed by the monitoring network design. These are project specific as well as specific to the environmental setting of the location where the project is proposed to be located

Hence, the network designs are associated with questions like:

- What are the expected outputs of the monitoring activity?
- Which problems do we need to address to? *etc*.

Defining the output will influence the design of the network and optimize the resources used for monitoring. It will also ensure that the network is specially designed to optimize the information on the problems at hand

What to Monitor?

The question of what to monitor is associated with the identification of VECs.

VECs are generally defined as environmental attributes or components of the environment that are valued by society as identified during the scoping stage of the project. They are determined on the basis of perceived public concerns. For example, changes to water quality and quantity could have implications on fish by affecting habitat, food supply, oxygen, and contaminant uptake. Similarly, employment and business, and economies are both VECs that serve as pathways.

The choice of VECs is also related to the perceived significant impact of the project implementation on important environmental components. In general, the significance or importance of environmental components is judged based on:

- legal protection provided (for example, rare and endangered species)
- political or public concerns (for example, resource use conflicts and sustainable development)
- scientific judgment (for example, ecological importance); or
- commercial or economic importance

However, in addition to their economic, social, political or ecological significance, the chosen VEC should also have unambiguous operational ease, be accessible to prediction and measurement; and be susceptible to hazard. Once the VECs are defined, the VECs may be directly measured (for example, extent of habitat for an endangered species). In cases where it is impossible or impractical to directly measure the VECs, the chosen measurement endpoints or environmental indicators must correspond to, or be predictive of assessment endpoints.

The chosen environmental indicators must be: 1) measurable; 2) appropriate to the scale of disturbance/ contamination; 3) appropriate to the impact mechanism; 4) appropriate

and proportional to temporal dynamics; 5) diagnostic; and 6) standardized; as well as have: 1) a low natural variability; 2) a broad applicability; and 3) an existing data series.

Where, How and How Many Times to Monitor?

These are the other components of Monitoring Network Design. These questions are best answered based on local field conditions, capacity and resources available, prevailing legal and regulatory priorities, *etc*. For this, screening or reconnaissance surveys of the study area are also necessary. This may also include some simple inexpensive measurements and assimilative/dispersion modeling. The data will give some information on the prevailing special and temporal variations, and the general background air pollution in the area. The number of monitoring stations and the indicators to be measured at each station in the final permanent network may then be decided upon based on the results of the screening study as well as on the knowledge of the sources of the proposed development and prevailing local environmental/meteorological conditions. The best possible definition of the air pollution problem, together with the analysis of the resources: personnel, budget and equipment available, represent the basis for the decision on the following questions:

- What spatial density (number) of sampling stations is required? How many samples are needed and during what period (sampling (averaging) time and frequency)?
- Where should the stations be located?
- What kind of equipment should be used?
- What additional background information is needed?
  - meteorology
  - topography
  - population density
  - emission sources and emission rates
  - effects and impacts
- How will the data be made available/communicated?

C. Site Selection

When considering the location of individual samplers, it is essential that the data collected are representative for the location and type of area without the undue influence from the immediate surroundings. In any measurement point in the study area the total ambient concentration is the representative of:

- natural background concentration
- regional background
- impact of existing large regional sources such as Industrial emissions

To obtain the information about the importance of these different contributions it is therefore necessary to locate monitoring stations so that they are representative for different impacts. In addition to the ambient pollution data, one would often need other data governing the variations such as meteorological data for air pollution, to identify and quantify the sources contributing to the measurements.

ANNEXURE X
Guidance for Assessment of Baseline Components and Attributes

GUIDANCE FOR ASSESSMENT OF BASELINE COMPONENTS AND ATTRIBUTES

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
A. Air				
▪ Meteorological ▪ Wind speed ▪ Wind direction ▪ Dry bulb temperature ▪ Wet bulb temperature ▪ Relative humidity ▪ Rainfall ▪ Solar radiation ▪ Cloud cover	Minimum 1 site in the project impact area requirements Other additional site(s) are require depending upon the model applied or site sensitivities	Min: 1 hrly observations from continuous records	Mechanical / automatic weather station Rain gauge As per IMD As per IMD	IS 5182 Part 1-20 Sit-specific primary data is essential Secondary data from IMD, New Delhi for the nearest IMD station
Pollutants ▪ SPM ▪ RSPM ▪ SO2 ▪ NO2 ▪ Asbestos (parameters are given in ToR for EIA based on nature of project, raw material & process technology, location-nature/activities within of air	10 to 15 locations in the project impact area	24 hrly twice a week 8 hrly twice a week 24 hrly twice a week	▪ Gravimetric (High – Volume) ▪ Gravimetric (High – Volume with Cyclone) ▪ EPA Modified West & Gaeke method ▪ Arsenite Modified Jacob & Hochheiser ▪ NDIR technique ▪ Methylene-blue ▪ Nessler's Method ▪ Infra Red analyzer ▪ Specific Ion meter	**Monitoring Network** Minimum 2 locations in upwind side, more sites in downwind side / impact zone All the sensitive receptors need to be covered **Measurement Methods** As per CPCB standards for NAQM, 1994

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
B. Noise				
Hourly equivalent noise levels	Same as for Air Pollution along with others Identified in study area	At lest one day continuous in each season on a working and non-working day	Instrument : Sensitive Noise level meter (preferably recording type)	Min: IS: 4954- 1968 as adopted by CPCB
Hourly equivalent noise levels	Inplant (1.5 m from machinery or high emission processes)	Same as above for day and night	Instrument : Noise level meter	CPCB / OSHA
Hourly equivalent noise levels	Highways (within 500 metres from the road edge)	Same as above for day and night	Instrument : Noise level meter	CPCB / IS : 4954-1968
Peak particle velocity	150- 200m from blast site	Based on hourly observations	PPV meter	
C. Land Environment				
▪ Soil ▪ Particle size distribution ▪ Texture ▪ pH ▪ Electrical conductivity ▪ Caution exchange capacity ▪ Alkali metals ▪ Sodium Absorption Ratio (SAR) ▪ Permeability ▪ Porosity	One surface sample from each landfill and/or hazardous waste site (if applicable) and prime villages, (soil samples be collected as per BIS specifications) in the study area	Season-wise	Collected and analyzed as per soil analysis reference book, M.I.Jackson and soil analysis reference book by C.A. Black	The purpose of impact assessment on soil (land environment) is to assess the significant impacts due to leaching of wastes or accidental releases and contaminating

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
Land Use/Landscape				
▪ Location code ▪ Total project area ▪ Topography ▪ Drainage (natural) ▪ Cultivated, forest plantations, water bodies, roads and settlements	At least 20 points along with plant boundary and general major land use categories in the study area. `	Drainage once in the study period and land use categories from secondary data (local maps) and satellite imageries	Global positioning system Topo-sheets Satellite Imageries (1:25,000) Satellite Imageries (1:25,000)	Drainage within the plant area and surrounding is very important for storm water impacts. From land use maps sensitive receptors (forests, parks, mangroves *etc*.) can be identified
D. Solid Waste				
Quantity				
▪ Based on waste generated from per unit production ▪ Per capita contribution ▪ Collection, transport and disposal system ▪ Process Waste ▪ Quality (oily, chemical, biological)	For green field unites it is based on secondary data base of earlier plants.	Process wise or activity wise for respective raw material used. Domestic waste depends upon the season also	Guidelines IS 9569 : 1980 IS 10447 : 1983 IS 12625 : 1989 IS 12647 : 1989 IS 12662 (PTI) 1989	
▪ General segregation into biological/organic/inert/hazardous ▪ Loss on heating ▪ pH ▪ EC ▪ Calorific value, metals etc.	Grab and Composite samples	Process wise or activity wise for respective raw material used. Domestic waste depends upon the season also	Analysis IS 9334 : 1979 IS 9235 : 1979 IS 10158 : 1982	

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
Quality				
▪ Permeability And porosity ▪ Moisture pH ▪ Electrical conductivity ▪ Loss on ignition ▪ Total nitrogen ▪ Caution exchange capacity ▪ Particle size distribution ▪ Heavy metal ▪ Ansonia	Grab and Composite samples. Recyclable components have to analyzed for the recycling requirements	Process wise or activity wise for respective raw material used.	Analysis IS 9334 : 1979 IS 9235 : 1979 IS 10158 : 1982	Impacts of hazardous waste should be performed critically depending on the waste characteristics and place of discharge. For land disposal the guidelines should be followed and impacts of accidental releases should be assessed
E. Biological Environment				
Aquatic ▪ Primary productivity ▪ Aquatic weeds ▪ Enumeration of ▪ phytoplankton, zooplankton and benthos ▪ Fisheries ▪ Diversity indices ▪ Trophic levels ▪ Rare and endangered species ▪ Sanctuaries / closed areas / Coastal regulation zone (CRZ) ▪ Terrestrial	Considering probable impact, sampling points and number of samples to be decided on established guidelines on ecological studies based on site eco-environment setting within 10/25 km radius from the proposed site Samples to collect from upstream and downstream of	Season changes are very important	Standards techniques (APHA et. Al. 1995, Rau and Wooten 1980) to be followed for sampling and measurement	Seasonal sampling for aquatic biota One season for terrestrial biota, in addition to vegetation studies during monsoon season Preliminary assessment Microscopic analysis of plankton and meiobenthos, studies of macrofauna, aquatic vegetation and application of indices,

Attributes	Sampling		Measurement Method	Remarks
	Network	Frequency		
▪ Vegetation – species, list, economic importance, forest produce, medicinal value ▪ Importance value index (IVI) of trees ▪ Wild animals	discharge point, nearby tributaries at down stream, and also from dug wells close to activity site			viz. Shannon, similarity, dominance IVI, *etc* Point quarter plot-less method (random sampling) for terrestrial vegetation survey.
Avifauna ▪ Rare and endangered species ▪ Sanctuaries / National park / Biosphere reserve	For forest studies, chronic as well as short-term impacts should be analyzed warranting data on micro climate conditions			Secondary data to collect from Government offices, NGOs, published literature Plankton net Sediment dredge Depth sampler Microscope Field binocular
F. Socio-economic				
▪ Demographic structure ▪ Infrastructure resource base ▪ Economic resource base ▪ Health status: Morbidity pattern ▪ Cultural and aesthetic attributes	Socio-economic survey is based on proportionate, stratified and random sampling method	Different impacts occurs during construction and operational phases of the project	Primary data collection through R&R surveys (if require) or community survey are based on personal interviews and questionnaire	Secondary data from census records, statistical hard books, toposheets, health records and relevant official records available with Govt. agencies

* Project Specific

ANNEXURE XI
Sources of Secondary Data Collection

Annexure XIA: Potential Sources of Data For EIA

	Information	Source
	Air Environment	
1.	Meteorology- Temperature, Rainfall, Humidity, Inversion, Seasonal Wind rose pattern (16 point compass scale), cloud cover, wind speed, wind direction, stability, mixing depth	⑨ Indian Meteorology Department, Pune
2.	Ambient Air Quality- 24 hourly concentration of SPM, RPM, SO_2, NO_x, CO	⑨ Central Pollution Control Board (CPCB), ⑨ State Pollution Control Board (SPCB), ⑨ Municipal Corporations ⑨ Ministry of Environment and Forests (MoEF) ⑨ State Department of Environment (DoEN)
	Water Environment	
3.	Surface water- water sources, water flow (lean season), water quality, water usage, Downstream water users Command area development plan Catchment treatment plan	⑨ Central Water Commission (CWC), ⑨ Central Pollution Control Board (CPCB), ⑨ State Pollution Control Board (SPCB), Central Water and Power Research Institute (CWPRS), Pune ⑨ State Irrigation Department ⑨ Hydel Power generation organizations such as NHPC, State SEBs
4.	Ground Water- groundwater recharge rate/withdrawal rate, ground water potential groundwater levels (pre monsoon, post monsoon), ground water quality, changes observed in quality and quantity of ground water in last 15 years	⑨ Central Ground Water Board (CGWB) ⑨ Central Ground Water Authority (CGWA) ⑨ State Ground Water Board (SGWB) ⑨ National Water Development Authority (NWDA)
5.	Coastal waters- water quality, tide and current data, bathymetry	⑨ Department of Ocean Development, New Delhi ⑨ State Maritime Boards ⑨ Naval Hydrographer's Office, Dehradun ⑨ Port Authorities ⑨ National Institute of Oceanography (NIO), Goa
	Biological Environment	
6.	Description of Biological Environment- inventory of flora and fauna in 7 km radius, endemic species, endangered species, Aquatic Fauna, Forest land, forest type and density of vegetation, biosphere, national parks, wild life sanctuaries, tiger reserve, elephant reserve, turtle nesting ground, core zone of biosphere reserve, habitat of migratory birds, routes of migratory birds	⑨ District Gazetteers ⑨ National Remote Sensing Agency (NRSA), Hyderabad ⑨ Forest Survey of India, Dehradun ⑨ Wildlife Institute of India ⑨ World Wildlife Fund ⑨ Zoological Survey of India ⑨ Botanical Survey of India ⑨ Bombay Natural History Society, (BNHS), Mumbai ⑨ State Forest Departments ⑨ State Fisheries Department ⑨ Ministry of Environment and Forests ⑨ State Agriculture Departments ⑨ State Agriculture Universities
	Land Environment	
7.	Geographical Information-Latitude, Longitude, Elevation (above MSL)	⑨ Toposheets of Survey of India, Pune ⑨ National Remote Sensing Agency (NRSA), Hyderabad ⑨ Space Application Centre (SAC), Ahmedabad

	Information	Source
8.	Nature of Terrain, topography map indicating contours (1:2500 scale)	⑨ Survey of India Toposheets ⑨ National Remote Sensing Agency (NRSA), Hyderabad ⑨ State Remote Sensing Centre, ⑨ Space Application Centre (SAC), Ahmedabad
9.	Hydrogeology- Hydrogeological report (in case of ground water is used/area is drought prone/wastewater is likely to discharged on land) Geomorphological analysis (topography and drainage pattern) Geological analysis (Geological Formations/Disturbances- geological and structural maps, geomorphological contour maps, structural features, including lineaments, fractures, faults and joints) Hydrogeological analysis (disposition of permeable formations, surface-ground water links, hydraulic parameter determination etc) Analysis of the natural soil and water to assess pollutant absorption capacity	⑨ NRSA, Hyderbad ⑨ Survey of India Toposheets ⑨ Geological Survey of India ⑨ State Geology Departments ⑨ State Irrigation Department ⑨ Department of Wasteland Development, Ministry of Rural Areas ⑨ National Water Development Authority (NWDA)
10.	Nature of Soil, permeability, erodibility classification of the land	⑨ Agriculture Universities ⑨ State Agriculture Department ⑨ Indian Council for Agriculture Research ⑨ State Soil Conservation Departments ⑨ National Bureau of Soil Survey and Landuse Planning ⑨ Central Arid Zone Research Institute (CAZRI), Jodhpur
11.	Landuse in the project area and 10 km radius of the periphery of the project	⑨ Survey of India- Toposheets ⑨ All India Soil and Landuse Survey; Delhi ⑨ National Remote Sensing Agency (NRSA), Hyderabad ⑨ Town and County Planning Organisation ⑨ State Urban Planning Department ⑨ Regional Planning Authorities (existing and proposed plans) ⑨ Village Revenue Map- District Collectorate ⑨ Directorate of Economics and Statistics-State Government ⑨ Space Application Centre, Ahmedabad
12.	Coastal Regulation Zones- CRZMP, CRZ classification, Demarcation of HTL and LTL*	⑨ Urban Development Department ⑨ State Department of Environment ⑨ State Pollution Control Board ⑨ Space Application Centre* ⑨ Centre for Earth Sciences Studies, Thiruvanthapuram* ⑨ Institute of Remote Sensing, Anna University Chennai* ⑨ Naval Hydrographer's Office, Dehradun* ⑨ National Institute of Oceanography, Goa* ⑨ National Institute of Ocean Technology, Chennai ⑨ Centre for Earth Science Studies

* *Agencies authorized for approval of demarcation of HTL and LTL*

	Information	Source
	Social	
13.	Socioeconomic - population, number of houses and present occupation pattern within 7 km from the periphery of the project	⑨ Census Department ⑨ District Gazetteers- State Government ⑨ District Statistics- District Collectorate ⑨ International Institute of Population Sciences, Mumbai (limited data) ⑨ Central Statistical Organisation
14.	Monuments and heritage sites	District Gazetteer Archeological Survey of India, INTACH District Collectorate Central and State Tourism Department State Tribal and Social Welfare Department
	Natural Disasters	
15.	Seismic data (Mining Projects)- zone no, no of earthquakes and scale, impacts on life, property existing mines	⑨ Indian Meteorology Department, Pune ⑨ Geological Survey of India
16.	Landslide prone zone, geomorphological conditions, degree of susceptibility to mass movement, major landslide history (frequency of occurrence/decade), area affected, population affected	⑨ Space Application Centre
17.	Flood/cyclone/droughts- frequency of occurrence per decade, area affected, population affected	⑨ Natural Disaster Management Division in Department of Agriculture and Cooperation ⑨ Indian Meteorological Department
	Industrial	
18.	Industrial Estates/Clusters, Growth Centres	⑨ State Industrial Corporation ⑨ Industrial Associations ⑨ State Pollution Control Boards ⑨ Confederation Indian Industries (CII) ⑨ FICCI
19.	Physical and Chemical properties of raw material and chemicals (Industrial projects); fuel quality	⑨ Material and Safety Data Sheets ⑨ ENVIS database of Industrial Toxicological Research Centre, Lucknow ⑨ Indian Institute Petroleum
20.	Occupational Health and Industrial Hygiene- major occupational health and safety hazards, health and safety requirements, accident histories	⑨ Central Labour Institute, Mumbai ⑨ Directorate of Industrial Safety ⑨ ENVIS Database of Industrial Toxicological Research Centre, Lucknow ⑨ National Institute of Occupational Health, Ahmedabad
21.	Pollutant release inventories (Existing pollution sources in area within 10 km radius)	⑨ Project proponents which have received EC and have commenced operations
22.	Water requirement (process, cooling water, DM water, Dust suppression, drinking, green belt, fire service)	⑨ EIA Reports ⑨ National and International Benchmarks

Annexure XIB: Summary of Available Data with Potential Data Sources for EIA

	Agency	Information Available
1.	Archaeological Survey of India Department of Culture Government of India Janpath, New Delhi - 110011 Asi@del3.vsnl.net.in	⑨ Inventory of monuments and sites of national importance- Listing and documentation of monuments according to world heritage, pre historic, proto historic and secular, religious places and forts
2.	Botanical Survey Of India P-8, Brabourne Road Calcutta 700001 Tel#033 2424922 Fax#033 2429330 Email: envis@cal2.vsnl.net.in. . RO - Coimbatore, Pune, Jodhpur, Dehradun, Allahabad, Gantok, Itanagar, Port Blair	⑨ Photodiversity documentation of flora at National, State and District level and flora of protected areas, hotspots, fragile ecosystems, sacred groves etc ⑨ Identification of threatened species including endemics, their mapping, population studies ⑨ Database related to medicinal plants, rare and threatened plant species ⑨ Red data book of Indian plants (Vol 1,2, and 3) ⑨ Manual for roadside and avenue plantation in India
3.	Bureau of Indian Standards Manak Bhawan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002 Tel#3230131, 3233375, 3239402 (10 lines) Fax : 91 11 3234062, 3239399, 3239382 Email- bis@vsnal.com	⑨ Bureau of Indian Standards Committees on Earthquake Engineering and Wind Engineering have a Seismic Zoning Map and the Wind Velocity Map including cyclonic winds for the country
4.	Central Water Commission (CWC) Sewa Bhawan, R.K.Puram New Delhi - 110066 cmanoff@niccwc.delhi.nic.in RO- Bangalore, Bhopal, Bhubaneshwar, Chandigarh, Coimbatore/Chennai, Delhi, Hyderabad, Lucknow, Nagpur, Patna, Shillong, Siliguri and Vadodara	⑨ Central Data Bank -Collection, collation and Publishing of Hydrological, Hydrometeorological, Sediment and Water Quality data-. ⑨ Basin wise Master Plans ⑨ Flood atlas for India ⑨ Flood Management and Development and Operation of Flood Forecasting System- CWC operate a network of forecasting stations Over 6000 forecasts are issued every year with about 95% of the forecasts within the permissible limit. ⑨ Water Year Books, Sediment Year Books and Water Quality Year Books. ⑨ Also actively involved in monitoring of 84 identified projects through National, State and Project level Environmental Committees for ensuring implementation of environmental safeguards
5.	Central Ground Water Board (HO) N.H.IV, New CGO Complex, Faridabad - 121001 RO - Guwahati, Chandigarh, Ahemadabad, Trivandrum, Calcutta, Bhopal, Lucknow, Banglore, Nagpur, Jammu, Bhubneshwar, Raipur, Jaipur, Chennai, Hyderabad, Patna	⑨ surveys, exploration, monitoring of ground water development

[16] *Based on web search and literature review*

6.	Central Pollution Control Board Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, DELHI - 110 032 INDIA E-mail : cpcb@alpha.nic.in	⑨ National Air Quality Monitoring Programme ⑨ National River Water Quality Monitoring Programme- Global Environment Monitoring , MINARS ⑨ Zoning Atlas Programme ⑨ Information on 17 polluting category industries (inventory, category wise distribution, compliance, implementation of pollution control programmes
7.	Central Arid Zone Research Institute, Jodhpur Email : cazri@x400.nicgw.nic.in Regional Centre at Bhuj in Gujarat	⑨ AGRIS database on all aspects of agriculture from 1975 to date ⑨ Also have cell on Agriculture Research Information System; ⑨ Working on ENVIS project on desertification ⑨ Repository of information on the state of natural resources and desertification processes and their control ⑨ The spectrum of activities involves researches on basic resource inventories; monitoring of desertification, rehabilitation and management of degraded lands and other areas
8.	Central Inland Capture Fisheries Research Institute, Barrackpore-743101, Tel#033-5600177 Fax#033-5600388 Email : cicfri@x400.nicgw.nic.in	⑨ Data Base on Ecology and fisheries of major river systems of India. Biological features of commercially important riverine and estuarine fish species. Production functions and their interactions in floodplain wetlands. ⑨ Activities - Environmental Impact Assessment for Resource Management ; Fisheries Resource surveys
9.	Central Institute of Brackish Water Aquaculture 141, Marshalls Road, Egmore , Chennai - 600 008, Tel# 044-8554866, 8554891, Director (Per) 8554851 Fax#8554851,	⑨ Repository of information on brackish water fishery resources with systematic database of coastal fishery resources for ARIS ⑨ Agricultural Research Information System (ARIS) database covers State wise data on soil and water quality parameters, land use pattern, production and productivity trends, ⑨ Social, economic and environmental impacts of aquaculture farming, ⑨ Guidelines and effluent standards for aquaculture farming
10.	Central Marine Fisheries Research Institute (CMFRI), Cochin	⑨ Assessing and monitoring of exploited and un-exploited fish stocks in Indian EEZ ⑨ Monitoring the health of the coastal ecosystems, particularly the endangered ecosystems in relation to artisanal fishing, mechanised fishing and marine pollution ⑨ The institute has been collecting data on the catch and effort and biological characteristics for nearly half a century based on scientifically developed sampling scheme, covering all the maritime States of the country ⑨ The voluminous data available with the institute is managed by the National Marine Living Resources Data Centre (NMLRDC)
11.	Central Water and Power Research Station, Pune Tel#020-4391801-14; 4392511; 4392825 Fax #020-4392004,4390189	⑨ Numerical and Physical models for hydro-dynamic simulations
12.	Central Institute of Road Transport, Bhosari, Pune 411 026, India. Tel : +91 (20) 7125177, 7125292, 7125493, 7125494	⑨ Repository of data on all aspects of performance of STUs and a host of other related road transport parameters

13.	Department of Ocean Development	⑨ Assessment of environment parameters and marine living resources (primary and secondary) in Indian EEZ (Nodal Agency NIO Kochi) ⑨ Stock assessment, biology and resource mapping of deep sea shrimps, lobsters and fishes in Indian EEZ (Nodal agency-Fisheries Survey of India) ⑨ Investigations of toxical algal blooms and benthic productivity in Indian EEZ (Nodal agency- Cochin University of Science and technology) ⑨ Coastal Ocean Monitoring and Prediction System (COMAP) - monitoring and modelling of marine pollution along entire Indian coast and islands. Parameters monitored are temp, salinity, DO, pH, SS, BOD, inorganic phosphate, nitrate, nitrite, ammonia, total phosphorus, total nitrite, total organic carbon, petroleum hydrocarbons, pathogenic vibros, pathogenic E.coli, shigella, salmonella, heavy metals (Cd, Hg, Pb) and pesticide residues (DDT, BHC, Endosulfan). Monitoring is carried out along the ecologically sensitive zones and urban areas (NIO Mumbai- Apex coordinating agency). ⑨ Sea Level Measurement Programe (SELMAM)- sea level measurement at selected stations (Porbandar, Bombay, Goa, Cochin, Tuticorin, Madras, Machilipatnam, Visakhapatnam, Paradeep, Calcutta and Kavaratti (Lakshadweep Island)) along Indian coast and islands using modern tide gauges ⑨ Detailed coastal maps through Survey of India showing contour at 1/2 a metre interval in the scale of 1:25000. (Nellore- Machhalipatnam work already over) ⑨ Marine Data Centre (MDC) IMD for Ocean surface meteorology, GSI for marine geology, SOI for tide levels, Naval Hydrographic Office for bathymetry, NIO Goa for physical chemical and biological oceanography, NIO Mumbai for marine pollution, CMFRI for coastal fisheries, Institute of Ocean Management Madras for coastal geomorphology ⑨ DOD has setup Indian National Centre for Ocean Information Services (INCOIS) at Hyderabad for generation and dissemination of ocean data products (near real time data products such as sea surface temperature, potential fishing zones, upwelling zones, maps, eddies, chlorophyll, suspended sediment load etc). MDC will be integrated with INCOIS ⑨ Integrated Coastal and Marine Area Management (ICMAM) programme - GIS based information system for management of 11 critical habitats namely Pichavaram, Karwar, Gulf of Mannar, Gulf of Khambat, Gulf of Kutch, Malvan, Cochin, Coringa mangroves, Gahirmata, Sunderbans and Kadamat (Lakshadeep) ⑨ Wetland maps for Tamil Nadu and Kerala showing the locations of lagoons, backwaters, estuaries, mudflats etc (1:50000 scale) ⑨ Coral Reef Maps for Gulf of Kachch, Gulf of Mannar, Andaman and Nicobar and Lakshadeep Islands (1:50,000 scale) indicating the condition of corals, density etc
14.	Environment Protection Training and Research Institute Gachibowli, Hyderabad - 500 019, India Phone: +91-40-3001241, 3001242, 3000489 Fax: +91-40- 3000361 E-mail: info@eptri.com	⑨ Environment Information Centre- has appointed EPTRI as the Distributed Information Centre for the Eastern Ghats region of India. EIC Collaborates with the Stockholm Environment Institute Sweden Database on Economics of Industrial Pollution Prevention in India Database of Large and Medium Scale Industries of Andhra Pradesh Environmental Status of the Hyderabad Urban Agglomeration Study on 'water pollution-health linkages' for a few Districts of A.P

		⑨ Environment Quality Mapping Macro level studies for six districts in the State of Andhra Pradesh Micro level studies for two study zones presenting the permissible pollutant load and scoping for new industrial categories Zonation of the IDA, Parwada which helped APIIC to promote the land for industrial development Disaster management plan for Visakhapatnam Industrial Bowl Area
15.	Forest Survey of India (FSI) Kaulagarh Road, P.O., IPE Dehradun - 248 195 Tel# 0135-756139, 755037, 754507 Fax # 91-135-759104 E-Mail : fsidir@nde.vsnl.net.in fsihq@nde.vsnl.net.in RO- Banglore, Calcutta, Nagpur and Shimla	⑨ State of Forest Report (Biannual) ⑨ National Forest Vegetation Map (Biannual exercise) (on 1: 1 million scale) ⑨ Thematic mapping on 1:50,000 scale depicting the forest type, species composition, crown density of forest cover and other landuse National ⑨ Basic Forest Inventory System ⑨ Inventory survey of non forest area ⑨ Forest inventory report providing details of area estimates, topographic description, health of forest, ownership pattern, estimation of volume and other growth parameters such as height and diameter in different types of forest, estimation of growth, regeneration and mortality of important species, volume equation and wood consumption of the area studied
16.	Geological Survey of India 27 Jawaharlal Nehru Road, Calcutta 700 016, India Telephone +91-33-2496941 FAX 91-33-2496956 gsi_chq@vsnl.com	⑨ Environmental hazards zonation mapping in mineral sector ⑨ Codification of base line information of geo-environmental appreciation of any terrain and related EIA and EMP studies ⑨ Lineament and geomorphological map of India on 1:20,000 scale. ⑨ Photo-interpreted geological and structural maps of terrains with limited field checks.
17.	Indian Council of Agriculture Research, Krishi Bhawan, New Delhi, Tel#011-338206 – ICAR complex, Goa- Agro metrology – Central Arid Zone Research Institute- Agro forestry – Central Soil salinity Research Institute, – Indian Institute of Soil Science – Central Soil and Water Conservation Research and Training Institute – National Bureau of Soil Survey and Landuse Planning	⑨ A total of 80,000 profiles at 10 kms grid across the country were analyzed to characterize the soils of India. ⑨ Detailed soil maps of the Country (1:7 million), State (1:250,000) and districts map (1:50,000) depicting extent of degradation (1:4.4 millions) have been prepared. ⑨ Thematic maps depicting soil depth, texture drainage, calcareousness, salinity, pH, slope and erosion have been published ⑨ Agro-climate characterization of the country based on moisture, thermal and sunshine regimes ⑨ Agro-ecological zones (20) and sub-zones (60) for the country were delineated based on physiography, soils, climate, Length of Growing Period and Available Water Content, and mapped on 1:4.4 million scale. ⑨ Digitization of physiography and soil resource base on 1:50,000 scale for 14 States have been completed. ⑨ .Soil fertility maps of N,P,K,S and Zn have also been developed ⑨ Water quality guidelines for irrigation and naturally occurring saline/sodic water ⑨ Calibration and verification of ground water models for predicting water logging and salinity hazards in irrigation commands
18.	Indian Bureau of Mines Indira Bhawan, Civil Lines Nagpur Ph no - 0712-533 631, Fax- 0712-533 041	⑨ National mineral inventory for 61 minerals and mineral maps ⑨ Studies on environmental protection and pollution control in regard to the mining and mineral beneficiation operations ⑨ Collection, processing and storage of data on mines, minerals and mineral-based industries, collection and maintenance of world mineral intelligence, foreign mineral legislation and other related matters

19.	Indian Meteorology Department Shivaji nagar, Pune 41100 RO- Mumbai, Chennai, Calcutta, New Delhi, Nagpur, Guwahati	⑨ Meteorological data ⑨ Background air quality monitoring network under Global Atmospheric Watch Programme (operates 10 stations) ⑨ Seismicity map, seismic zoning map; seismic occurrences and cyclone hazard monitoring; list of major earthquakes ⑨ Climatological Atlas of India , Rainfall Atlas of India and Agroclimatic Atlas of India ⑨ Monthly bulletin of Climate Diagnostic Bulletin of India ⑨ Environmental Meteorological Unit of IMD at Delhi to provide specific services to MoEF
20.	INTACH Natural Heritage, 71 Lodi Estate, New Delhi-110 003 Tel. 91-11-4645482, 4632267/9, 4631818, 4692774, 4641304 Fax : 91-11-4611290 E-mail : nh@intach.net	⑨ Listing and documentation of heritage sites identified by municipalities and local bodies (Listing excludes sites and buildings under the purview of the Archaeological Survey of India and the State Departments of Archaeology)
21.	Industrial Toxicology Research Centre Post Box No. 80, Mahatma Gandhi Marg, Lucknow-226001, Phone: +91-522-221856,213618,228227; Fax : +91-522 228227 Email: itrc@itrcindia.org	⑨ Activities include health survey on occupational diseases in industrial workers, air and water quality monitoring studies, ecotoxicological impact assessment, toxicity of chemicals, human health risk assessment ⑨ Five databases on CD-ROM in the area of environmental toxicology viz: TOXLINE, CHEMBANK, POISINDEX, POLTOX and PESTBANK. The Toxicology Information Centre provides information on toxic chemicals including household chemicals ⑨ ENVIS centre and created a full-fledged computerized database (DABTOC) on toxicity profiles of about 450 chemicals
22.	Indian Institute of Forest Management Post Box No. 357, Nehru Nagar Bhopal - 462 003 Phone # 0755-575716, 573799, 765125, 767851 Fax # 0755-572878	⑨ Consultancy and research on joint forest management (Ford Foundation, SIDA, GTZ, FAO etc)
23.	Indian Institute of Petroleum Mohkampur , Dehradun, India, 248005 0135- 660113 to 116 0135- 671986	⑨ Fuel quality characterisation ⑨ Emission factors
24.	Ministry of Environment and Forest	⑨ Survey of natural resources ⑨ National river conservation directorate ⑨ Environmental research programme for eastern and western ghats ⑨ National natural resource management system ⑨ Wetlands conservation programme- survey, demarcation, mapping landscape planning, hydrology for 20 identified wetlands National ⑨ wasteland identification programme
25.	Mumbai Metropolitan Regional Development Authority	⑨ Mumbai Urban Transport Project ⑨ Mumbai Urban Development Project ⑨ Mumbai Urban Rehabilitation Project ⑨ Information on MMR; statistics on councils and corporations Regional ⑨ Information Centre- Basic data on population, employment, industries and other sectors are regularly collected and processed

26.	Municipal Corporation of Greater Mumbai	⑨ Air Quality Data for Mumbai Municipal Area ⑨ Water quality of lakes used for water supply to Mumbai
27.	Ministry of Urban Development Disaster Mitigation and Vulnerability Atlas of India Building Materials & Technology Promotion Council G-Wing,Nirman Bhavan, New Delhi-110011 Tel: 91-11-3019367 Fax: 91-11-3010145 E-Mail: bmtpc@del2.vsnl.net.in	⑨ Identification of hazard prone area ⑨ Vulnerability Atlas showing areas vulnerable to natural disasters ⑨ Land-use zoning and design guidelines for improving hazard resistant construction of buildings and housing ⑨ State wise hazard maps (on cyclone, floods and earthquakes)
28.	Natural Disaster Management Division in Department of Agriculture and Cooperation	⑨ Weekly situation reports on recent disasters, reports on droughts, floods, cyclones and earthquakes
29.	National Bureau Of Soil Survey & Land Use Planning P.O. Box No. 426, Shankar Nagar P.O., Nagpur-440010 Tel#91-712-534664,532438,534545 Fax#:91-712-522534 RO- Nagpur, New Delhi, Banglore, Calcutta, Jorhat, Udaipur	⑨ NBSS&LUP Library has been identified as sub centre of ARIC (ICAR) for input to AGRIS covering soil science literature generated in India ⑨ Research in weathering and soil formation, soil morphology, soil mineralogy, physicochemical characterisation, pedogenesis, and landscape-climate-soil relationship. ⑨ Soil Series of India- The soils are classified as per Soil Taxonomy. The described soil series now belong to 17 States of the country. ⑨ Landuse planning- watershed management, land evaluation criteria, crop efficiency zoning ⑨ Soil Information system is developed state-wise at 1:250,000 scale. Presently the soil maps of all the States are digitized, processed and designed for final output both digital and hardcopy. The thematic layers and interpreted layers of land evaluation (land capability, land irrigability and crop suitability), Agro-Ecological Zones and soil degradation themes are prepared. ⑨ Districts level information system is developed for about 15 districts at 1: 50, 000 scale. The soil information will be at soil series level in this system. Soil resource inventory of States, districts water-sheds (1:250,000; 1:50,000; 1:10,000/8000)
30.	National Institute of Ocean Technology, Velacherry-Tambaram main road Narayanapuram Chennai, Tamil Nadu Tel#91-44-2460063 / 2460064/ 2460066/ 2460067 Fax#91-44-2460645	⑨ Waste load allocation in selected estuaries (Tapi estuary and Ennore creek) is one the components under the Integrated Coastal and Marine Area Management (ICMAM) programme of the Department of Ocean Development ICMAM is conducted with an IDA based credit to the Government of India under the Environmental Capacity Building project of MoEF (waste assimilation capacity of Ennore creek is over) ⑨ Physical oceanographic component of Coastal & Ocean monitoring Predictive System (COMAPS) a long term monitoring program under the Department of Ocean Development ⑨ Identification of suitable locations for disposal of dredge spoil using mathematical models & environmental criteria ⑨ EIA Manual and EIA guidelines for port and harbour projects
31.	National Institute of Oceanography, Goa RO- Mumbai, Kochi	⑨ Coastal Ocean Monitoring and Predictions(COMAP)-Monitoring of coastal waters for physicochemical and biological parameters including petroleum hydrocarbons, trace metals, heavy metals, and biomass of primary (phytoplankton) and secondary (zooplankton, microbial and benthic organisms) ⑨ Marine Biodiversity of selected ecosystem along the West Coast of India

32.	National Botanical Research Institute, Post Box No 436 Rana Pratap Marg Lucknow- 226001, Tel: (+91) 522 271031-35 Fax: (+91) 522 282849, 282881 Lucknow	⑨ Dust filtering potential of common avenue trees and roadside shrubs has been determined, besides studies have also been conducted on heavy-metals accumulation potential of aquatic plants supposedly useful as indicators of heavy metal pollution in water bodies and capable of reducing the toxic metals from water bodies. ⑨ Assessment of bio-diversity of various regions of India
33.	National Geophysical Research Institute, Uppal Road, Hyderabad Telephone:0091-40-7171124, FAX:0091-40-7171564	⑨ Exploration, assessment and management of ground water resources including ground water modelling and pollution studies
34.	National Environmental Engineering Research Institute, Nagpur RO- Mumbai, Delhi, Chennai, Calcutta, Ahmedabad, Cochin, Hyderabad, Kanpur	⑨ National Air Quality Monitoring (NAQM) for CPCB ⑨ Database on cleaner technologies of industrial productions
35.	National Hydrology Institute, Roorkee RO- Belgaum (Hard Rock Regional Centre), Jammu (Western Himalayan Regional Centre), Guwahati (North Eastern Regional Centre), Kakinada (Deltaic Regional Centre), Patna (Ganga Plains North Regional Centre), and Sagar (Ganga Plains South)	⑨ Basin studies, hydrometeorological network improvement, hydrological year book, hydrological modelling, regional flood formulae, reservoir sedimentation studies, environmental hydrology, watershed development studies, tank studies, and drought studies.
36.	National Institute Of Urban Affairs, India Habitat Centre, New Delhi	⑨ Urban Statistics Handbook
37.	National Institute of Occupational Health Meghaninagar, Ahmedabad RO- Banglore, Calcutta	⑨ epidemiological studies and surveillance of hazardous occupations including air pollution, noise pollution, agricultural hazards, industrial hazards in organised sectors as well as small scale industries, carcinogenesis, pesticide toxicology, etc ⑨ WHO collaborative centre for occupational health for South East Asia region and the lead institute for the international programme on chemical safety under IPCS (WHO)
38.	NRSA Data Centre Department of Space, Balanagar, Hyderabad 500 037 Ph- 040-3078560 3078664 sales@nrsa.gov.in	⑨ Satellite data products (raw data, partially processed (radiometrically corrected but geometrically uncorrected), standard data (radiometrically and geometrically corrected), geocoded data(1:50,000 and 1:25000 scale), special data products like mosaiced, merged and extracted) available on photographic (B?W and FCC in form of film of 240 mm X 240mm or enlargements/paper prints in scale varying between 1:1M and 1:12500 and size varying between 240mm and 1000mm) and digital media (CD-ROMs, 8 mm tapes)
39.	Rajiv Gandhi National Drinking Water Mission	⑨ Database for groundwater using remote sensing technology (Regional Remote Sensing Service Centre involved in generation of ground water prospect maps at 1:50,000 scale for the State of Kerala, Karnataka, AP, MP and Rajasthan for RGNDWM)
40.	Space Application Centre Value Added Services Cell (VASC) Remote Sensing Application Area Ahmedabad 380 053 079-676 1188	⑨ National Natural Resource Information System ⑨ Landuse mapping for coastal regulation zone (construction setback line) upto 1:12500 scale ⑨ Inventory of coastal wetlands, coral reefs, mangroves, seaweeds ⑨ Monitoring and condition assessment of protected coastal areas

	Fax- 079-6762735	⑨ Wetland mapping and inventory ⑨ Mapping of potential hotspots and zoning of environmental hazards ⑨ General geological and geomorphological mapping in diverse terrain ⑨ Landslide risk zonation for Tehre area
41.	State Pollution Control Board	⑨ State Air Quality Monitoring Programme ⑨ Inventory of polluting industries ⑨ Identification and authorization of hazardous waste generating industries ⑨ Inventory of biomedical waste generating industries ⑨ Water quality monitoring of water bodies receiving wastewater discharges ⑨ Inventory of air polluting industries ⑨ Industrial air pollution monitoring ⑨ Air consent, water consent, authorization, environment monitoring reports
42.	State Ground Water Board	
43.	Survey of India	⑨ Topographical surveys on 1:250,000 scales, 1:50,000 and 1:25,000 scales ⑨ Digital Cartographical Data Base of topographical maps on scales 1:250,000 and 1:50,000 ⑨ Data generation and its processing for redefinition of Indian Geodetic Datum ⑨ Maintenance of National Tidal Data Centre and receiving/ processing of tidal data of various ports. ⑨ Coastal mapping along the Eastern coast line has been in progress to study the effect of submergence due to rise in sea-level and other natural phenomenon. Ground surveys have been completed for the proposed coastal region and maps are under printing. ⑨ District planning maps containing thematic information (135 maps) have been printed out of 249 maps covering half the districts of India. Districts planning maps for remaining half of the area are being processed by National Atlas and Thematic Mapping Organisation (NATMO)
44.	Town and Country Planning Organisation	⑨ Urban mapping - Thematic maps and graphic database on towns (under progress in association with NRSA and State town planning department)
45.	Wildlife Institute of India Post Bag No. 18, Chandrabani Dehradun - 248 001, Uttaranchal Tel#0135 640111 -15, Fax#0135 640117 email : wii@wii .	⑨ Provide information and advice on specific wildlife management problems. ⑨ National Wildlife Database
46.	Zoological Survey of India Prani Vigyan Bhawan 'M' Block, New Alipore Calcutta - 700 053 Phone # 91-33-4786893, 4783383 Fax # 91-33-786893 RO - Shillong, Pune, Dehradun, Jabalpur, Jodhpur, Chennai, Patna, Hyderabad, Canning, Behrampur, Kozikode, Itanagar, Digha, Port Bliar, Solan	⑨ Red Book for listing of endemic species ⑨ Survey of faunal resources

ANNEXURE XII
Impact Prediction Tools

Table 1: Choice of Models for Prediction of Impacts: Air Environment

Model	Application	Remarks
ISCST 3	▪ Appropriate for point, area and line sources ▪ Application for flat or rolling terrain ▪ Transport distance up to 50 km valid ▪ Computes for 1 hr to annual averaging periods	▪ Can take up to 99 sources ▪ Computes concentration on 600 receptors in Cartesian on polar coordinate system ▪ Can take receptor elevation ▪ Requires source data, meteorological and receptor data as input
AERMOD with AERMET	▪ Settling and dry deposition of particles ▪ Building wake effects (excluding cavity region impacts) ▪ Point, area, line, and volume sources ▪ Plume rise as a function of downwind distance ▪ Multiple point, area, line, or volume sources ▪ Limited terrain adjustment ▪ Long-term and short-term averaging modes ▪ Rural or urban modes ▪ Variable receptor grid density and ▪ Actual hourly meteorology data	▪ Can take up to 99 sources ▪ Computes concentration on 600 receptors in Cartesian on polar coordinate system ▪ Can take receptor elevation ▪ Requires source data, meteorological and receptor data as input
PTDIS	▪ Screening model applicable for a single point source ▪ Computes maximum pollutant concentration and its occurrences for the prevailing meteorological conditions	▪ Require source characteristics ▪ Average met data (wind speed, temperature, stability class *etc*.) required ▪ Used mainly to see likely impact of a single source
MPTER	▪ Appropriate for point, area and line sources applicable for flat or rolling terrain ▪ Transport distance up to 50 km valid ▪ Computes for 1 hr to annual averaging periods ▪ Terrain adjustment is possible	▪ Can take 250 sources ▪ Computes concentration at 180 receptors up to 10 km ▪ Requires source data, meteorological data and receptor coordinates
CTDM PLUS (Complex Terrain Dispersion Model)	▪ Point source steady state model, can estimate hrly average concentration in isolated hills/ array of hills	▪ Can take maximum 40 Stacks and computes concentration at maximum 400 receptors ▪ Does not simulate calm met conditions ▪ Hill slopes are assumed not to exceed 15 degrees ▪ Requires sources, met and terrain

Model	Application	Remarks
		characteristics and receptor details
OCD (Offshore and coastal Dispersion Model)	▪ It determines the impact of offshore emissions from point sources on the air quality of coastal regions ▪ It incorporates overwater plume transport and dispersion as well as changes that occur as the plume crosses the shore line ▪ Most suitable for overwater sources shore onshore receptors are below the lowest shore height	▪ Requires source emission data ▪ Require hrly met data at offshore and onshore locations like water surface temperature; overwater air temperature; relative humidity *etc*.
FDM (Fugitive Dust Model)	▪ Suitable for emissions from fugitive dust sources ▪ Source may be point, area or line (up to 121 source) ▪ Require particle size classification max. up to 20 sizes ▪ Computes concentrations for 1 hr, 3hr, 8hr, 24hr or annual average periods	▪ Require dust source particle sizes ▪ Source coordinates for area sources, source height and geographic details ▪ Can compute concentration at max. 1200 receptors ▪ Require met data (wind direction, speed, Temperature, mixing height and stability class) ▪ Model do not include buoyant point sources, hence no plume rise algorithm
RTDM (Rough Terrain Diffusion Model)	▪ Estimates GLC is complex/rough (or flat) terrain in the vicinity of one or more co-located point sources ▪ Transport distance max. up to 15 km to up to 50 km ▪ Computes for 1 to 24 hr. or annual ave5rage concentrations	▪ Can take up to 35 co-located point sources ▪ Require source data and hourly met data ▪ Computes concentration at maximum 400 receptors ▪ Suitable only for non reactive gases ▪ Do not include gravitational effects or depletion mechanism such as rain/ wash out, dry deposition

Table 2: Choice of Models for Prediction of Impacts: Noise Environment

Model	Application
FHWA (Federal Highway Administration)	Noise Impact due to vehicular movement on highways
Dhwani	For predictions of impact due to group of noise sources in the industrial complex (multiple sound sources)
Hemispherical sound wave propagation Air Port	Fore predictive impact due to single noise source For predictive impact of traffic on airport and rail road

Table 3: Choice of Methods for Prediction of Impacts: Water Environment

Model	Application	Remarks
Estuary models/ estuarial Dynamic model	It is simulates tides, currents, and discharge in shallow, vertically mixed estuaries excited by ocean tides, hydrologic influx, and wind action Tides, currents in estuary are simulated	Dynamic model
Dynamic Water Quality Model	▪ It simulates the mass transport of either conservative or non-conservative quality constituents utilizing information derived from the hydrodynamic model Bay-Delta model is the programme generally used. ▪ Up to 10 independent quality parameters of either conservative or non-conservative type plus the BOD-DO coupled relationship can be handled	Dynamic model
HEC -2	To compute water surface profiles for stead7y, gradually: varying flow in both prismatic & non- prismatic channels	
SMS	Lake circulation, salt water intrusion, surface water profile simulation model	Surface water Modelling system Hydrodynamic model

Table 4: Choice of Models for Prediction of Impacts: Land Environment

Model	Application	Remarks
Digital Analysis Techniques	Provides land use / land cover distribution	
Ranking analysis for soil suitability criteria	Provides suitability criteria for developmental conversation activities	Various parameters viz. depth, texture, slope, erosion status, geomorphology, flooding hazards, GW potential, land use *etc*. are used.

Table 5: Choice of Methods for Prediction of Impacts: Biological Environment

Name	Relevance	Applications	Remarks
Aquatic Flora			
Sample plot methods	Density and relative density Density and relative dominance	Average number of individuals species per unit area Relative degree to which a species predominates a community by its sheer numbers, size bulk or biomass	The quadrant sampling technique is applicable in all types of plant communities and for the study of submerged, sessile (attached at the base) or sedentary plants
	Frequency and relative frequency	Plant dispersion over an area or within a community	Commonly accepted plot size: 0.1 m^2- mosses, lichens & other

Name	Relevance	Applications	Remarks
	importance value		mat-like plants
		Average of relative density, relative dominance and relative frequency	0.1 m^2- herbaceous vegetation including grasses
			10.20 m^2 – for shrubs and saplings up to 3m tall, and
			100 m^2 – for tree communities
Transects & line intercepts methods	Cover	Ratio of total amount of line intercepted by each species and total length of the line intercept given its cover	This methods allows for rapid assessment of vegetation transition zones, and requires minimum time or equipment of establish
	Relative dominance	It is the ratio of total individuals of a species and total individuals of all species	Two or more vegetation strata can be sampled simultaneously
Terrestrial Flora			
Plot-less sampling methods	Mean point plant Mean area per plant	Mean point – plant distance Mean area per plant	Vegetation measurements are determined from points rather than being determined in an area with boundaries
	Density and relative density		Method is used in grass-land and open shrub and tree communities
	Dominance and relative dominance		It allows more rapid and extensive sampling than the plot method
	Importance value		Point quarter method is commonly used in woods and forests.
Fauna			
Species list methods	Animal species list	List of animal communities observed directly	Animal species lists present common and scientific names of the species involved so that the faunal resources of the area are catalogued
Direct Contact Methods	Animal species list	List of animals communities observed directly	This method involves collection, study and release of animals
Count indices methods (Roadside and aerial count methods)	Drive counts Temporal counts	Observation of animals by driving them past trained observers	Count indices provide estimates of animal populations and are obtained from signs, calls or trailside counts or roadside counts
	Call counts	Count of all animals passing a fixed point during some stated interval of time	These estimates, through they do not provide absolute population numbers, Provide an index of the various species in an area
			Such indices allow comparisons through the seasons or between sites or habitats
Removal methods	Population size	Number of species captured	Removal methods are used to obtain population estimates of small mammals, such as, rodents

Name	Relevance	Applications	Remarks
			through baited snap traps
Market capture methods	Population size estimate (M)	Number of species originally marked (T) Number of marked animals recaptured (t) and total number of animals captured during census (n) N = nT/t	It involves capturing a portion of the population and at some later date sampling the ratio of marked to total animals caught in the population

Table 6: Choice of Methods for Prediction of Impacts: Socio-economic Aspect

Name	Application	Remarks
Extrapolative Methods	A prediction is made that is consistent with past and present socio-economic data, e.g. a prediction based on the linear extrapolation of current trends	
Intuitive Forecasting (Delphi techniques)	Delphi technique is used to determine environmental priorities and also to make intuitive predictions through the process of achieving group consensus	Conjecture Brainstorming Heuristic programming Delphi consensus
Trend extrapolation and correlation	Predictions may be obtained by extrapolating present trends Not an accurate method of making socio-economic forecasts, because a time series cannot be interpreted or extrapolated very far into the future with out some knowledge of the underlying physical, biological, and social factors	Trend breakthrough precursor events correlation and regression
Metaphors and analogies	The experience gained else where is used to predict the socio-economic impacts	Growth historical simulation commonsense forecasts
Scenarios	Scenarios are common-sense forecasts of data. Each scenario is logically constructed on model of a potential future for which the degrees of "confidence" as to progression and outcome remain undefined	Common-sense
Dynamic modeling (Input- Out model)	Model predicts net economic gain to the society after considering all inputs required for conversion of raw materials along with cost of finished product	
Normative Methods	Desired socio-economic goals are specified and an attempt is made to project the social environment backward in time to the present to examine whether existing or planned resources and environmental programmes are adequate to meet the goals	Morphological analysis technology scanning contextual mapping - functional array - graphic method Mission networks and functional arrays decision trees & relevance trees matrix methods scenarios

ANNEXURE XIII
Environmental, Health and Safety Measures

Mitigation Measures with respect to the Major Pollutants during Ship Recycling Activities

Source of Impacts	Mitigation Measures		
	Environmental Measures	**Health Measures**	**Safety Measures**
Asbestos		▪ Identifying asbestos location onboard ▪ An enclosed chamber shall be created in the ship where asbestos has been identified to avoid dispersion of air emission of asbestos ▪ Limited access area shall be created. ▪ Vacuum system to filter air shall be installed. ▪ Asbestos must be kept wet before and during removal operations ▪ ACM must be removed as much as possible in large portions without breaking it. ▪ When ACM is compounded with other material, then the compounded material must be entirely removed without disturbing ACM and then ACM is transported to dedicated asbestos handling environment for removal. ▪ Asbestos shall be packed in approved packaging system ▪ Minimize the amount of workers exposed to the asbestos containing area ▪ Clear asbestos area access regulations shall be defined. ▪ Decontaminate (shower) workers and change set of clothes when leaving regulated area ▪ The area must be covered to avoid air emission ▪ All solid wastes resulting from asbestos removal process should be collected ▪ Provision of adequate storage and disposal facilities ▪ Provision of adequate storm water discharge	▪ Employing specially designated asbestos workers and supervisors and ensure that employees comply to regulations regarding work with asbestos ▪ Wearing head covering, gloves, foot covering and face shield/ goggles

		facilities, to avoid dispersion of asbestos in storm water runoff ▪ Approved respirators should be provided for protection against airborne asbestos ▪ Wearing a separate set of washable clothing	
Paints	▪ Create a separate area for paint-removal operations, with impermeable floor ▪ Collect and contain all solid wastes resulting from paint removal process ▪ Provide adequate storage/disposal facilities ▪ Provide adequate storm water discharge facilities, to avoid contamination of storm water runoff	▪ Determine if paint is toxic ▪ If paint is toxic, remove all toxic paint from area to be cut prior to metal cutting ▪ Isolate area and create as much ventilation as possible ▪ In working yard create a separate area for paint-removal operations ▪ Create as much ventilation as possible ▪ For chemical paint and preservative removers, protect skin, eyes and face ▪ For toxic solvents, wear approved respiratory equipment and protect skin, eyes and face ▪ Create an enclosed chamber with point extraction to avoid dispersion to air. To be integrated with air filtration system. ▪ Limit access to the area ▪ Install vacuum system to filter air ▪ Create a separate area for paint removal operations, with impermeable floor ▪ Create a dedicated area for storage of paint/coatings residue ▪ Cover the area to avoid dispersion of air emission ▪ Wear hoods and appropriate respirators ▪ Wear goggles or face shields	▪ Determining the flammability of paint ▪ Removing all flammable paint from area to be cut prior to metal cutting to prevent ignition ▪ If using flammable liquids for chemical stripping, provide ventilation so that concentration of vapors is below 10% of lower explosive limit ▪ Keep fire-extinguishing equipment within instant access
PCB	▪ Identifying and labeling suspect materials and equipment ▪ Carefully removing all PCB containing materials, and transporting to dedicated area ▪ Disposing in controlled manner ▪ PCB containing materials shall be carefully removed, without use of heat inducing equipment (such as	▪ Specially designated personnel for identification and careful removal of PCB containing materials at source ▪ Create a dedicated area for removal / overhauling of PCB containing materials ▪ Create a dedicated area in for storage of PCB containing materials ▪ Create a dedicated disposal area ▪ Appropriate protective clothing and	

	torches) ▪ Keeping fire-extinguishing equipment nearby	equipment	
Oils and Fuels	▪ Adequate containment and pumping equipment ▪ Adequate Oil transfer facilities ▪ Adequate storage and disposal facilities ▪ Oil spill cleanup and notification procedures ▪ Oil spill containment boom ▪ Oil spill cleanup equipment	▪ Minimizing the use of manual labor at the source in the tanks for removal operations ▪ Use of solvents to dissolve heavy weight sludge so that most oil and sludge can be pumped out. ▪ Ventilating the compartments continuously ▪ Testing the compartment for oxygen and presence of toxics, corrosives, irritants prior to manual cleaning ▪ Use of personal protective equipments	▪ Physical identification of location onboard ▪ Cleaning oil tanks and compartments before hot work starts ▪ Ventilating compartments and tanks continuously ▪ Introducing hot work certification system ▪ Testing the compartment for presence of flammable vapors before issuing certificate ▪ Isolating the area and setting up “No Smoking” signs ▪ Keeping fire extinguishing equipment immediately available
Bilge and Ballast water	▪ Determining pollutant concentrations prior to removal of the water ▪ Adequate containment and pumping equipment ▪ Adequate transfer operations facilities ▪ Adequate storage and treatment facilities ▪ Spill cleanup and notification procedures ▪ Spill containment boom ▪ Spill cleanup equipment ▪ Change of ballast water	▪ Minimizing the use of manual labor at the source in the tanks for removal operations (use of pumps) ▪ Use of solvents to dissolve heavyweight sludge so that most residues can be pumped out Ventilate compartments continuously ▪ Testing the compartment for oxygen and presence of toxics, corrosives, irritants prior to manual cleaning ▪ Use of respiratory equipment (PPEs)	▪ Physical identification of location of bilge and ballast water onboard ▪ Cleaning oil tanks and compartments before hot works commences ▪ Ventilating compartments and tanks continuously ▪ Introducing a Hot-Works Certification system ▪ Test compartment for presence of flammable vapors before issuing certificate ▪ Isolate area and put up No Smoking signs Keep fire-extinguishing equipment immediately available

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