PROCESS DESCRIPTION

This guideline focuses on the shipbuilding processes and shipyards. This includes facilities (wet and dry docks, marine railways, design yards) which fabricate and dismantle floating vessels for inland and marine use vessels.

The main inputs at shipyards are steel plate, energy and labour. Large quantities of steelwork may be stockpiled, prior to shot blasting to remove oxidised layers and application of primer coat. The activities can occur in the open air or in purpose built facilities. There is likely to be a press shop and a building dock where large sections of hull are assembled.

The vessel is then transferred to another berth for fitting operations to be completed. These activities typically occur on the seaward side of the yard.

The remaining area of the shipyard will support ancillary activities including tank farms, manufacturing and maintenance shops, a galvanising operation and wastewater treatment, paint shop, various materials stores, boiler house, compressors and gas production.

The guidance outlines the processes, resources and materials used during the construction process; the facilities and services needed to enable the outputs and their environmental context. Shipyards use a varied range of services for new vessel construction; hull cleaning and de commissioning.

Investment in shipbuilding varies internationally with some regions investing heavily, others divesting and outsourcing. Typically, shipyards produce and build only 20-30% of the value of each vessel by themselves, the rest produced and installed by suppliers, subcontractors and turnkey suppliers.

The industry is under close regulatory scrutiny and faces compliance requirements related to hazardous wastes, wastewater, stormwater, and air emissions generated by vessel construction, maintenance and repair activities.

Shipyards are usually located in environmentally sensitive areas.

KEY ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Water Pollution

Oil spills during fitting operations may contaminate the waters surrounding the shipyard. Runoff water is likely to capture oils and debris that has accumulated on the dock area.

The bottoms of vessels that have prolonged seawater contact commonly are coated with "anti-fouling" paints containing chemicals that
inhibit the attachment of fouling organisms to hulls. The active ingredients commonly found in anti-fouling paints are metal-based such as cuprous (copper) oxide or tributyltin (TBT). The pesticides are harmful to many types of marine life as well as fouling organisms. Metals can enter the water through discharge of anti-fouling paint chips and paint removal materials during vessel maintenance activities. TBT is now banned globally but still remains as a hazardous substance on the hull of older vessels and is a concern during maintenance and servicing of hulls in shipyards.

**Waste water**

Galvanising and other metal preparation baths will discharge acid/alkali and metals laden waters. Water used in cleaning processes will also require treatment. Waste water treatment will be carried out either in a purpose built waste water treatment plant or will discharge to a municipal waste water treatment plant. In either case it is likely that water quality conditions are defined, possibly in a permit.

**Air Emissions**

Smaller vessels can be worked on beneath shop roofs, but larger vessels are worked on in open areas; on floating dry-docks or marine railways. Blasting grit used in shipyards typically is a slag, a by-product of ferronickel production. The constituents of blasting grit vary, but in general include oxides of silicon, iron, aluminium and calcium. Some grits also may contain oxides of zinc and magnesium, and trace amounts of copper, titanium, sulphur, and oxides of potassium and sodium.

Paint stripping jobs require varying amounts of grit. Stripping 280m$^2$ of hull surface area, for example, may require an estimated 60 tonnes of grit. The large quantities make management and disposal of grit a critical economic and environmental issue for shipbuilding and repair facilities. Air, drainage systems and coastal waters are vulnerable to contamination from the process.

**Solid Waste**

Spent grit needs to be tested for toxicity. If it is regarded as toxic, it must be managed and disposed of as hazardous waste. The likelihood that grit will fail the tests depends on how it has been used. Grit that has been used to remove anti-fouling bottom paints is more likely to fail the tests than grit that has been used to strip topside surfaces.

Sludge from waste water treatment, possibly with a heavy metal content, will need to be disposed through licensed contractors.

**Hazardous Materials**

Solvents are commonly used to formulate both bottom paints and coatings used for topside applications such as corrosion resistance. Solvents are sources of hazardous waste and of volatile organic compounds (VOCs). These compounds are hazardous air pollutants.

Hazardous materials, such as solvents, present a health and safety risk if incorrectly handled, stored and disposed of.

**Liquid Wastes**

- Wash water, oily water from bilges and tank cleaning, and engine fluids such as oil, hydraulic fluids, lubricants, and anti-freeze are among the waste liquids generated by during maintenance shipyard activities.
- Fuelling facilities are another potential generator of waste liquids. Hydrocarbons,
glycols and other pollutants in these liquids can come into contact with waterways and aquatic life through spills and leaks from storage tanks.

**Noise**

Pneumatic hammers, gouging tools and chipping machines are sources of significant noise exposure in shipyards.

**Falls from height**

Falls from height occur on shipyards while vessels are being constructed.

**Falling objects**

As vessels are being constructed in many levels falling objects are a hazard. In addition, personnel can be hit by falling/moving objects during fabrication where failure of fixtures and conveyance gantries can occur.

**Confined spaces**

Many areas on a vessel are designated as confined spaces, which can result in vapour build up.

**Slips, trips and falls**

There is a high incidence of slips, trips and falls at shipyards as a result of uneven surfaces, unsteady walk ways and wet decks.

**OTHER POTENTIAL ENVIRONMENTAL AND HEALTH AND SAFETY RISKS/LIABILITY ISSUES**

**Ground Contamination**

Poor management of materials, waste and discharges from production presents a potential risk of soil contamination. Heavy metals and accidental discharges from spills and storage tank leakages may also contaminate groundwater in areas where soils beneath the site are permeable.

Contamination could arise from deteriorating drainage networks.

**Radiation**

Some key workers, especially those associated with submarine facilities, work with radioactive substances. Some cases of leukaemia, lymphoma, and lung cancer have been known to occur due to poor site radiation control protection and management practices.

**Polychlorinated Biphenyls (PCBs) and Asbestos**

- PCBs are a group of substances which are good electrical insulators. Typically, PCBs may be present as constituents of hydraulic oils or dielectric fluids in electrical switchgear, transformers and fluorescent light starters.

- Asbestos has been used on a large scale for many years as a fire proofing and insulation material and may be encountered in a wide range of forms including asbestos cement boards, as fire retardant gaskets in pipework and as fire retardant insulation around boilers and furnaces.

Particular attention should be given to refurbishment of vessels constructed before the 1980’s.
Machinery

All equipment should have safety guarding and workers should be issued with appropriate personal protective equipment to protect against unavoidable sharp items and edges. Particular attention should be paid to metal cutting equipment.

Inhalation

Use of solvents in the process, creation of dust during shot blasting, machining and welding activities can result in respiratory disease.

Occupational Dermatitis

This can occur as a result of contact with antioxidants, chromates and solvents.

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<th>KEY SOCIAL, LABOUR AND COMMUNITY RISK/LIABILITY ISSUES</th>
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Noise, odour and dust

Noise, odours and dust can cause nuisance issues for neighbours of the shipyard.

Recreational activities

Impact on recreational use of river banks, shorelines, coasts and wetlands include interference with recreational activities such as angling, boating, diving and bathing and walking due to the health and safety risks oily water presents to river bank, coast, wetland or shoreline.

Migrant Labour

Shipyards might attract the skills associated with migrant labour.

FINANCIAL IMPLICATIONS

- IMO is focusing on global regulations (2009) for the design, construction, operation and preparation of ships to facilitate safe and environmentally sound recycling, without compromising the safety and operational efficiency of ships. They will be establishing an appropriate enforcement mechanism for ship recycling, incorporating certification and reporting requirements. Ships sent for recycling will be required to undertake an inventory for hazardous materials. The new regulation will prohibit or restrict the use of certain hazardous materials in shipyards. Shipyards converted to ship recycling yards will be required to have a ship recycling plan.

- New ships constructed after this regulation will have to be designed for deconstruction and recycling.

- The visual and olfactory impact of oily water releases could result in compensation for loss of income and long-term damage and degradation of impacted infrastructure including restaurants, hotels, industries abstracting water for processes, marinas, private home owners, and compensation of fishing industry for loss of fish stock and destruction of equipment.

- Injuries may lead to increased payroll costs to replace skilled workers and lost production time;

- Capital investment may be required to comply with new environmental, health and safety requirements;

- Fines, penalties and third party claims may be incurred for non-compliance with environment, health and safety regulations.
Improvements

- Development of an innovative method to safely reduce the risk of toxic particulates from hull cleaning and maintenance activities which, would greatly improve occupational health and safety, increase productivity and decrease overall cost.

- Wash wastewater treatment facility to reduce contaminant loading and potential release into watercourses and drainage systems. Have closed drainage systems on site.

- Consider application of TBT removal methodologies to treat waste waters from ship hull maintenance discharges to reduce environmental risk.

- Introduce maintenance, housekeeping, materials management and chemical and materials inventory control practices that aim to minimize wastes from activities such as hull stripping and painting, dry dock and marine railway maintenance, engine maintenance, and handling of hazardous materials during shipbuilding and other waste liquids.

- Apply closed-loop recycling for processing waste water, with oil/water separation and waste oil reclamation.

- Investigate environment friendly spent grit recycling and disposal and the application of alternative hull stripping methods such as use of high-pressure water, wetted grit, and media such as steel shot, plastic particles or wheat starch.

- Note the condition of the sea around the shipyard, is there evidence of oil and/or debris in the water;

- Regular inspection should be carried out of all bulk containment on site to prevent leakage and product loss.

- Provision of secondary spill containment for bulk storage tanks and silos.

- Good housekeeping should be maintained at all times in all areas.

Health and Safety Improvements

- Provision of personal protective equipment (PPE) that is fit for the task to prevent injury and maintain hygiene standards. Staff should be trained in the correct selection, use and maintenance of PPE. PPE should be inspected regularly and maintained or replaced as necessary.

- Train workers in correct use of machinery and safety devices.

- Install mechanical lifting aids where possible and rotate work tasks to reduce repetitive activities.

- Separation of people from moving equipment. Install walkways to separate people from vehicles or moving parts to reduce risk of collision.

- To reduce the risk of noise exposure isolate noisy equipment and rotate tasks to minimise time spent in a noisy area over an eight hour period and provide personal protective equipment where people have to enter noisy areas.

- Provide appropriate fall arrest equipment.

- Install local exhaust ventilation.
- Ensure a safe means of access between vessel and shore to prevent falls;
- Restrict access to confined spaces and other high risk areas.

**GUIDE TO INITIAL DUE DILIGENCE SITE VISITS**

During the initial site visit, the issues will vary according to the specific processes being adopted and depending on the level of environment, health and safety management already introduced. While visiting the site it is important to discuss and review the following:

- Note whether the plant discharges to water or the municipal wastewater treatment works;
- Check the condition of storage facilities for bulk raw materials;
- Note the noise and dust levels at the site to determine whether abatement equipment is in use or might be required;
- What is the standard of “housekeeping” on site? Do areas look clean and tidy? Look for evidence of any recent spills or releases of raw materials/product.
- Are staff wearing Personal Protective Equipment?
- Check signage around the site:
  - Does it convey the health and safety risks?
  - Are fire exits and/or evacuation routes clearly marked?
  - Are there demarcated routes for pedestrians and vehicles?
- Is fire fighting and first aid equipment available?
- Check the age and condition of equipment, look for signs of wear and tear, degradation, leaks and breaks;
- Check that solid waste storage and disposal (storage equipment) is in a good condition;
- Check that waste storage areas are clear of debris and that skips are covered to prevent waste escaping, for example, check that waste containers have lids or are stored in an area with a roof;
- Have the premises been inspected recently by the regulatory authorities for health and environment? What were their findings?
- Check for automatic safeguards on machinery to prevent accidental injury;
- Check that wages and working hours are consistent with the average for the sector and national standards;
- Does the organisation have insurance in place to cover the recall of contaminated products? Have there been any recent product recall incidents?
- Have there been any recent incidents on site such as fatalities, fires/explosions, spills? Is insurance in place to cover such incidents?
- Does the business plan have line items for Environment, Health and Safety improvements?
- Check the conditions and duration of validity for all permits;
If the investment or refinancing will lead to restructuring of the company, what will be the potential impacts on health and safety at the operational, employee welfare and wide community impacts level?

If the company plans to invest in new technology, what will be the impact on human resources, in particular health and safety and employee welfare?

Check that labour standards, contracting and remuneration are in line with national law and are consistent with the average for the sector.

Check that hours, including overtime, are recorded and staff should receive written details of hours worked and payment received.

Has the company received inspections from the local labour inspectorate in the previous three years? Have these resulted in any penalties, fines, major recommendation or corrective action plans?

Does the organisation have a grievance mechanism which allows employees to raise workplace concerns?

Are employees free to form, or join, a worker’s organisation of their choosing?

Take note/ask questions relating to any activities that address the improvements listed in the improvements section of this document.

**ACTION PLANS**

Dependent on the individual business and nature of the shipyard/ship building activity, select appropriate improvements from the list above to include in the action plan. As a minimum, any business should be required to have the following in place:

- Operational procedures to manage environmental, health and safety risks;
- Monitoring programmes;
- Improvement objectives, targets and project plans;
- Training for personnel;
- Regular inspections, checks and audits with records to demonstrate achievement of the required level of performance against legal requirements and improvement action;
- Emergency plans for environment, health and safety accidents or hygiene non-compliance;
- Management review/demonstrated involvement in environment, health, safety and hygiene management.
REFERENCES AND ADDITIONAL SOURCES


European Environmental Agency (2002) Accidental and illegal discharges of oil by ships at sea

Patin, Stanislav, Dr. (2002) Off-shor environment, pollution of the sea

European Metal Workers’ Federation. (Press article) “the Turkish shipbuilding expansion: putting profits before health and safety and risking workers’ lives” 10.03.2009

European Metal Workers’ Federation FEM 34/2003 A future for the European Shipbuilding Industry: LeaderSHIP 2015 needs a commitment for immediate action

IMO (1998) Annex VI of MARPOL 73/78, Regulations for the prevention of air pollution from ships and NOx technical code

IMO (2004), Prevention of pollution by sewage from ships

IMO Adopted guidelines on Ship recycling 23rd Assembly, Dec 2003

MARIN Maritime Research Institute, Netherlands (www.marin.nl)