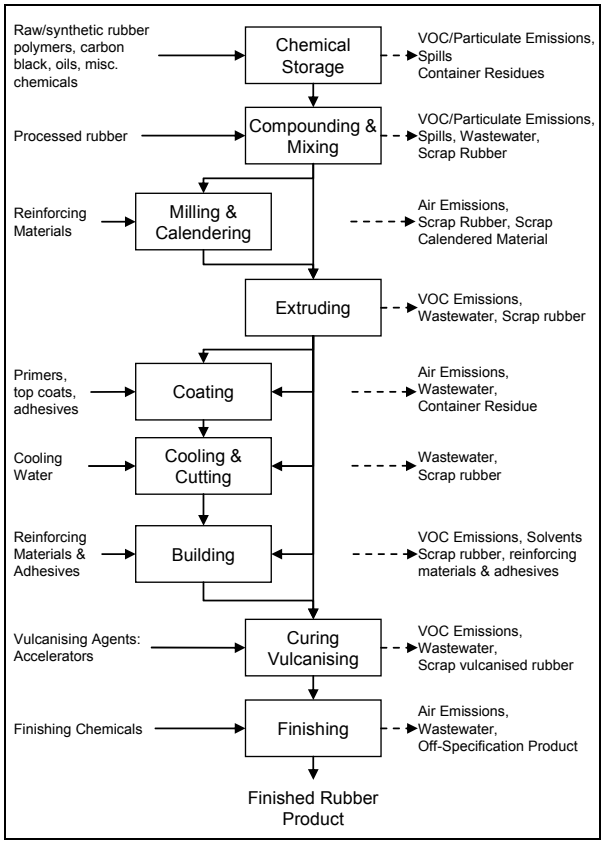
European Bank
for Reconstruction and Development

Sub-sectoral Environmental and Social Guidelines: Rubber Products

PROCESS DESCRIPTION

There are two types of rubber in common use: natural and synthetic. Natural rubber comes from the rubber tree (Hevea brasiliensis). Latex is tapped from a diagonal incision in the tree trunk and solidified by acidification. Synthetic rubber is made by cracking crude oil (see Petroleum Refining and Petroleum Products guidelines).

Rubber product manufacturing is as diverse as the range of products but there are several basic processes. There are 2 main types of operation: dry and wet. The dry process is shown in the diagram below, some or all of the stages may be used.



- Mixing: Polymers (natural or synthetic), carbon black, oils and other chemicals (as need for the desired characteristics) are weighed and loaded in the compounding area into a mixer ("Banbury" mixer);
- Milling: The mixed rubber is formed into a long strip or sheet;
- Extruding: Rubber is forced through dies by a rotating screw to form various shapes or profiles. This process heats the rubber;
- Calendering: Rubber from the milling process is squeezed into reinforcing fibres or fibre matrices to form thin sheets of rubber-coated materials;
- Building; Extruded and calendered rubber components are layered with other reinforcing materials such as wire and polyester. Adhesives are sometimes used to enhance the bonding of the layers.
- Vulcanising: All rubber products are vulcanised. The assembled product is heated to cure the rubber. The polymer chains in the rubber matrix cross-link to form durable, elastic, thermoset rubber.
- Finishing: Operations to prepare the product for delivery to the end user e.g. grinding, printing, washing, wiping, buffing, balancing.
- In the wet process (latex dipping) a suitably shaped former is dipped into a natural or synthetic latex compound, withdrawn, dried and vulcanised. Dipped goods are usually leached to remove water-soluble materials. Some products may be subjected to chlorination after vulcanization.
- Ancillary activities include steam generation, cooling water systems, electricity generation and primary wastewater treatment.

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KEY ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Air Emissions

- Fugitive dust emissions can be released from open storage, weighing and loading of powdered materials. This can be eliminated by purchasing chemicals in small, preweighed sealed bags which is put directly into the mixer.

- Dust and fine rubber particles may be released during surface grinding activities of finished products;

- Volatile organic compounds (VOC) and other hazardous air pollutants may be generated during each of the processing steps and through the use of solvents, cement and adhesive evaporation. Organic solvents may be easily replaced with water, silicon and non-solvent-based alternatives.

Organic solvents and ozone depleting substances may be used extensively on some sites for cleaning in coatings and adhesives. These can be replaced by high-pressure water systems or citrus based solvents removing the potential for hazardous air emissions and wastewater contamination.

The release of emissions is controlled through air permits issued by local regulatory authorities, with limits for carbon black normally set at a lower level than other particulates.

Wastewater

Wastewater from cooling, heating, vulcanizing and cleaning operations may be contaminated due to direct contact with the product and contain suspended solids, oil, grease and trace metals such as zinc. Wastewater from the latex dipping process may be contaminated with additives used in the process.

Rubber in wastewater should be removed with a rubber trap and recycled/reused in the process. Some further pre-treatment for solids settling, pH adjustment or oil removal may be required before the water can be discharged to a water treatment plant either onsite or to a municipal water treatment works.

Most facilities will have been issued with an effluent permit from the local regulatory authorities which specifies limits for various contaminants.

Solid Wastes

The majority of scrap from the process can be recycled directly into the process or shredded/ground and recycled into other products. Some waste rubber, e.g. excessively heated polymer parts, are disposed of as waste. Waste rubber should be segregated into cured and uncured rubber.

Inhalation Risks & Dermatitis

- Dust and fumes generated during the production process are hazardous to health in the form of asthma, lung disease and cancer. Rubber fume is a very complex mixture of substances, the main constituents being volatile organic compounds (VOCs), particulates and certain carcinogenic compounds. Many of these risks can be reduced by eliminating known carcinogens e.g. 2-napthylamine and related products which is known to cause bladder cancer.

- Contact dermatitis has been reported frequently among rubber workers and users of rubber products.

OTHER ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Energy Consumption

Rubber production requires significant heat, steam and pressure generation capacity. Many rubber manufacturing sites have large on site boilers to meet these high temperature and pressure requirements. The emissions from the boilers will be dependent on the fuel used (coal, oil or gas). Large coal fired boilers may emit high concentrations of pollutants for example, sulphur dioxide, nitrogen oxides, and particulates.

Water Consumption

Significant quantities of fresh water may be consumed for cooling and steam generation. A closed-loop water cooling or heating system should be employed.

Burns and heat stress

Working at high temperatures can increase the temperature of the working environment which can lead to heat stress for those working in the vicinity. Contact burns can result from contact with hot equipment especially during maintenance activities.

Noise

Noise levels at heavy mixing machinery can be high . Significant noise exposure may also occur from equipment such as mills, braiders, belt grinders, air-exhausts, and from compressed air and steam leaks.

Machinery

The industry uses very powerful machinery with the potential to cause fatal and serious injury. 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 mills, mixers and calenders.

Collision

This often takes the form of people being hit by moving, flying or falling objects.

Slips, Trips and Falls

These often occur on the same level and are primarily caused by uneven surfaces, inappropriate footwear, lighting, weather conditions, trailing cables and pipe work especially during unblocking, maintenance and cleaning activities.

Manual Handling and Repetitive Work

Lifting and carrying heavy or awkwardly shaped objects, such as bags, can result in manual handling injuries.

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 buildings constructed before the 1980s

Permitting

Rubber production facilities in the EU are subject to national regulations under the Integrated Pollution Prevention and Control Directive (2008/1/EC). Operations outside the EU will still be subject to local regulations.

Waste may be burnt on site as a means of disposal. This practice is not usually allowed under local legislation as dark smoke may be emitted. Particular care should be taken if rubber products are burnt due to the hazardous composition of the smoke emitted.

Packaging

Large quantities of packaging may be used. Companies operating within the European Union (either as a manufacturer or as a supplier into European Union countries) will be subject to the European Union Packaging and Packaging Waste Directive (94/62/EC), which aims to reduce the amount of packaging that is being introduced into waste streams.

KEY SOCIAL, LABOUR AND COMMUNITY RISK/LIABILITY ISSUES

Dust and Odour

Public/environmental health and nuisance issues associated with dust and vented fumes can arise from production activities and may have a significant effect on neighbouring locations. This may be important if there are neighbouring residential and industry in the area;

Child Labour

Child labour is used in some countries to tap latex from rubber trees and in other roles on rubber plantations that supply the raw materials for the rubber production process. This may be unlawful, breach international conventions and/or present reputational risks.

OTHER SOCIAL, LABOUR AND COMMUNITY RISK/LIABILITY ISSUES

Tyre Disposal

Scrap tyre disposal is a major waste disposal issue for most countries. Tyres are bulky, virtually indestructible and tend to rise to the surface when buried. Scrap tyre piles are a fire hazard and burn with an intense heat giving off a black smoke and are difficult to extinguish. The majority of scrap tires can be recycled, reused or recovered but these capabilities may not be present or well-developed in all countries. In some countries, authorities have imposed taxes on the sale of all new tyres to cover the cost of waste tyres. These charges may or may not affect the price for rubber products. Retailers and manufacturers may attempt to pass on additional charges to rubber manufacturers.

Transport

Transport of products by either road or rail can be a significant issue. This might lead to road noise and traffic congestion;

FINANCIAL IMPLICATIONS

- Many countries are signatories to the Kyoto Protocol and have adopted targets for the reduction of CO_2 emissions. Where Governments have set up carbon emission reduction programmes industrial processes

have been required to reduce their CO_2 emissions through the setting of targets. This can result in a need for substantial investment in new/clean technologies to achieve the emission targets. These targets may be reflected in environmental permits.;

- Under the EU Emissions Trading Scheme (ETS) Member States allocate allowances for carbon emissions to industrial sites, including refineries. The scheme can create both financial assets (sites have emitted less carbon than set) or liabilities (sites have emitted more carbon than set) and entities can trade their carbon allowances;

- 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 or industry standards;

- There is a relatively high potential for soil and groundwater contamination to be present which can be very costly to remediate. Financial provisions may need to be set aside to address contamination and retirement of assets;

- Fines, penalties and third party claims may be incurred for non-compliance with environment, health and safety regulations or industry/customer standards.

IMPROVEMENTS

Environmental, Health and Safety Improvements

- Purchase dry chemicals in small pre-weighed, sealed bags that can be placed directly in mixer without opening;

- Receive and store larger quantities of chemicals in enclosed, sealed containers;

- Provision of secondary spill containment for storage containers and areas;

- Consider installation of automatic dispensing and weighing equipment to minimise spills and improve quality control;

- Replace toxic chemicals by reformulation of product and substitute hazardous chemicals, e.g. solvents and oils with less damaging alternatives;

- Segregate waste streams (including different types of scrap rubber) to increase recycling and reuse opportunities

- Recover and re-use raw materials and waste rubber where practicable. Scrap rubber that cannot be recycled into the process can be added to fuel for process boilers.

- Reduce fume levels by controlling compound temperatures to the minimum needed by the process. Cool fuming products as soon as processing is complete, e.g. using water, air or passing over chilled surfaces.

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

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

- Enclose processes, conveyors and storage areas to reduce dust;

- Installation or upgrade of abatement technology to minimise exposure to control the release of emissions, e.g. appropriate local

exhaust ventilation with filters, baghouses, cyclones, filters;

- Maintain on site abatement equipment and treatment plant;
- Recycle wastewater where possible back to the processes or to secondary uses such as for cleaning;
- Use dry techniques where appropriate to abate particulate and gaseous exhaust streams;
- Segregate process water, rainwater and indirect cooling water streams to reduce the hydraulic loading to waste water treatment equipment or sewers;
- Use dry cleaning methods wherever practicable for solids, e.g. vacuum extraction, wipe down equipment that is accessible rather than washing and rinsing it;
- Improve insulation to minimise heat loss;
- Recover heat and energy from processes for use elsewhere on the site or to supply heat and power off site;
- 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;
- Train workers in correct use of machinery and safety devices. Redesign manual processes to avoid heavy lifting/repetitive activities;
- Install mechanical lifting aids where possible and rotate work tasks to reduce repetitive activities;
- Separate people from moving equipment:;
- Install safeguards on moving parts of conveyor belts to reduce risk of entrapment of employees;
- To reduce the risk of noise, dust and fume exposure isolate such hazardous processes to minimise time spent in these environments over time and provide personal protective equipment where people have to enter these areas;
- Route cables and pipework under walkways to prevent slips, trips and falls;
- Construct walkways of non slip materials;
- Provide a good standard of lighting;
- Install automatic alarms and shut off systems;
- Provide local fire department with list of products stored on the premises;
- Emergency storage lagoons may be needed to prevent contaminated firewater reaching controlled waters;

Social, Labour and Community Improvements

- Implement a programme of assessment of routine monitoring of worker health;
- Implement a programme to engage with neighbouring communities, including having a system to record and act on any complaints. Involve and take account of the local community in any major emergency response plan.

GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

During the initial site visit, the issues will vary according to the type of product being produced 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:

- Confirm organisational responsibilities and systems for EHS
- Check the condition of the wastewater treatment plant and location of discharge points for wastewater from the facility. Note the colour and appearance of adjacent watercourses;
- Note whether the wastewater treatment plant discharges to a local watercourse or the municipal wastewater treatment works. Higher environmental risks will be associated with facilities discharging to water courses;
- Check the condition of storage facilities for raw materials and finished products;
- Discuss procedures to check the source of raw materials and/or materials for waste incineration;
- Check for automatic safeguards on machinery to prevent accidental injury;
- Note any odours that might cause a nuisance;
- 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, hygiene and environment? What were their findings?
- Check for automatic safeguards on machinery to prevent accidental injury;
- Does the organisation have insurance to cover any significant damage to the environment/community/operations (this may be covered by public liability insurance

or the organisation may be party to an industry insurance scheme). Review the terms of the cover.

- Has the organisation been subject to E&S or quality audits by customers/insurers? What was the outcome of these audits?
- Does the organisation have insurance in place to cover the recall of damaged or contaminated/faulty 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? Is any legal action likely?
- Does the business plan have line items for Environment, Health and Safety improvements as well as asset management and maintenance?
- If investment or refinancing will lead to restructuring of the organisation what will be the potential impacts on health and safety at the operation and wider community? Have these been considered and assessed by the company?
- If the company plans to invest in new technology, what will be the impacts and benefits for human resources?
- Check the conditions and duration of validity for all permits;

Social, Labour and Community Issues

- 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 worked, including overtime, are recorded and staff should receive written details of hours worked and payment received;
- Check that wages and working hours are consistent with the average for the sector and national standards;
- Has the Company received inspections from the local labour inspectorate in the previous three years? Have these resulted in any penalties, fines, major recommendations 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, 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:

Environmental, Health and Safety

- 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

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