European Bank
for Reconstruction and Development

Sub-sectoral Environmental and Social Guidelines: Industrial Inorganic Chemicals

PROCESS DESCRIPTION

This guideline covers the production of a large range of non-carbon compounds, cyanides and carbonates. Production of these chemicals involves the conversion of raw materials, or chemical intermediates, to active chemical substances through several stages of synthetic chemistry.

The inorganic chemicals sector comprises a large number of different installations with relatively few common factors. The larger inorganics processes are continuous and are often co-located on large integrated sites, so that they can exchange/reuse raw materials, products, by-products and wastes. Ancillary activities may include boilers, refrigeration equipment, wastewater treatment and storage facilities for raw materials and finished products.

KEY ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Air Emissions

Possible sources of air emissions include vapours or dusts from raw materials and final products, combustion products (sulphur oxides, nitrogen oxides and carbon oxides) and odours. Many of these emissions may be harmful to the environment. Facilities may be required to obtain a permit from local regulators.

- Fugitive releases of dust and small particulates from joints in conveyor systems, from stock-piles, and from packaging causing significant issues on many plants;
- Where gases or liquids with moderately high vapour pressures are handled, there is the potential for releases of acid gases, ammonia, volatile organic compounds (VOCs) or volatile inorganic compounds from flanges, pumps, agitators and valves with seals, storage tanks, tanker connections, and sample points;
- Significant quantities of acid gases, and/or volatile inorganic or organic compounds, dust, fume or wet particulates some containing toxic substances, such as, heavy metal compounds may be released from process vents, storages and abatement system exhausts.

Energy Consumption

Many of the processes require significant energy input to produce heat, steam and compressed air to drive the reactions. The release to air of greenhouse gas emissions from energy generation often has the biggest single environmental impact from the installation. However, some installations in the sector are very significant net generators of energy due to the exothermic nature of the reactions.

Energy consumption is also associated with electrically driven process equipment and utilities such as heating, ventilation, air-conditioning and humidity control.

Wastewater

Some inorganic installations generate wastewaters containing pollutants such as heavy metal compounds or complexes. Where it is not practicable to prevent the generation of these difficult wastewaters, they need to be segregated and treated separately, before being discharged to municipal wastewater treatment facilities. Many facilities operate wastewater treatment plants which include primary treatment of wastewaters prior to their discharge to the sewerage system. Variations to wastewater and/or effluent discharge consents may require

changes in the operation of the treatment plant, in order to maintain compliance.

Hazardous Materials

Significant hazardous properties relating to individual chemicals include flammability, combustion potential, toxicity, corrosive potential and oxidising potential. Chemicals with such properties should be labelled with the appropriate internationally recognised diamond shaped hazard symbol[1]. Inadequate control of hazardous chemicals can elevate the risk of major accident harming workers, the local community and the environment.

Some chemicals may only possess a hazard potential if they have the opportunity to react with other compounds. Chemicals with different hazard symbols should not be stored together - clear guidance on the compatibility of different chemicals can be obtained from the Materials Safety Data Sheet (MSDS) which should be readily available from the manufacturer and on site.

Accidental release of hazardous chemicals on site and in transit may result in explosions, air pollution and significant environmental impacts in relation to soil, groundwater and surface water contamination. Releases of hazardous substances to the air could impact the local environment including human receptors.

Solid Wastes

The inorganics sector is diverse and wastes are generated and could be very process-specific, but some parts of the sector do generate significant quantities of waste and in most cases they are non-combustable so there are major volumes of disposals of waste to landfill (if not hazardous). These wastes mainly contain inert material from the feedstock, impurities from the feedstock, insoluble precipitated salts, wastes generated during the neutralisation of process streams and losses raw materials during handling.

Accidental release of hazardous chemicals

Accidental release of hazardous chemicals on site and in transit may result in explosions, air pollution and significant environmental impacts in relation to soil, groundwater and surface water contamination. Releases of hazardous substances to the air could impact the local environment including human receptors, potentially leading to large compensation claims. Remediation costs could be high, particularly if the site is in an area of high environmental sensitivity, for example, if located above a drinking water aquifer. Additional costs may include criminal or civil fines, ecosystem rehabilitation (e.g. fish restocking) and claims from third parties such as nearby landowners or residents.

OTHER ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Noise and Vibration

Noise and vibration from compressors and other machinery, steam relief valves, large combustion units, flares are constant features of most large volume inorganics plants. This can lead to noise induced hearing loss and result in nuisance to neighbours

Soil, Groundwater and Surface Water Contamination

Contamination of soil, groundwater and surface waters (on site and in transit) can occur through

[1] United Nations 2007

acute incidents and accidents such as a major spillage or via gradual or repeated leakage. Surface waters are particularly vulnerable to chemical contamination. Chronic, undetected leakages on site can occur as a result of fractured vessels, seals, valves and pipelines. This is of particular concern where heavy metals and other persistent inorganic chemicals, including cyanide, are released.

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

Packaging

Large quantities of packaging may be used. Companies operating with 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.

Permitting

Chemical production facilities in the EU are subject to national regulations under the Integrated Pollution Prevention and Control Directive (2008/1/EC) and the Seveso II (1996/82/EC) which aims to control the major accident hazard from dangerous substances. Operations outside the EU will be subject to local regulations.

Legal entities in the EU manufacturing, importing or using certain chemical substances may be subject to a new EU regulation called the Registration, Evaluation and Authorisation of Chemicals (REACH) (1907/2006). This regulation places potentially new requirements on "users/manufacturers" to evaluate and control the health and environmental risks associated with certain substances.

Machinery

Moving parts of machinery can result in entanglement and entrapment. Particular attention should be paid to conveyors and packaging machinery.

Respiratory Disease

Dust created in the process can be inhaled and cause respiratory disease.

Collision

This often takes the form of people being hit my 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.

Confined Spaces

Storage silos are dangerous confined spaces and entry to them must be strictly controlled and avoided wherever possible.

Fire/Explosion risk

Major explosions or fires at chemical storage facilities have resulted in widespread contamination and destruction, impacting not only the immediate site but surrounding land, rivers and communities. The release of hazardous gases which may travel many kilometres from the site, is of particular concern. Compensation costs for such incidents are high and widespread remediation and rebuilding may be necessary.

Security

Chemical plants, storage and distribution networks could be targets for criminal or terrorist attack and therefore appropriate security measures must be implemented to minimise this hazard.

POTENTIAL COMMUNITY ENVIRONMENT, HEALTH & SAFETY RISKS

Public Anxiety

Public anxiety, particularly from neighbouring residents, can be caused by a lack of knowledge regarding the nature of the chemicals being stored on the site, odours from the site, the potential for fires and explosions and the action that will be taken in the case of an accidental release. This public anxiety can result in significant planning constraints being imposed on this type of facility.

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 industrial activities in the area;

- Some of the substances produced or used have the potential to cause offensive odour to neighbouring communities

Transport

Transport of products by either road 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 or liabilities and entities can trade their carbon allowances;

- Injuries may lead to increased payroll costs to replace skilled workers and lost production time;
- If the products are manufactured, imported or distributed within the EU they may be registered under the REACH regulations. This may represent a substantial cost and will be particularly significant to manufactures producing small quantities of a large range of chemicals. Other product legislation will also apply;
- Capital investment may be required to comply with new environmental, health and safety requirements;
- There is a relatively high potential for soil and groundwater contamination to be present which can be very costly to remediate;
- Fines, penalties and third party claims may be incurred for non-compliance with environment, health and safety regulations.

IMPROVEMENTS

Environmental, Health and Safety Improvements

- Conduct a facility wide risk assessment [not sure what exactly this should include?] ;
- Consider adoption of pre treatment processes to purify raw materials to reduce the amount of waste produced during the manufacturing process;
- Aim to minimise fugitive releases of liquid and gaseous organics at the design stage by the specification of high quality items and materials of construction which minimise leakage;
- Implement a formal Leak Detection and Repair (LDAR) programme and where necessary, replace with higher quality items, any equipment which generate significant fugitive emissions;
- Recover and re-use raw materials and waste and/or damaged products where practicable;
- Regular inspection should be carried out of all bulk containment and infrastruture 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;
- Installation or upgrade of abatement technology to minimise exposure to toxic raw materials and product and to control the release of emissions, e.g. enclosure of equipment, appropriate ventilation with filters, gas balancing systems baghouses, cyclones, filters, and wet or alkali scrubbers;
- Enclose conveyors and storage areas to reduce dust;
- Maintain on site abatement equipment and treatment plant
- Recycle wastewater where possible back to the processes or to secondary uses such as for cleaning;

- Minimise the consumption of water in the process including water used in product purification and equipment cleaning;
- Use dry techniques where appropriate to abate particulate and gaseous exhaust streams;
- Segregate process wastewaters, rainwater and indirect cooling water streams to reduce the hydraulic loading to wastewater treatment plants or sewers;
- Eliminate equipment cleaning between batches of the same product unless essential. Where this not possible, such as at weekend shutdown, consider a reduced level of cleaning;
- Use dry cleaning methods wherever practicable for solids, e.g. vacuum extraction, wipe down equipment that is accessible rather than washing and rinsing it;
- Treatment chemicals, such as corrosion inhibitors, coagulants, flocculants, descaling agents, NaOH and biocides, should be chosen so that they minimise concentration of pollutants in wastewater;
- Emergency storage lagoons may be needed to prevent contaminated firewater reaching controlled waters [not sure what is the meaning of term 'controlled waters'?];
- Improve insulation to minimise heat loss;
- Recover heat and energy from inorganic 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;
- Redesign manual processes to avoid heavy lifting/repetitive activities;
- Install mechanical lifting aids where possible and rotate work tasks to reduce repetitive activities;
- Separation of people from moving equipment:;
  - Ensure that the process layout reduces opportunities for process activities to cross paths;
  - Installation of safeguards on moving parts of conveyor belts to reduce risk of entrapment of employees;
  - Install walkways to separate people from vehicle movements 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;
- Route cables and pipework under walkways to prevent slips, trips and falls;
- Construct walkways of non slip materials;
- Install automatic alarms and shut off systems;
- Systems should be subject to frequent and proper inspection;

- Provide the local fire department with a list and volume of raw materials and products stored on the premises;
- Control the effect of fires and explosions by segregating process, storage, utility and safe areas;
- Avoid potential sources of ignition including banning smoking in and around facilities;
- Use explosion-proof equipment and conductive materials and ensure that equipment is grounded and bonded;
- Consider need for upgrades to security measures.

Social, Labour and Community Improvements

- Involve the neighbouring community in the creation and practice of plans to respond to major incidents at the installation;
- Implement a programme of assessment of routine monitoring of worker health;

GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

During the initial site visit, the issues will vary according to the type of process being used and 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 effluent and/or 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 without adequte treatment;
- Check the condition of storage facilities for raw materials and finished products;
- 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? Is there a trained and competent fire fighting resource on site?

- 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;
- 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/faulty products? Have there been any recent product recall incidents?
- 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?
- 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 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

- 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, safety and social 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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