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Sub-Sectoral Environmental and Social Guidelines: Pesticide Production

PROCESS DESCRIPTION

Facilities in the pesticide industry, manufacture, formulate, package and repackage a variety of pesticide products, including herbicides, insecticides and fungicides. These facilities typically have physical divisions between formulating and packaging operations, and between dry and liquid operations.

Pesticide manufacture entails several process steps to build up a biologically active chemical entity from raw materials and/or specific chemical intermediates. All manufacturing steps may generate air emissions, effluents, waste and by-products.

Secondary processing involves the formulation of the pesticide in a marketable form. Pesticides are formulated in a number of forms, for example, as emulsifiable concentrates, oil in water emulsions, flowable concentrates, granules, water dispersible granules and wettable powders, depending upon the product. This normally only involves physical operations such as vessel charging, mixing, milling, warming, cooling, product transfers, granulation, drying, sieving and packaging. No chemical reactions should take place during secondary processing.

Formulation techniques include both automated and manual formulation and packaging lines. Formulations are packaged by transferring the final product into containers or boxes, either manually by gravity feeding or automatically.

The application and use of pesticides is outside the scope of this guideline.

KEY ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Hazardous Materials

The manufacture of these biologically active molecules poses a high degree of risk to the environment. Some pesticides are manufactured from extremely hazardous raw materials such as organophosphorus compounds (OPs) and other persistent organic pollutants. The final products are persistent in the environment and thus extra care must be taken when handling these materials.

Pesticide production uses and creates significant quantities of hazardous materials, both in terms of raw materials, intermediate, waste and final products.

Air Emissions

Volatile organic compounds (VOC), fine particulates, exhaust gases and greenhouse gases may be generated during pesticide production processes.

- VOCs are emitted during pesticide manufacture and formulations and during equipment cleaning;
- Dust can contain active ingredients that are toxic to humans and the environment.

Wastewater

Many facilities operate wastewater treatment plants to perform primary treatment to effluent prior to discharge to the sewerage system. Variations to wastewater discharge consents may require changes in the operation of the



treatment plant, in order to maintain compliance.

- Wastewater from pesticide production processes may contain organic biodegradable compounds and trace amounts of active pesticides;
- Spent fermentation substances from biopesticide manufacture may contain substances with a high biological (BOD) and chemical oxygen demand (COD) and high total suspended solids (TSS);
- Cooling and heating waters may be a source of thermal pollution

Wastes

Pesticide production generates both hazardous and non-hazardous liquid and solid wastes, including: residues and filtrates contaminated with hazardous chemicals, active pesticides, cyanides, heavy metals; off-specification products; packaging waste; and spent solvents.

Both damaged product and packaging can generate significant volumes of solid waste. Damaged product, particularly if hazardous in nature, will require appropriate storage and disposal techniques. Packaging may be contaminated with hazardous chemicals. The site should comply with the regulatory requirements for the storage and disposal of solid and hazardous wastes and use authorised waste transport and disposal contractors.

Soil, Groundwater and Surface Water Contamination

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

major spillage or via gradual or repeated leakage. Surface waters are particularly vulnerable to pesticide contamination. Chronic, undetected leakages on site can occur as a result of fractured vessels, seals, valves and pipelines.

Fire/Explosion Risk

Solvents used in the manufacture of pesticides can give rise to fire and explosion hazards. In addition, pesticide dusts can be highly explosive. Large volumes of flammable and highly flammable products will be handled and stored along with combustible gases and process chemicals. 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. Hazardous gases, may be released, which may travel many kilometres from the site causing significant exposures to hazardous, volatile and flammable chemicals to workers and surrounding communities. Sites may be subject to legislation designed to control the risk of such major accidents. Compensation costs for such incidents are high and widespread remediation and rebuilding may be necessary.

Security

Pesticide 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.



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OTHER ENVIRONMENTAL, HEALTH AND SAFETY RISK/LIABILITY ISSUES

Storage of Oils, Gases and Chemicals

Considerable quantities of oils, gases and chemicals may be utilised in the production and formulation process. Typical storage includes:

- Aboveground and underground storage tanks containing raw materials, fuel oil and finished product;
- Drums of assorted additives, caustics, disinfectants, detergents and solvents.

Underground tanks and pipelines are at greater risk from undetected damage and corrosion and therefore above ground storage tanks are preferred.

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.

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

Water consumption

Water is used for raw material preparation, cooling, dust suppression and vehicle cleaning. This can be supplied either from the mains or from local abstraction. Where local abstraction occurs, a permit or consent, which controls

volumes of water removed, is likely to be required.

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.

Energy Consumption

Pesticide production plants consume large amounts of energy to generate electricity, heat and steam.



Permitting

Pesticide 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 still be subject to local regulation but this will generally set less stringent requirements on the techniques to be adopted.

Pesticide products placed on the market within the EU may be subject to the Dangerous Substances Directive (2006/11/EC), the REACH Regulations (1907/2006), the Biocidal Products Directive (98/8/EC) and may also be subject to the Plant Protection Products Directive (91/414).

Pesticides should only be manufactured under licence and registered and approved by the appropriate authority in accordance with the Food and Agriculture Organization's (FAO) International Code of Conduct on the Distribution and Use of Pesticides and be labelled in accordance with international standards and norms.

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.

Machinery

People working with moving parts and equipment are at risk of 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.

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.

KEY SOCIAL, LABOUR AND COMMUNITY RISK/LIABILITY ISSUES

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.

Accidental Leaks

Accidental leaks of toxic compounds and the presence of flammable gases and liquids pose the most critical hazards to community health and safety.



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Air Emissions

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.

Transport

As pesticides are produced in large volumes and often not close to the customer, transport of products by either road or rail can be a significant issue. In the case of road transport this might lead to road noise and traffic congestion.

Water Use

Where water is abstracted it is typical for abstraction or water use permits to detail volumes of water abstraction allowed as over abstraction can impact local communities.

FINANCIAL IMPLICATIONS

- Many countries are signatories to the Kyoto Protocol and have adopted targets for the reduction of CO₂ emissions. Where Governments have set up carbon emission reduction programmes industrial processes have been required to reduce their CO₂ 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. The scheme can create both financial assets or

liabilities and entities can trade their carbon allowances

- Where large quantities of energy are used then this can result in high operating costs to the business;
- Injuries may lead to increased payroll costs to replace skilled workers and lost production time;
- If the products are manufactured, sold or used within the EU they may have to 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 as well as those manufacturing substances subject to the most stringent forms of regulation;
- Capital investment may be required to comply with new environmental, health and safety requirements and industry and product standards;
- Phased out/reduced usage of pesticides because of tighter legislation may have a significant effect on the market for these products;
- If the products are manufactured, sold or used within the EU they must 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;
- There is a relatively high potential for soil and groundwater contamination to be



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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 ;
 - Consider dedicating equipment to one product, product family or entirely to solvent or water-based products to minimise cleaning required between product runs;
 - If dedicated equipment is not possible, consider managing the production schedule so as to minimise product changeover cleaning required;
 - Recover water and solvents used to rinse containers and equipment and reuse in product lines;
 - Install wastewater pre-treatment stages as required to reduce pollution;
 - Use flow reduction equipment to control the volume of water used in cleaning operations, e.g. spray nozzles, high-pressure/low-volume washers;
 - Use brushes, scrapers and vacuums to remove dried product prior to washing;
 - Minimise leakages and fugitive releases from pipework through use of appropriate
- corrosive resistant materials and leak proof valve and pump design;
 - Regular inspection should be carried out of all bulk containment and infrastructure 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 of abatement technology to minimise exposure to toxic raw materials and products and to control the release of volatile or dust emissions, e.g. such as enclosure of equipment, appropriate ventilation with filters, gas balancing systems, scrubbers. Recovered material should be recycled into the production process where possible;
 - Maintain on site abatement equipment and treatment plant;
 - Consider use of non-halogenated and non-aromatic solvents instead of more toxic compounds;
 - Install systems to recover and concentrate active ingredients;
 - 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;
- Construct walkways of non slip materials;
- Install automatic alarms and shut off systems;
- Maintain an up-to-date inventory of all substances present or likely to be present which could be hazardous to health or the environment;
- 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;
- Establish formal communication channels and procedures with the emergency services and other relevant authorities for use in the event of an accident;
- 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;
- Reduce solvent flammability by dilution with water in filtration and recovery steps;
- 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

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

GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

During the initial site visit, the issues will vary according to the type of pesticide 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;
- 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;
- Note any odours that might cause a nuisance;
- Note the 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;
- 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?
- Have there been any recent incidents on site such as fatalities, fires/explosions, spills? Is insurance in place to cover such incidents? Is there any legal action pending/likely?
- 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?
- Is the business involved with production of pesticides subject to bans and/or phase out (globally, nationally or locally)? If yes, what are the financial consequences of this?
- 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.
- 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:

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;
- 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



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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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