Sub-sectoral Environmental Guidelines APPAREL and Other Textile Products (Clothes Making)

PROCESS DESCRIPTION

The manufacture of clothing involves the cutting to size and subsequent sewing of the fabric into the final product. The sewing operation may be fully automated, semi-automated (this is the most common in the industry) or carried out by hand. Ancillary activities may include steam ironing, dry cleaning trial runs, the application of waterproofing or other coatings and packaging.

This guidance note does not include the dyeing or other treatment of fabrics and materials.

SUMMARY OF KEY ENVIRONMENTAL RISK/LIABILITY FACTORS

The environmental risks associated with the manufacture of clothing are limited with few significant risks. However attention should be paid to the issues outlined below:

Dust and Fly Generation

The cutting and working of material generates significant quantities of small particles of fabric, referred to in the industry as *fly*. High levels of fly and dust within buildings can be a cause of significant occupational health hazards (primarily respiratory). If uncontrolled, emissions of fly and dust may cause litter and nuisance problems outside the building. If not properly cleaned, build up of fly on machines can ignite and cause fires.

FINANCIAL IMPLICATIONS

The main costs are associated with dust and fly generation, in particular, requirements to improve the ventilation and extraction systems. This has health and safety benefits as well as reducing the potential risk of fires.

OTHER POTENTIAL ENVIRONMENTAL ISSUES

Environmental impacts arising from clothing manufacture are minor in nature. The main source of emissions to air are from boilers. Wastewater is primarily sanitary and laundry in origin. Solid and liquid wastes are unlikely to have a significant impact on the local environment. The use of energy may be high, particularly if electricity is used to power the machines. The industry is likely to use small amounts of specialist chemicals, such as antistatic agents, wax, waterproofing agents and solvents for dry cleaning. These chemicals should be

stored in a secure location with secondary containment. If the process of application generates wastewater a permit to discharge effluent may be required from the regulatory authorities.

ENVIRONMENTAL IMPROVEMENTS

Potential environmental improvements may include:

- regular cleaning and sweeping of dust and fly in the building;
- energy efficient lighting;
- upgrade of extraction and ventilation system to ensure dust/fly is controlled.

ENVIRONMENTAL ACTION PLAN

Recommended environmental action plans should focus on means to minimise the generation of dust/fly, the adequacy of ventilation and the use of chemicals.

GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

During the initial site visit it will be important to assess the following:

- the standard of housekeeping and amount of accumulated dust/fly on the floor, equipment, outside the building;
- level and adequacy of ventilation within the building. Check for solvent smells when first entering work areas;
- quantity and type of chemicals used, for example, solvents;
- potential for fire hazards in building and emergency response to fires, fire escapes, evacuation etc.;
- disposal practices for waste materials.

Contact should be made with the local regulatory agencies to determine compliance record and whether complaints have been made by the public. An example might include checking with the Health and Safety agency for instances of excess noise.

Sub-sectoral Environmental Guidelines
TANNERIES AND LEATHER PRODUCTS

PROCESS DESCRIPTION

Tanning is the act of converting animal hides and skins into leather. These are made of principally protein and also contain minor amounts of lipids, albumins, globulin and carbohydrates. The preliminary tannery processes or beamhouse processes (cleaning, trimming, deliming etc) prepare the hide protein so that all the undesirable impurities are removed, leaving the skin in a receptive condition to absorb the chromium, vegetable or occasionally other tanning agents used in the subsequent tanning operations. Fellmongers and tanners receive raw materials usually in a preserved (salted) and wet state although imported raw materials may be salted and dried. The number and type of processes will often vary from one tannery to another depending on the type of animal hide or skin processed. For example degreasing of hides using detergents is necessary for sheep and pigskins. After tanning, the skins/hides are thinned, shaped, dried and finished (though other treatment may also be applied).

SUMMARY OF KEY ENVIRONMENTAL RISK/LIABILITY FACTORS

Key risk/liability factors specific to tanneries include:

- wastewater discharge;
- soil and groundwater contamination;
- solid wastes and sludges;
- atmospheric emissions.

Wastewater Discharge

The principal pollutants in wastewater discharges are from the beamhouse operations and the subsequent tanning operations. The wastewater is rich in organic substances, solids and dissolved substances and it is extremely polluting.

Beamhouse flows contain high levels of suspended solids and dissolved organic matter, curing salt and grease, in addition to unused process chemicals (particularly dissolved sulfides); they will also be alkaline and will have a high oxygen demand.

Tanning produces acidic effluents which when derived from chrome tanning will contain unused trivalent chromium salts. Typically, approximately 25% of the applied charge of chromium salt is discharged on completion of the tanning operation.

Other harmful chemicals contained in tannery wastewater discharges include:

- lindane (gamma hexachlorobenzene) - an insecticide found on some hides/skins

- pentachlorophenol - a fungicide found on some imported hides/skins
- cadmium - used in certain colouring pigments

Typically wastewater treatment on site involves physical settlement/screening and chemical treatment to precipitation dissolved substances (eg., chromium)

Issues to Consider:

- Consider if it is cheaper to partially/fully treat waste on site or pay (higher) fees and penalties for discharging to sewer.
- Tightening of regulatory requirements may necessitate investment in technology in order to maintain compliance.
- Ability of industrial sewer to capture all process effluents.
- Integrity of drainage system is critical when carrying chrome effluent.
- Possibility of accidental or environmental sensitive materials reaching local water courses
- Efficiency of wastewater treatment and potential need for upgrade.
- Runoff/stormwater drainage from raw material, production and waste holding areas.

Soil and Groundwater Contamination

Soil and groundwater contamination occurs when chemicals and wastewater seep through the soil from unlined ponds, pipes and drains, or from dumps and spills. In this way underground water sources can become contaminated. Important pollutants are chlorides, tannins, chromium, sulphate and sulphides as well as trace organic chemicals and chlorinated solvents.

Issues to Consider:

- Secondary containment of tanks and working areas (bunds etc.) to prevent spills reaching the wider environment.
- Licensing of storage facilities.
- Age, construction details and testing programme of tanks.
- Labeling and environmentally secure storage of drums (including waste storage).
- Accident/fire precautions and emergency procedures.
- Disposal/recycling of solvents, tanning solutions, waste oils, etc.

Disposal of Solid Wastes and Sludges

Hair, offcuts, sludge are the main types of solid waste. Solids are usually disposed of to a landfill site. Dewatered sludges from tanneries can also be disposed of to controlled landfills without significant environmental problems being incurred. Tanning sludges should immediately be covered with inert material to avoid odour generation and insect infestation.

Landfills which receive other industrial residues, hydrogen sulfide particularly acidic wastes, may not be suitable for receiving tannery wastes. Toxic hydrogen sulphide (H_2S) may be liberated and chromium will become soluble and hence escape to groundwater via leachate seepage.

Tannery sludges of organic composition, if free of chrome and sulphides, can have some value as a soil conditioner.

Issues to Consider:

- Solid waste should not be stored too long on site due to the nuisance effect of smells (see below).
- Regulatory requirements.
- Fees and penalties.
- Ownership of waste disposal sites.
- Potential pollution of soil and groundwater related to on-site and off-site storage.

Air Pollution and Odour

In confined areas where releases to atmosphere arise from open-topped vessels, air extraction systems need to be designed to take account not only of occupational health requirements but any local air quality standards, having particular regard to total particulates (from mechanical operations), hydrogen sulphide (H_2S - from deliming), volatile organic compounds (if relevant to the operations) and formaldehyde (if still used for fixing resins in coatings).

Apart from odour, few major air impacts are expected outside a fellmongering or tannery operation. Overall, provided occupational hygiene requirements within the workplace are met and alkaline sulphide liquors are oxidised before being allowed to mix with other (neutral/acidic) flows, thus avoiding formation and stripping of odorous and toxic H_2S gas, atmospheric emissions should not normally create serious problems.

Issues to Consider:

- Regulatory requirements (including health and hygiene permit requirements).
- Fees and penalties.
- Requirements to upgrade pollutant abatement equipment.

FINANCIAL IMPLICATIONS

- Pollution abatement may be achieved at a moderate cost via management initiatives. Installation of abatement technology may involve significant costs.
- The need to pay fines for contamination of nearby surface watercourses.
- If permit limits are breached, fines may be imposed and the installation of on-site effluent treatment plants may be required.
- Drainage systems may need to be inspected, upgraded, replaced or re-routed.
- Capital expenditure may be required for the installation of settlement tanks.
- Soil and groundwater remediation may be costly to perform.

OTHER POTENTIAL ENVIRONMENTAL ISSUES

Asbestos and PCBs

Asbestos and PCBs may need to be removed from the site.

- Asbestos may be found in building materials and as insulation on pipework.
- PCBs can be found in transformer hydraulic equipment oil and capacitors.

Health and Safety Issues

Management and staff should be aware of applicable health and safety legislation and procedures.

ENVIRONMENTAL IMPROVEMENTS

- Water/wastewater minimisation.
- Sulphide substitution in dehairing.
- Recycling lime/sulphide liquors after fine (1mm) screening.
- Sulphide stripping at low pH and collection of H_2S in caustic soda solution.
- Dehair/hair save techniques.
- Reductions in chrome discharges in tanning (improved process controls, use of self-basifying chromium compounds and dicarboxylic acids).
- Chrome tannage recycling.
- Chrome effluent recovery.
- Use of chrome substitutes (aluminium, titanium and zirconium salts, glutaraldehyde, cod oil).
- Increased bi-product possibilities (gelatine, glue, leatherboard, tallow, protein, etc.).
- Improved wastewater treatment.
- Segregation and partial treatment of alkaline sulphide-containing unhairing liquors, often by screening and subsequent catalytic oxidation (aeration in the presence of a manganese catalyst).
- Balancing of the treated alkaline liquor with screened neutral and acidic flows from all other processes.
- Chemical flocculation/precipitation of the combined balanced flows at controlled pH and subsequent settlement.

Thickening/dewatering of primary sludges prior to off-site disposal (e.g. landfill).

GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

When visiting the sites of potential borrowers, or during loan supervision, use the following as a practical guide to due diligence.

- Perform a complete tour of the site compound if possible.
- Note the quantities and characteristics of atmospheric emissions, wastewater discharges and solid and hazardous waste arisings.
- Enquire about the current status regarding pollution abatement technology.
- Inspect the effluent treatment and disposal system for waste.

- Note signs of poor housekeeping; fugitive dusts, rubbish piles etc. check for smells, check for stained workers hands.
- Look for localised spills, leaking pipes etc.
- Check use of personal protective equipment for hearing and breathing.
- Review age and condition of process equipment.
- Assess emergency response to fires, major spills etc.
- Review historical and projected environmental fees and fines.

It is also suggested that contact is made with local regulatory agencies to determine compliance record and whether complaints have been made by the public.

Sub-sectoral Environmental Guidelines TEXTILE MANUFACTURE

PROCESS DESCRIPTION

The principal raw material used in textile manufacture are the natural fibres wool, cotton and silk, and man-made (synthetic) fibres.

Raw fibres may be in staple (short fibre) or continuous filament form. In the staple form, fibres are converted into yarn by spinning and twisting. Wool and cotton are available in the staple form only, while man-made fibres are available in either stable or continuous filament forms. Silk is available in continuous filament form only. Staple form man-made fibres are typically used to produce blended fabrics containing combinations of man-made fibres, or man-made and natural fibres.

The manufacture of natural textiles involves a wide variety of physical and chemical processes, depending on the fibre type and the specification of the fabric product for use in clothing, furnishings or for industrial applications. The nature of the processing exerts a strong influence on the potential impacts associated with textile manufacturing operations.

Key processes include the conversion of fibre into yarn by spinning and twisting and the conversion of yarn into fabric by weaving or knitting. The grey (unfinished) goods can then either be sold on or cleaned.

The cleaning of grey (unfinished) goods includes:

- boiling;
- carbonising and scouring in hot alkaline soap or detergent solution to remove wax, dirt and grease; and
- dry cleaning of knit fabrics using solvents

The cleaned fabric will then be subject to a series of finishing processes including:

- removal of excess fibres from cotton cloth (singeing);
- coating of warp yarns to stiffen or strengthen them;
- removal of sizing material used in binding using either enzyme treatment or sulphuric acid (de-sizing);
- bleaching;
- mercerising of bleached cotton, using caustic soda, to increase fibre size and prepare fabric for dyeing;
- dyeing and printing;
- final finishing, such as waterproofing, fireproofing, mothproofing and permanent press, dependent on the properties required for the final product.

The nature of the cleaning and finishing regime is dependent on both the use specification of the final fabric product and on the fibre type. Generally, the

natural fibres require more rigorous cleaning and pre-dying treatments than the blended or man-made fibres. For example, cotton-polyester blends do not necessarily require mercerisation to improve dye affinity of the fabric; and man-made fibres require only light scouring with little or no bleach in prepare for dyeing, as they are essentially free from impurities.

SUMMARY OF KEY ENVIRONMENTAL RISK/LIABILITY FACTORS

Wastewater discharge

Water utilisation, treatment and disposal of aqueous effluent represent the key environmental issues associated with textile manufacture. Hence, the risk factors are primarily associated with the principle wet processes, including scouring, desizing, mercerising, bleaching, dyeing and finishing (in particular, large quantities of wastewater are produced from desizing, scouring and bleaching process).

Treatment to remove colour can increase the risk of pollution. For example, treating azo-dyes results in production of amines which could be a greater risk to the environment than the dye itself. Therefore careful consideration of the environmental effects of the treatment method used is necessary. Removal of colour at municipal sewage treatment works is not usually viable.

Prevention of spillages of dyes into watercourses and treatment of effluents to reduce the quantity of dyes present in waste water. The method of removing colour from the wastewater varies according to the class of dye. Some types of dyes cause visual pollution but are not otherwise polluting.

Pollution of local water courses due to discharge of wastewater or spillage of chemicals, which may include dyes, pesticides, metals and detergents.

Land contamination

Contamination of soil and groundwater as a result of current or previous activities at the site from dyes, cleaning and finishing chemicals, wastes, oils and fuel.

Fire hazard

In production areas the high temperatures generated by production machinery and the presence of flammable materials and dust, represents a fire hazard.

Health and safety

Health and safety issues related to emissions of dust, the risk of Bysinosis (lung disease) at cotton mills and noise from machinery.

FINANCIAL IMPLICATIONS

The potential financial implications associated with environmental risks and liabilities in textile manufacture include:

- Contamination of the site or groundwater may result in expenditure on site clean up and reduced asset value.
- Tighter regulatory standards for wastewater discharges to sewer to direct to water courses, together with regional/national plans for environmental improvement targets for the quality of receiving waters may require changes in raw materials or technology used on wastewater control equipment. Even where wastewater is discharged to a wastewater treatment plant, some form of pre-treatment is likely to be necessary, including neutralisation of pH and removal of solids and organic materials. Dewatering of the sludges produced by these treatment processes may also be required. Such requirements will have implications for both capital and operating expenditure.

- Stricter legislation will increase the costs of other environment-related expenditure such as waste disposal, water supply and water abstraction, and control of air emissions.

OTHER POTENTIAL ENVIRONMENTAL ISSUES

Atmospheric emissions

Atmospheric emissions arise from process operations, fuel combustion and dewatering of sludges.

- Emissions of volatile organic compounds (VOCs) arise from:
  - cleaning of fabrics during preparation processes;
  - use of inks in printing;
  - fabric surface coating operations;
  - handling and storage of materials.
- Emissions of particulates, formaldehydes and di-isocyanates arise from textile finishing processes.
- Dust emissions inside the plant.

Issues to consider:

- Air extraction measures, such as afterburners and absorbers, to prevent escape of VOCs and to capture emissions produced during the dewatering of sludges.

Water supply

- Security and cost of water supply, from mains or via direct abstraction, will affect the viability of the business.
- Quality of process water used. This may require pre-treatment prior to use.

Handling and storage of raw materials

- Typical storage containers include tanks and drums, sacks and bags.

- Pollution risks to water courses and soil arise from spillages of dyes, wastes, chemicals, oils and fuels.

Issues to consider:

- Develop procedures for the handling and treatment of hazardous materials in the event of spillage.
- Carry out handling of VOC and dust-generating materials in enclosed areas, fitted with air extraction equipment where necessary.
- Secondary containment of tanks (bunds, for example) to prevent spills reaching the wider environment.
- Regular inspection of secondary containment facilities and fitting of alarms, where not regularly inspected.
- Develop emergency procedures for the containment of spillages and preventing escape to water courses.

Solid and hazardous waste management

Solid wastes include waste from fabric preparation, sludge from wastewater treatment processes, and some sludge from processing of natural fibres. Hazardous wastes include waste oils and solvents from maintenance and operation of equipment.

Issues to consider:

- On-site management of solid and hazardous waste.
- Sludges must be disposed of to licensed landfill.
- Ensure that wastes are removed from site by licensed waste collection/disposal contractors.

Odours and Noise

Odour emissions and noise of operations can cause a local nuisance.

Asbestos and PCBs

Asbestos and polychlorinated biphenyls (PCBs) may need to be removed from the site which can be costly. Asbestos is found in building materials, pipework and insulation. PCBs can be found in electrical equipment such as transformers/hydraulic equipment and capacitors.

ENVIRONMENTAL IMPROVEMENTS

- Effluent facilities or holding tanks, can regulate the rate of discharge of wastewater, balancing out the load on watercourses and sewage treatment works.
- Changing the class of dye used and improving the fixation efficiency of dyes may reduce the problem of removing dye from wastewater.

- Where feasible identify importing suppliers who can provide a guarantee that their loomstate fabrics or natural fibres have not been treated with organophosphorus compounds.
- Secondary containment of bulk storage chemical tanks would help prevent the spread of routine spills to the wider environment. Further contamination of land could be prevented through the provision of containment for temporary storage areas of solid wastes such as empty chemical drums.
- Chemical substitution. Substituting dye stuffs and finishing chemicals.
- Introduce process changes that facilitate water use reduction and/or enable water re-use/recycling.

GUIDE TO INITIAL DUE DILIGENCE SITE VISITS

When visiting the sites of potential borrowers or during loan supervision, use the following as a practical guide to due diligence.

- Perform a complete tour of the site works, accompanied by someone knowledgeable about all the activities at the works.
- Identify the sources of fibres used in the plant and possibility of contamination of raw fibres with pesticides.
- Look for signs of poor housekeeping, such as signs of spillages and leaks and uncontained piles of empty drums, especially in the vicinity of sensitive receptors such as water courses.
- Find out whether drainage systems lead to wastewater treatment systems or discharge directly.
- Note the extent of treatment systems for the different types of wastewater, including process water, surface water runoff and cleaning water.
- Find out about the history of the site and the area, particularly any previous industrial use, in order to assess the likelihood of soil and groundwater contamination.
- Note the colour and appearance of adjacent water courses.
- Review measures preventing the escape of volatile organic compounds during process operations and materials handling, for example using afterburners.
- Note odour and noise levels at and around the site, particularly if there are residential areas nearby.
- Assess the level of health and safety awareness at the works, for example the presence of safety notices, the general appearance of the site and the use of personal protective equipment.
- Note the location and integrity of oil and chemical storage areas. These should be located away from operational areas and have measures to contain spillages.
- Assess emergency response planning in the event of a fire, major spill etc.
- Identify the source of process water and site sanitary/domestic water supply. Determine the conditions of any abstraction licence for process.
- Find out what, if any, treatment is required for process water prior to use.
- Review historical and projected environmental fees and fines.

It is also suggested that contact is made with local regulatory agencies to determine compliance record and whether complaints have been made by the public.