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SECTORAL GUIDEBOOK

Prepared for:

SIDBI

Prepared by:

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Public Disclosure Notice

Small Industries Development Bank of India (SIDBI) and Bureau of Energy Efficiency (BEE) as the co-implementing agencies are currently preparing a World Bank funded project titled *Financing Energy Efficiency at MSMEs*. The project will be supported by a grant from the Global Environment Facility (GEF). The main objective of the project is to improve efficiency and reduce Green House Gas (GHG) emissions through commercial investments in energy efficiency goods and services in target Micro, Small and Medium Enterprise clusters.

The proposed project will facilitate energy efficiency improvement through capacity building in MSME clusters and provision of grant support for preparing investment grade proposals for EE improvements. In addition to reductions in direct energy consumption, the implementation of potential EE improvements can produce additional positive environmental impacts from reduced combustion of fossil fuels.

In order to address any such environmental and social issues, SIDBI proposes to use ***Environmental and Social Risk Management Framework*** **(ESRMF),** prepared under a World Bank funded Lines of Credit for SIDBI titled ***Small and Medium Enterprise Finance and Development Project (SMEFDP).*** Currently ESRMF is being used for implementation of SMEFDP. The ESRMF is available at the URL: **http://www.smefdp.net/Projects/ESManuals.aspx**

Prior to formally adopting the ESRMF for implementation of *Financing Energy Efficiency at MSMEs Project*, SIDBI hereby discloses the above stated information in the public domain, and invites comments and suggestions if any.

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INTRODUCTION

The Sectoral guide book is developed to provide technical assistance to SIDBI's credit officers in assessing and monitoring E&S issues associated with potentially polluting industrial units. The Sectoral guide book is specifically designed to be used in context of SIDBI's environmental Policy and Environmental Risk Management Framework.

Based on SIDBI's portfolio and other secondary information sources, 30 sectors of SMEs have been identified. The Sector specific environmental information is collated under respective sectoral profiles.

HOW TO USE THIS DOCUMENT

The objective of this document is assist credit officers during environmental appraisal of the project & site visits by highlighting key environmental risk issue generally associated with specific sector of Industry.

During the initial meeting with the prospective borrower, credit officer is required to identify the relevant sector. He can then, read the corresponding sectoral profile in this document, in order to build understanding of environmental issues that may be associated with the unit.

The sectoral profiles have been formulated to facilitate ease of reference for the C.O. The following section describes the structure of these sectoral profiles and how a credit officer should use provided information in the most optimal manner.

1. **Process description** outlines the key process generally applied in respective sectors.

2. **Basic polluting process**, provides the list of processes which have the potential to create environmental issues within the industry. All of these processes may or may not be available in the concerned unit. These processes generally discharge emissions / effluents, which may be hazardous in nature. Number of these processes may vary from industry to industry. During appraisal of the project document the credit officer should note how many of these polluting processes are applicable in the concerned unit. All of these processes will constitute a waste stream. During site visits or discussions with client, the CO should enquire about the management of these streams and ensure that all of the waste streams are collected and channelised through some treatment process.

3. **Critical Pollutants,** provide the list of common pollutants generated to various media i.e air, water, solid waste and hazardous waste. Nature and concentration of these pollutants determines the technology required for treatment.

4. **Summary of Key Environmental issue,** highlights the key issues corresponding to type of pollution such as air pollution, water pollution etc., which may pose environmental risk to the unit. Credit officers should ensure that sufficient management measures are provided to deal with these issues in the project document.

5. **Recommended Pollution Prevention Measures,** provides indicative list of pollution control infrastructure that may be provided by the units in relation to type of pollution. During project appraisal the credit officer should ensure that provision for installation of these infrastructure has been made in the project document and the cost are appropriately tied up in the financial outlay of the proposal. Moreover on compilation of the implementation phase of the project, a physical check may be done to confirm installation of this infrastructure.

6. **Cleaner Production Initiative,** provides the list of common cleaner production initiative generally applicable to respective sectors. Cleaner production initiatives are a voluntary exercise which enable to a unit to reduce pollution load and save cost at the same time. Provision for these initiatives in any unit, signifies the promoters willingness and commitment towards environmental protection. Credit officer may share information on cleaner production options with the promoters in order to provide awareness for environmental protection and good management practices.

7. **Regulatory obligations,** provides the list of environmental regulatory obligations as per the Indian law. CO should ensure that the promoter has met all of these requirements prior to sanction of loan. Project proponent is required to submit copies of relevant permits / documents prior to signing of loan agreement. Promoter is required to submit an undertaking stating that he will regularly update the legal documentation and will abide with the provisions made under these permits / documents. During site visits, in the operational stage of the project, CO should check these documents and ensure that they are properly updated.

SUMMARY OF POTENTIAL ENVIRONMENTAL RISK

Sl. NO	SECTORS	AIR EMISSIONS	WASTE WATER	HAZARDOUS WASTE	CATEGORY
1	Bakeries & Confectionaries	M	L	L	E-III
2	Brick kilns	M	L	L	E-III
3	Ceramics	M	L	M	E-II
4	Cement Plant	H	M	L	E-I
5	Dairy and Dairy products	M	L	L	E-III
6	Distilleries	M	H	H	E-I
7	Dye & Dye intermediates	H	H	H	E-I
8	Edible Oil & Vanaspati	L	L	M	E-III
9	Electroplating	L	H	H	E-I
10	Engineering units (Cutting and shaping)	L	L	L	E-III
11	Engineering units (Metal surface treatment)	M	M	H	E-I
12	Floor and Pulse mills	M	L	L	E-II
13	Foundry	H	L	M	E-I
14	Food & fruit processes	L	L	M	E-I
15	Glass	M	L	M	E-II
16	Lime Kilns	M	L	L	E-II
17	Natural Rubber	M	L	M	E-II
18	Organic chemical Industries	H	H	M	E-I
19	Paints & varnishes	M	H	M	E-I
20	Pesticides	H	H	H	E-I
21	Pharmaceuticals	H	H	H	E-I
22	Plaster of Paris	M	L	L	E-II
23	Plastic Products	M	M	L	E-I
24	Pulp and Paper	H	H	M	E-I
25	Rice mills	L	L	L	E-I
26	Sports Good Industry	L	L	L	E-III
27	Soaps and Detergents	L	M	L	E-II
28	Stone Crushers	M	L	L	E-II
29	Tannery	L	H	H	E-I
30	Textiles (Dying & Printing)	L	H	H	E-I

H- High, M- Medium, L-Low

1.0 BAKERIES AND CONFECTIONARIES

1.1 PROCESS DESCRIPTION

The baking process uses yeast, salt, flour and water as raw material. They are first mixed using high speed mixers. After mixing the doughs are divided into loaf of breads. The loafs are then molded using two rollers. The dough pieces are then taken to proovers where the yeast action causes the loafs to enlarge in size. The high risen loaf are then taken to pre-heated oven for baking. After baking, the loaf is cooled and finally cut into bread pieces and packed to keep its softness.

21.2 BASIC POLLUTING PROCESS

- Kneading/mixing
- Baking
- Packing
- Washing

1.1 CRITICAL POLLUTANTS

Critical pollutants typically generated in the baking and confectionary industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Boilers and DG Sets emissions such as SPM, NOx.
2	Water	Floor washings, vessel cleanings containing BOD & O&G
3	Solid	Rejects, dough spills, packing paper, Bread crumbs.

1.2 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of the air pollution are DG sets, boilers releasing SPM and NOx. Generally the potential of air pollution is reletively less from this industry.

Water Pollution

The effluents are generated from the vessel cleanings, bottles washings, etc. Waste water may contains high Biochemical oxygen demand thus Aquatic life can be adversely affected due to discharge of the wastewater on surface water bodies.

Solid Waste

The main solid wastes are the rejects, dough spills generated during baking and other operations. Other waste includes the packing paper and bread crumbs.

1.3 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the measures for treating the various types of waste generated in the baking and confectionary industry.

1.1.1 AIR POLLUTION

Equipments like fabric filters, bag houses, wet scrubbers and electrostatic precipitators are used for particulate removal.

1.1.2 WATER POLLUTION

In case the unit is a member of CETP then only primary treatment is required. If not, the *effluent treatment* includes pretreatment i.e. screening etc. to remove large solids. *Primary treatment* consists of sedimentation/filtration operation to remove suspended solids. Chemical treatment includes pH adjustment. *Secondary treatment* involves biological treatment using activated sludge process / anaerobic systems

1.4 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution generated from the bakery and confectionary industry as well as leading to resource conservation in the manufacturing process.

- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Minimization of unplanned or unroutined discharges of wastewater caused by equipment failures, human errors, and faulty maintenance procedures.
- Efforts to reduce odour problems using ventilation systems.
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1.2 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

2.0 BRICK KILNS

1.5 PROCESS DESCRIPTION

The manufacturing of brick begins with the crushing of raw materials i.e. surface clays and shales in the crusher which, breaks up the large chunks of clay or shale and passes it to conveyors heading for the grinders. The grinders or 'Muller Wheels' pulverize the material to a fine consistency. After screening, the material is sent to the pug mill where it will be tempered to make a homogeneous plastic mass ready for shaping in the required brick form. The homogeneous plastic mass is moulded to give the shape of the brick. The green brick is then passed through the long length of the coal-fired kiln having a combination of horizontal or vertical drafts. The preheating, burning and cooling is done in zones varying in temperatures up to 2,000 degrees. After exiting the kiln, the brick is allowed to cool prior to handling. The finished product is packaged and transported to the different places.

1.6 BASIC POLLUTING PROCESS

- Green Brick Moulding
- Firing of Brick in kiln
- Ash laying
- Coal crushing
- Brick unloading and transportation

1.7 CRITICAL POLLUTANTS

Pollutants typically generated in a brick kiln is as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	SPM, SOx, NOx, Dust, CO, CO_2
2	Solid waste	Ash, rejects from kiln & coal crushing and loading/unloading,
3	Noise	From mechanised brick moulding, coal crusher

1.8 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Major sources of air pollution are coal crushing and burning operations, loading and unloading operations, transportation, firing operations in kilns. Some of the Klins have movable chimneys, they cause fugitive emissions during change in their positions. These chimneys are banned under the Indian regulations. Due to CO_2 emissions from coal burning the brick kiln sector is a major green house gas contributor.

Noise generation

Mechanized brick moulding and coal crushers are the cause of noise pollution. They may create problems for the workers and the surrounding population.

1.9 RECOMMENDED POLLUTION PREVENTION MEASURES

2.1.1 AIR POLLUTION

SPM, Dust can be treated by using fabric filters, wet scrubbers, electrostatic precipitators and bag houses. Other methods like appropriate ventilation and wet dust suppression may also be used for prevention of dust from spreading. Gaseous emission like SO_2, NOx, CO are minimized by dry scrubbing, condensation, absorption, adsorption (using activated carbon, silica gel, limestone, activated alumina and zeolites).

2.1.2 NOISE

Noise pollution can be controlled by use of efficient, sound-proof equipments. If possible, the industry should be located far from residential areas.

1.10 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reducing the load of pollution on the system as well as resource conservation in the manufacturing process.

- Use of cleaner fuel such as low sulphur coal can be use to reduce air emissions.
- Promotion of vertical shaft brick kiln technology for brick kilns.
- Use of energy efficiency processes wherever feasible.
- Water spraying to be carried out to prevent dust generation.
- Location of brick kilns should be far from the residential, agricultural and areas with gardens and fruits trees.
- Development of green belt around the cement kilns.

2.2 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

3.0 CEMENT PLANTS

3.1 PROCESS DESCRIPTION

The preparation of cement involves mining, crushing, and grinding of raw materials (principally limestone and clay); calcining the materials in a rotary kiln; cooling the resulting clinker; mixing the clinker with gypsum; and milling, storing, and bagging the finished cement.

Limestone and other materials containing calcium, silicon, aluminium and iron oxides are crushed and milled into a raw meal. This raw meal is blended (in for instance blending silos) and is then heated in the pre-heating system to initiate the dissociation of carbonate to calcium oxide and carbon dioxide. A secondary fuel is fed into the preheating system to keep the temperature sufficiently high. The meal then proceeds to the rotary kiln for heating and reaction between calcium oxide and other elements to form calcium silicates and aluminates at a temperature up to 1450^{o} C. Primary fuel is used to keep the temperature high enough in the burning zone for the chemical reactions to take place. The reaction products leave the kiln as a nodular material called clinker. The clinker is then inter-ground with gypsum, limestone and/or ashes to a fine product called cement. This fine product is then bagged to be transported to various places.

3.2 BASIC POLLUTING PROCESS

- Raw material handling
- Crusher
- Preheating
- Clinker formation and cooling
- Coal mill
- Cement mill
- Product handling & packaging

3.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the mini cement plant are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Particulate matter, SOx, NOx, fugitive emissions, trace elements in dust.
2	Noise	Cement Mill, Kilns, crusher
3	Solid	Fly ash

3.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of air pollution are clinker cookers, crushers, material-handling equipments, grinding mill operations. CO_2 emissions from combustion of fossil fuels and limestone calcining are a major green house gases source. Use of Petroleum coke results higher emissions of SO_2 from the Kiln.

3.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the pollution preventive measures for various wastes streams generated in the mini cement plants.

3.5.1 AIR POLLUTION

Mechanical systems such as cyclones trap the large particulates in kiln gases and act as pre-conditioners for downstream collection devices. Electrostatic precipitators (ESPs) and fabric filter systems are options for collection and control of fine particulates. Lime content of the raw materials can be used to control sulfur oxides. Gaseous releases can be treated by dry scrubbing, condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites). Water spray by truck(s), hoses and/or sprinklers helps to prevent the spread and movement of dust emissions.

3.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted with an aim of reduction in pollution generation from the mini cement plants as well as leading to resource conservation in the manufacturing process.

- Reduction of mass load emitted from the stacks, from fugitive emissions, and from other sources. Collection and recycling of dust in kiln gases is required to improve efficiency of operation and to reduce atmospheric emissions.
- Use of dust recovery systems to minimize the dust generation.
- Use of low NO_x burners, proper kiln design, afterburning in a reducing atmosphere and recovery of energy of gases in a preheated / precalciner to control NO_x emissions.
- Ventilation systems with hoods and enclosures covering transfer points and conveyors for control of fugitive dust emissions. Water spray on intermediates and finished product storage piles to reduce dust generation.
- Appropriate storm water and runoff control systems to be provided to minimize the quantities of suspended materials carried off site.
- SO_x emissions are controlled by use of low sulphur fuels and raw materials.
- Installation of equipment covers and filters for crushing, grinding and milling operations.

3.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	Yes
9	Submission of environmental statement (EPA,1986)	Yes

4.0 CERAMICS

(Potteries, sanitary ware, crockery ware, etc.)

4.1 PROCESS DESCRIPTION

The basic steps include raw material procurement, beneficiation, mixing, forming, green machining, drying, presinter thermal processing, glazing, firing, final processing, and packaging. The raw materials used in the manufacture of ceramics range from relatively impure clay materials mined from natural deposits to ultrahigh purity powders prepared by chemical synthesis. Naturally occurring raw materials used to manufacture ceramics include silica, sand, quartz, flint, silicates, and aluminosilicates.

28.2 BASIC POLLUTING PROCESS

- Crushing and grinding
- Sieving
- Filter pressing
- Wet finishing
- Drying/calcining
- Material handling and transportation

4.2 CRITICAL POLLUTANTS

Critical pollutants typically generated in the ceramics industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	SPM, SOx, NOx,
2	Water	Heavy metals, wastewater containing dust, TDS, TSS
3	Noise	From Crusher, grinder, blender, mill house, hydraulic press operations
4	Hazardous	Solid waste contains heavy metals due to discarded glaze which may contain Pb, Hg, B, etc; dust from bag house and rejects (fired and unfired scrap, paints, etc.)

4.3 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The air pollutants are primarily generated from the raw materials benification consisting of particulate matter. Raw material calciners emit filterable and condensible PM, gaseous pollutants like SOx, NOx, CO, CO2 etc. Particulate matter emissions consisting of metal and mineral oxides also arise. PM and products of combustion are emitted from spray dryers used for granulation. Emissions of fluorine compounds also are associated with firing. Other emission

sources associated with ceramics manufacturing include final processing operations and fugitive dust sources.

Water Pollution

The effluent contains TDS, TSS, heavy metals etc. The various sources are grinding, moulding, glazing and washing operations etc. If the wastewater from the industry is discharged into river/water body it may deteriorate water quality of recipient body.

Hazardous and Solid Waste

The various hazardous wastes are solid waste contains heavy metals due to discarded glaze which may contain Pb, Hg, B, etc; dust from bag house and rejects (fired and unfired scrap, paints, etc.).

4.4 RECOMMENDED POLLUTION PREVENTION MEASURES

4.4.1 AIR POLLUTION

Wet scrubbers, electrostatic precipitators etc. are used for particulate removal. Gaseous releases are treated by dry scrubbing using $Ca(OH)_2$ for NO_X and acidic gases. Other treatment options are condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites) and in some cases biofilteration, and bioscrubbing (using peat or heather, bark, composts, and bioflora to treat biodegradable organics), and thermal decomposition.

4.4.2 WATER POLLUTION

The effluent treatment includes *pretreatment* having screening, flow equalization, and *primary treatment* using sedimentation/filtration to remove suspended solids. *Secondary treatment* includes physio-chemical process such as precipitation, flocculation, and neutralization. Biological treatment includes biodegradation using aerobic oxidation, oxidation ponds or another aerobic process leading to 95 % removal of BOD.

4.5 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the generation of pollution from the ceramics industry as well as leading to resource conservation in the manufacturing process.

- Use of appropriate grinders and crushers for grinding and crushing operations leading to efficient grinding with minimum generation of dust particles.
- Material handling operations should be carried out in closed buildings to prevent the spread of dust particles.
- Regeneration and reuse of solvents should be carried out, if feasible.

- Noise preventive measures be taken to reduce noise pollution like provision of soundproof cabins for noise-producing equipments.
- Green belt should be developed around the areas to minimize the impact on ambient air quality.
- Frequent cleaning of equipment should be done.
- Recycle treated wastewater, if feasible.

4.6 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

5.0 DAIRY AND DAIRY PRODUCTS

5.1 PROCESS DESCRIPTION

The dairy industry generally involves following steps: (a) Procurement of milk from the farm; (b) Reception and storage of milk in plant; (c) Centrifugal clarification and separation; (d) Mix preparation and heat treatment followed by Homogenization; (e) Inoculation and incubation; (f) Cooling, incorporation of fruit and flavouring, and packaging; (g) Storage and distribution.

5.2 BASIC POLLUTING PROCESS

- Separation
- Pasteurisation
- Homogenisation
- Packing
- Washing, cooling tower, water softening

5.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the dairy farms and industry is as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Boiler emissions, methane, ammonia, reactive organics, dust
2	Water	BOD, Total suspended solids, O&G, dissolved sugars & protein, fats, nitrogen, phosphorus, pathogens
3	Solid	Non-toxic sediments/sludge, cow dung (from dairy farms)

5.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

A dairy often generates dust, which need to be controlled. Emissions of reaction gases due to decomposition of animal waste can create smog. Methane emissions contribute to global warming. Ammonia emissions can lead to formation of fine particulate matte.

Water Pollution

Due to high Biochemical Oxygen Demand (BOD) in the wastewater, aquatic life may be affected when wastewater is discharged into surface water body. Soil pollution can occur in case of land discharge. Nitrate pollution in groundwater can reach unhealthy levels due to runoff from dairy farms. Excess nutrients in water can cause algal blooms which deplete DO, killing fish and other aquatic life.

5.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the pollution preventive measures for various wastes streams generated in the dairy farms and industry.

5.5.1 AIR POLLUTION

Odour can be controlled by ventilation (use of adsorbents / biofilters on exhaust systems) and scrubbing should be implemented. Fabric filters are used for dust control. Gaseous emissions are minimized by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites).

5.5.2 WATER POLLUTION

In case of absence of CETP, the wastewater treatment comprises *pretreatment* involving preliminary screening using bar screens, communiters etc., and flow equalization and *primary treatment* using sedimentation/filtration for removal of large quantities of solids. *Secondary treatment* uses physical and chemical mediums involving neutralization and air floatation for removal of solids, fats and TSS. *Secondary treatment* also includes biodegradation like oxidation ponds, trickling filters, rotational biological contactors and activated sludge systems, sequential batch reactors for removal of BOD, COD and nutrients. Biological phophate removal systems (BPR) can also be used for phosphate removal.

5.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reducing the pollution load from the dairy farm and industry as well as leading to resource conservation in the manufacturing process.

- Reduction of product losses by better production control.
- Use of disposable packaging instead of bottles where feasible.
- Collection of waste product for use in lower-grade products such as animal feed.
- Optimization of use of water and cleaning chemicals and recirculation of cooling waters.
- Segregation of effluents from sanitary installations, processing, and cooling systems facilitating recycle of wastewater.
- Use of condensates instead of fresh water for cleaning.
- Recovery of energy by using heat exchangers for cooling and condensing.
- Use of high-pressure nozzles to minimize water usage.
- Avoidance of use of phosphorus-based cleaning agents.

5.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

6.0 DYE AND DYE INTERMEDIATES

6.1 PROCESS DESCRIPTION

Dyes are synthesized in a reactor, filtered, dried, and blended with other additives to produce the final product. The synthesis step involves reactions such as sulfonation, halogenation, amination, diazotization, and coupling followed by separation processes that may include distillation, precipitation, and crystallization. In general, organic compounds such as naphthalene are reacted with an acid or an alkali along with an intermediate (such as a nitrating or a sulfonating compound) and a solvent to form a dye mixture. The dye is then separated from the mixture and purified. On completion of the manufacture of actual color, finishing operations, including drying, grinding, and standardization, are performed; these are important for maintaining consistent product quality.

1.11 BASIC POLLUTING PROCESS

- Charging
- Reflux
- Distillation
- Filtration
- Washing & Finishing
- Drying
- Grinding
- Batch Reactions
- Cooling water bleed and boiler blow-down
- Left out mother liquor

6.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the dye industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	NOx, SOx, dust, ammonia, Cl2, Br2, H2S, VOCs, HCl, HI, HBr, fugitive emissions.
2	Water	BOD, COD, Acidity, TDS, Colour, chlorides, sulphides, phenolic compounds, heavy metals, non-biodegradable dyes & organic chemicals, acid/alkali/toxic trace metals, aromatic amines
3	Hazardous	Sodium sulphate/sulphite sludge, napthalene bearing sludge, process waste sludge/residues containing acid or other toxic metals or organic compounds, iron sludge, chemical sludge from ETP, dust from air filtration system, incinerator ash.

1.12 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The air pollutants are mainly generated from the charging, distillation, grinding operations as well as cleaning operations. Fugitive emissions are also generated during the manufacturing process. Care should be taken in handling operations.

Wastewaster Generation

Liquid effluents are generated from the washings and cleaning operations, boilers blow down operations, distillation etc. Cooling waters are normally re-circulated.

Hazardous and Solid Waste

The hazardous waste generates from, wastes and residues of the processes, sludge from the chemical reactions and ETP, incinerator ash and dust from APC equipments.

1.13 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the pollution preventive measures for various types of wastes streams generated in the Dye industry.

6.3.1 AIR POLLUTION

Stack gas scrubbing and/or carbon adsorption (for toxic organics) are applicable and effective technologies for minimizing release of significant pollutants. Combustion is used to destroy toxic organics, if any. Particulates can be removed by fabric filters, wet scrubbers and electrostatic precipitators. Control methods like appropriate ventilation and wet dust suppression are used for dust. Treatment methods like dry scrubbing, condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites) can also be used for gaseous emissions like NOx, SOx, ammonia, Cl2, Br2, H2S, VOCs, HCl, HI, HBr.

6.3.2 WATER POLLUTION

In case the unit is a member of CETP then only primary treatment is required. If not, the effluent treatment comprises of *pretreatment* i.e. screening, settling for removal of large solids. *Primary treatment* involves application of sedimentation/filtration for removal of suspended solids. Physical and Chemical treatment includes neutralization, flocculation, coagulation for removal of heavy metals, TDS, COD, BOD and other parameters. *Secondary treatment* using biological treatment consists of activated sludge systems, anaerobic systems etc. for removal of BOD, COD and other materials. *Tertiary treatment* includes carbon adsorption, detoxification of organics by oxidation (using UV systems or peroxide solutions). Reverse Osmosis (RO), Ultrafiltration and other filtration techniques are used to recover and concentrate process intermediates.

6.3.3 HAZARDOUS WASTE

If the unit is member of common TSDF, it requires only temporary storage facilities for hazardous wastes as per the required practices in pits / recommended containers. Various types of sludges can be thickened, dewatered, and stabilized using chemical agents (such as lime) before disposal, which must be in an approved and controlled landfill. Other wastes like ash etc. can be finally disposed to the secure landfill before some pre-treatment like incineration, stabilization, chemical treatment etc., if required. Contaminated wastes are generally incinerated, and the flue gases formed, are scrubbed if they are acidic in nature.

1.14 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of pollution load on the Dye industry as well as leads to resource conservation in the manufacturing process.

- Avoidance of manufacture of toxic azo dyes and provide alternative dye stuffs to users such as textile manufacturing.
- Replacement of highly toxic and persistent ingredients with less toxic and degradable ones.
- Measurement and control of quantities of toxic ingredients to minimize wastage.
- Re-use of by-products from the process as raw materials or as raw materials substitutes in the other processes.
- Use of automated filling to minimize spillage.
- Use of equipment washdown waters as makeup solutions for subsequent batches.
- Return of toxic materials packaging to supplier for reuse, where feasible.
- Provision of productive uses for off-specification products to avoid disposal problems.
- Use of high-pressure hoses for equipment cleaning to reduce the amount of wastewater generation.
- Labeling and storage of toxic and hazardous material in secure and bunded areas.

6.4 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	Yes
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture,	Yes

Sl. No	**Requirements under Indian Environmental Legislations**	**Applicable (Yes/ No)**
	storage and import of hazardous chemical rules, 1989)	
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	Yes
8.	Public liability Insurance (Public Liability Insurance Act)	Yes
9	Submission of environmental statement (EPA,1986)	Yes

7.0 DISTILLERY

7.1 PROCESS DESCRIPTION

The general process of beverage manufacture consists of malting and brewing. The malting process consists of converting raw material i.e. barley into malt by the development of enzymes which results in providing the maximum fermentable matter (malt extract). The malted barley is then subjected to the grinding and then mashing using water for dissolving the content of malt producing a sweet liquid or sugar solution. This sugar solution is finally fermented using yeast micro-organisms to produce alcohol.

7.2 BASIC POLLUTING PROCESS

- Malting
  - Steeping/germination
  - Drying
  - Kilning
- Brewing
  - Grinding
  - Mashing
  - Extraction & brewing
  - Fermentation

7.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the typical small distillery industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Boiler emission, SPM, NOx, SO_2, Odour.
2	Water Pollution	BOD, COD, Suspended solids, ammonical nitrogen.
3	Solid waste	Broken bottles, ETP sludge.

7.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Air emissions are emitted from boiler operations, furnaces in the kilning, drying, fermentation and other operations. Dust is generated in the grinding operations prior to mashing operations. Odur is the common problem of this industry. In general, the potential of the distillery industry is not high.

Waste Water generation

Liquid effluents are generated in the drying, mashing, and washing operations. The wastewater generated contains BOD, COD, suspended solids etc which requires treatment before discharge. In general, the potential of the industry to cause water pollution is high.

Hazardous and Solid Waste

Hazardous waste from distillery plant includes ETP sludge

7.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the End-of –Pipe treatment for various types of wastes generated in the distillery industry.

7.5.1 AIR POLLUTION

The gaseous air pollutants released from the distillery industry like SO_2, NOx etc. can be minimized by dry scrubbing, condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites). For the control of SPM, removal technologies like fabric filters, ceramic filters, wet scrubbers, electrostatic precipitators are used. Odour problem can be addressed by the making provisions for sufficient ventilation, location of manufacturing units far from residential areas.

7.5.2 WATER

The effluent treatment includes *pretreatment* i.e. screening etc. for removal of large solids, papers, cloth etc. *Primary treatment* involves sedimentation/filtration for removal of suspended solids. For the removal of BOD and COD, Physical and Chemical treatment includes neutralization, flocculation and coagulation. *Secondary treatment* involving biological treatment uses oxidation ponds, activated sludge systems, anaerobic systems etc. for further removal of BOD and COD before final discharge of the effluent.

7.5.3 HAZARDOUS AND SOLID WASTE

ETP Sludge can be thickened, dewatered, and stabilized using chemical agents (such as lime) before disposal, which must be in an approved and controlled landfill. Other wastes like broken bottles can be send to the recycling industry, if feasible.

7.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reducing the load on the pollution control system as well as resource conservation in the manufacturing process.

- Use of efficient and automated equipments, where feasible to minimize the generation of waste.
- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Regeneration and recovery of chemicals to the extent possible.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.
- Efficient ventilation and exhaust systems for odour removal.

7.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	Yes
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

8.0 EDIBLE OIL AND VANASPATI

8.1 PROCESS DESCRIPTION

The vegetable oil processing industry involves the extraction and processing of oils and fats from the vegetables. The preparation of raw material includes husking, cleaning, crushing, and conditioning. The extraction processes are generally mechanical (boiling for fruits, pressing for seeds and nuts) or involve the use of solvent such as hexane. After boiling, the liquid oil is skimmed; after pressing, the oil is filtered; and after solvent extraction, the crude oil is separated and the solvent is evaporated and recovered. Residues are conditioned (for example, dried) and are reprocessed to yield by-products such as animal feed.

8.2 BASIC POLLUTING PROCESS

- Oil extraction from seed i.e. expelling
- Solvent extraction from cakes
- Refining
- Filtering
- Bleaching

8.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the vegetable oil and vanaspati industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Solvents Hexane, boiler and DG Set emissions
2	Water	Free and emulsified oil, Suspended solids, BOD, TDS, sulphates, mixed dissolved fatty acids
3	Solid	Waste spent earth, Husk
4	Hazardous	Spent catalyst, ETP sludge

8.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Dust is generated in materials handling and in the processing of raw materials, including in the cleaning, screening, and crushing operations. DG sets and boilers are also major sources of air pollution. Solvent vapors are generated during the processing operations.

Water Pollution

The effluent contains BOD, COD, SS, oil and far residues etc. Seed dressing and edible fat and oil processing generate wastewater. There is possibility of groundwater and soil contamination in case of land application of effluent. Similarly, next point choking of conveyance system may

take place due to free and emulsified oil. The aquatic life can be affected in case of discharge of effluent to surface water bodies.

Hazardous and Solid Waste

Most of the solid wastes are of vegetable origin and can be processed into by-products or used as fuel. Spent catalyst can be sold for nickel recovery. Bleaching earth can be disposed off for oil recovery or as fuel in brick kilns.

8.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the measures for treating the various types of waste generated in the paper and pulp industry.

8.5.1 AIR POLLUTION

Proper circulation of air, using an extractive and cleaning system, normally is required to maintain dust at acceptable levels. Dust control is provided by fabric filters. Odor control is done by ventilation, but scrubbing may also be required. Gaseous emissions are treated by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites).

8.5.2 WATER POLLUTION

In case the unit is a member of CETP, then only *primary treatment* is to be done by the industry. Primary treatment involves screening and secondary treatment i.e. air floatation to remove fats and solids. In absence of CETP beside primary treatment also involves *secondary treatment* using biological treatment consisting of oxidation ponds, trickling filters, rotating biological contactors and activated sludge treatment for reduction of BOD and COD.

8.5.3 HAZARDOUS AND SOLID WASTE

In case the unit is member of common TSDF, it requires only temporary storage facilities for hazardous wastes as per the required practice. Spent catalysts can be sent back to the suppliers or to recycling industry for Nickel recovery. Sludges can be thickened, dewatered, and stabilized using chemical agents (such as lime) before disposal, which must be in an approved and controlled landfill. Bleaching earth can be disposed off for oil recovery or as fuel in brick kilns. Wastes like husk can undergo combustion before the disposal of the residue to the secure landfill.

8.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution load from the paper and pulp industry as well as leading to resource conservation in the manufacturing process.

- Prevention of formation of moulds on edible materials by controlling and monitoring air humidity.
- Use of citric acid instead of phosphoric acid, where feasible, in degumming operations.
- Preference to physical refining than chemical refining of crude oil to reduce the environmental impact of active clay.
- Reduction of product losses through better production control.
- Maintaining volatile organic compounds below the explosive limits like hexane below 150 mg/m^3 of air.
- Provision of dust extractors to maintain a clean workplace.
- Recovery of solvent vapours to minimize losses.
- Optimization of use water and cleaning chemicals.
- Recirculation of cooling waters.
- Collections of waste products for use in by-products such as animal feed, where feasible without exceeding cattle-feed quality limits.

8.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

9.0 ELECTROPLATING

9.1 PROCESS DESCRIPTION

Electroplating involves deposition of thin protective layer (usually metallic) onto a pre-pared metal surface, using electrochemical process. The process involves pre treatment (cleaning, degreasing and other preparation steps, plating, rinsing, passivating and drying. The cleaning and pre- treatment stages involve a variety of solvents such as chlorinated hydrocarbons. In the plating process, the object to be placed is usually used as cathode in an electrolytic bath. Plating solution is acid or alkaline and may contain complex agents such as cyanides.

9.2 BASIC POLLUTING PROCESS

- Pre-treatment: degreasing, ultrasonic method
- Plating : Anodic / electrolytic dissolution
- Post treatment : Phosphating, chromating, polishing, buffing

9.3 CRITICAL POLLUTANTS

Key pollutants likely to be generated from a typical electroplating unit are as follows

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	VOCs & Toxic organic substances, Acid/Alkali vapours, cyanides and fluorides, heavy metals in vapour form.
2	Water Pollution	Heavy metals, acid and alkali residues, cleaning agents, spent bath, TDS
3	Hazardous waste	Sludge from bath containing sulphide, cyanide, toxic metals and organic solvents, plating metal sludge, chemical sludge from ETP.

9.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air pollution

The solvents and vapors in hot plating bath may results in high levels of volatile organic compounds. Volatile metallic compounds such as chromates may also release to the ambient air during the process. Presence of these compounds in workplace ambient air may pose serious health risk to the workers. The mixing of cyanide with acidic water can generate lethal hydrogen cyanide gas and this must be avoided.

Water Pollution

Waste water is mainly generated during rinsing / washing of products and preparation of fresh bath (plating bath needs to be replaced periodically due to increase in concentration of impurities). All of the substances used during the process such as acidic solutions, toxic metals, solvents and cyanides, can be found in wastewater. The effluent is may have high concentration of heavy metals including chrome, lead, copper, zinc, nickel and cyanides, depending on the process. The effluent generated from any electroplating unit may pose serious environmental risk, if allowed to release without proper treatment.

Hazardous waste

Hazardous waste sludge is mainly generated from effluent treatment plants and cleaning or changing of process tanks. The sludge contains high concentration of organics and heavy metals and has high potential of soil and ground water contamination, if stored / disposed unscientifically.

9.5 RECOMMENDED POLLUTION PREVENTION MEASURES

9.5.1 AIR POLLUTION

Exhaust hoods and ventilation systems can be used efficiently to protect the workplace environment. Acid mists and vapours should be collected and scrubbed with water before venting. In some cases, VOC levels of the vapors can are reduced by use of carbon filters, which allow the reuse of the solvents or by combustion (and energy recovery) after scrubbing.

9.5.2 WATER POLLUTION

If the unit is member of CETP only primary treatment i.e neutralisation and sedimentation may be required. Cynaide reduction, flow equalisation, neutralisation and metal removal are common treatments processes applicable to any electroplating units. If hexavalent chromium is occurs in waste water than it is usually pre-treated to reduce the chromium in trivalent compounds using reducing agents such as sulphides. The treatment process includes equalization, neutralisation, precipitation, flocculation and sedimentation and filtration.

9.5.3 HAZARDOUS WASTE

In case the unit is member of common TSDF, unit requires only temporary storage facilities for hazardous wastes as per the required practices like lined pits, containers etc. Otherwise, besides containment, combustion (preceded in some cases by solvent extraction) of toxic organics is an effective treatment technology. Heavy metals containing waste shall only be disposed in a secured landfill after stabilization.

9.6 CLEANER PRODUCTION OPTIONS

- Replacement of cadmium with high-quality corrosion resistant zinc plating. Use of cyanide-free systems for zinc plating. Where cadmium plating is necessary, use of bright chloride, high-alkaline baths, or other alternatives.
- Use of trivalent chrome instead of hexavalent chrome.
- Preference to water-based-surface-cleaning agents, instead of organic cleaning agents.
- Regeneration of acids and other process ingredients wherever feasible.
- Minimization of dragout through effective draining of bath solutions from plated part.
- Uniformity of the density, viscosity and temperature of the baths to minimize dragout.
- Placement of recovery tanks before the rinse tanks. The recovery tanks provides for static rinsing with high dragout recovery.
- Agitation of rinse water to increase rinsing efficiency.
- Use of multiple counter-current rinses and spray rinses.
- Recycle of process baths after concentration and filteration.
- Recycle of rinse waters after filteration.
- Regular analysis and regeneration of process solutions to maximize useful life.
- Regular cleaning of racks between baths to minimize contamination.
- Covering of degreasing baths containing chlorinated solvents when not in use to reduce losses.

9.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	Yes
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	Yes
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	Yes
8.	Public liability Insurance (Public Liability Insurance Act)	Yes
9	Submission of environmental statement (EPA,1986)	Yes

10.0 ENGINEERING UNITS (CUTTING & SHAPING)

10.1 PROCESS DESCRIPTION

This sector includes those metal fabrication units which only involves cutting and shaping of the metal rods, sheets etc and does not include any surface treatment. The key process includes cutting, machining, welding, buffing and surface finishing (sand blasting etc.)

10.2 BASIC POLLUTING PROCESS

- Forming operation – cutting shearing, bending, drawing, rolling & spinning
- Machining – drilling, shaping, sawing, grinding

10.3 CRITICAL POLLUTANTS

Sl. No	Type of pollution	Critical pollutants
1	Air	Fine dust / metal particles
2	Water	Waste oil (cutting & cooling)
3	Noise	Machining operations, ,material handling etc.

10.4 KEY ENVIRONMENTAL ISSUE

Air pollution

Metal dusts are generated during buffing operations and may pose serious health risk to the workers. High VOCs levels can also be observed near the machines, due to usage of cutting and cooling oil.

Water pollution

Cutting / cooling oil is generated from the machining operations. These oils are generally mixed with the waste water. If waste water is allowed to be discharged without any treatment, may result in soil and ground water contamination.

Noise pollution

High noise levels in workplace are also a major occupational hazard in this type of units. Sustain exposure to such environment may leads to lot of health related problems to the workers.

10.5 RECOMMENDED POLLUTION PREVENTION MEASURES

10.5.1 WORKPLACE AIR POLLUTION

Buffing area should be provided with proper ventilation. Dust arrestors such as bag filters etc may be provided near buffing and cutting machines.

10.5.2 WATER POLLUTION

A typical effluent treatment plant for metal fabrication unit will consist of oil & grease separation unit followed by Physio - chemical treatment such as coagulation & flocculation, and biological process such as activated sludge and trickling filter.

10.6 CLEANER PRODUCTION OPTION

- Noise preventive measures be taken to reduce noise pollution like provision of soundproof cabins for noise-producing equipments.
- Green belt should be developed around the areas to minimize the impact on ambient air quality.
- Preventing solids and oily wastes from entering the drainage systems.

10.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	No
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

11.0 ENGINEERING UNITS

(Surface treatment & finishing)

11.1 PROCESS DESCRIPTION

The Surface treatment and finishing operations are carried out to control friction and wear, improve corrosion resistance of the fabricated metal products. Surface treatment involves some cleaning techniques containing the application of organic solvents to degrease the surface of the metal before carrying out the finishing operations. Other techniques, emulsion cleaning, for example, use common organic solvents (e.g., kerosene, mineral oil, and glycols) dispersed in an aqueous medium with the aid of an emulsifying agent.

After cleaning and de-greasing, finishing operations are carried out. Anodizing is an electrolytic process which converts the metal surface to an insoluble oxide coating. Anodized coatings provide corrosion protection, decorative surfaces, a base for painting and other coating processes, and special electrical and mechanical properties. Following anodizing, parts are typically rinsed, then proceed through a sealing operation that improves the corrosion resistance of the coating.

Chemical conversion coating includes chromating, phosphating, metal coloring, and passivating operations. Electroplating is the production of a surface coating of one metal upon another by electro deposition. Polishing, hot dip coating, and etching are processes that are also used to finish metal. Polishing is an abrading operation used to remove or smooth out surface defects (scratches, pits, or tool marks) that adversely affect the appearance or function of a part.
Hot dip coating is the coating of a metallic workpiece with another metal to provide a protective film by immersion into a molten bath. Etching produces specific designs or surface appearances on parts by controlled dissolution with chemical reagents or etchants.

11.2 BASIC POLLUTING PROCESS

- Degreasing and cleaning
- Anodizing
- Plating –chemical conversion, coating, electroplating etc.
- Other finishes – Polishing, hot dip coating, etching, etc.

11.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the metal fabrications industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Metal bearing mists, acid mists, solvent & VOCs, metalic and

		acidic fumes.
2	Water	Acidic and basic wastewater, cyanide, metal bearing wastewater, solvent wastes
3	Hazardous	ETP sludge, metal & cyanide waste, paint solvents, polishing sludge, metal dross, etching sludge and wastes solvents

11.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of the air pollution are various operations carried out during surface treatment and finishing operations. Solvent degreasing and emulsion operations produces solvent vapours. Similarly anodizing, chemical conversion, electroplating operations produces metal ion bearing and acid mist. Polishing and hot dip coating operations produces metal and acid fumes. Occupational health hazards due to fugitive emissions and acidic fumes.

Water Pollution

The effluents are also generated from the surface treatment operations like Solvent degreasing and emulsion consisting of solvent, alkaline and acid waste. Finishing operations like anodizing, electroplating etc. produces acid, metal wastes. Aquatic life can be adversely affected due to discharge of the wastewater on surface water bodies. It may also cause soil contamination due to discharge on land.

Hazardous and Solid Waste

Different types of hazardous wastes are also generated from the surface treatment operations like Phospating etc. and solvent wastes from solvent degreasing etc. Finishing operations also produces wastes like base metals and spent solutions, cyanides and metal wastes, polishing sludge etc.

11.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the measures for treating the various types of waste generated in the metal fabrication industry.

11.5.1 AIR POLLUTION

Exhaust hoods and ventilation systems protect the working environment. Acid mists and vapors should be scrubbed with water before venting. In some cases, VOC levels of the vapors are reduced by use of carbon filters, which allow the reuse of the solvents, or by combustion (and energy recovery) after scrubbing, adsorption, or other treatment methods. Gaseous emissions are treated by condensation, absorption, adsorption (using activated carbon, silica gel, activated

alumina, alkali and zeolites). Control methods like appropriate ventilation and wet dust suppression can also be used for dust particles.

11.5.2 WATER POLLUTION

In case the unit is a member of CETP, then only primary treatment is required by the industry. If not, the treatment includes *pretreatment* using screens, flow equalization tanks, and *primary treatment* using sedimentation/filtration to remove suspended solids. Physical and chemical treatment includes precipitation, flocculation, and neutralization for acids, TDS, COD etc. removal. Biological treatment includes biodegradation using aerobic oxidation, oxidation ponds or another aerobic process leading to 95 % removal of BOD. *Tertiary treatment* if used, includes carbon adsorption, precipitation, filteration, and ultrafilteration for further removal of the various parameters.

11.5.3 HAZARDOUS AND SOLID WASTE

In case the unit is a member of common TSDF, unit requires only temporary storage facilities for hazardous wastes as per the required practices like pits, specified containers. Otherwise, besides the storage of the wastes, treatment methods like electrolytic methods for the recovery of the metals, stabilization using (lime, cement etc.) and chemical treatment etc. to isolate toxic parts from the sludges. Sludges are usually thickened, dewatered, and stabilized using chemical agents (such as lime) before disposal, which must be in an approved and controlled landfill.

11.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution load from the soft drink industry as well as leading to resource conservation in the manufacturing process.

- Replacement of cadmium with high-quality corrosion resistant zinc plating. Use of cyanide-free systems for zinc plating. Where cadmium plating is necessary, use of bright chloride, high-alkaline baths, or other alternatives.
- Use of trivalent chrome.
- Regeneration of acids and other process ingredients wherever feasible.
- Uniformity of the density, viscosity and temperature of the baths to minimize dragout.
- Recycle of rinse waters after filtration.
- Regular analysis and regeneration of process solutions to maximize useful life.
- No use of ozone-depleting substances.

11.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

12.0 FLOUR AND PULSE MILLS

12.1 PROCESS DESCRIPTION

The Flour and pulse mill involves dehusking, aspiration, separation of pulse and grading. After bringing the grains, they are cleaned to make them free of dust, dirt. In some cases, an emery roller machine is used to obtain cracking and scratching of clean pulses. A screw conveyor allows the scratched or pitted material to pass through it and allows mixing of some edible oil like linseed oil to the pulses. Pulses are conditioned by alternate wetting and drying to facilitate in the dehusking operations. This followed by dehusking operation using emery rollers for removal of outer membrane or green envelope of the pulse grains After dehusking the grains are splitted. The aspiration operation is carried out to the separate and collect the husk generated from the pulses splitting. The de-husked splitted pulse grains are subjected to the finishing operations like polishing and are finally graded according to the size and other properties.

12.2 BASIC POLLUTING PROCESS

- Loading/unloading operations and transfer point
- Cleaning
- Milling
- Grinding
- Washing (wet type flour mills)

12.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the pharmaceutical industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Dust, fine particulate matter.
2	Water	Washing of wheat, BOD & TSS.
3	Solid	Dust collected by APC measures in milling section
4	Noise	Cleaning, Milling and Grinding operations.

12.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The air pollutants are generated during dehusking, splitting, grinding and sieving operations. There is possibility of occupational health hazards due to long term exposure to the dust.

Water Pollution

Liquid effluents are primarily resulted from wet manufacturing and process equipment cleaning operations. The effluent generated is not highly toxic and potential of water pollution is low.

Hazardous and Solid Waste

The solid waste consists of dust collected from APC in the milling operations. Some husk is also generated during dehusking operations which is collected in the aspiration operations using filter.

12.5 RECOMMENDED POLLUTION PREVENTION MEASURES

12.5.1 AIR POLLUTION

Pollutants like particulate can be removed by using fabric filters, wet scrubbers and electrostatic precipitators. Control methods like appropriate ventilation and wet dust suppression can also be used for dust particles.

12.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reducing the pollution load from the flour and pulse mills as well as leading to resource conservation in the manufacturing process.

- Use of energy efficiency processes wherever feasible.
- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.
- Regular cleaning and washing of equipments.
- Water spraying to be carried out to prevent dust generation.

12.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

13.0 FOUNDRIES

13.1 PROCESS DESCRIPTION

In foundries, molten metals are cast into objects of desired shapes. The main production steps include:

- Preparation of raw materials.
- Metal melting
- Preparation of molds
- Casting
- Finishing (which includes fettling and tumbling).

The raw materials are first prepared to be put in the furnaces for melting. The types of furnaces may vary based on the foundry type for e.g. electric furnaces, cupola furnaces etc. The casting process usually employs non-reusable molds of green sand, which consists of sand, soot, and clay (or water glass). The sand in each half of the mold is packed around a model, which is then removed. The two halves of the mold are joined, and the mold is filled with molten metal, using ladles or other pouring devices. For hollow casting, the mold is fitted with a core. Finishing processes such as fettling involves the removal from the casting of the gating system, fins (burrs), and sometimes feeders. This is accomplished by cutting, blasting, grinding, and chiseling. Small items are usually ground by tumbling, carried out in a rotating or vibrating drum, usually with the addition of water, which may have surfactants added to it.

13.2 BASIC POLLUTING PROCESS

- Scrap & charge preparation
- Fluxing, metal melting
- Slag removal
- Quenching & finishing

13.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the foundry industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Fine particulates, VOCs, HAPs, Hydrocarbons, CO, NOx, CO_2, metal oxides fumes, SO_2, fugitive emissions
2	Water	Solvents, oil & grease, TSS, phenol, wastewater with high pH.
3	Solid	Scrap metal, slag

13.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Operations like melting and treatment of molten metals, mould manufacture, shakeout and cleaning operations generate particulate emissions. Oil mists are released from the lubrication of the metals. Odor and alcohol vapor are released from surface treatment of alcohol-based blacking. Handling compounds like halogenated organics, including aluminum scrap contaminated with chlorinated organics, polyvinyl chloride (PVC) scrap and turnings with chlorinated cutting oil may emit dioxins during melting operations. Foundries also contributes to Global Warming due to emission of CO_2. High concentration of CO in furnace presents explosion hazard.

Wastewaster Generation

Oil and suspended solids are released into process effluents, and treatment is required before their discharge.. Cooling waters may contain oil and some chemicals for the control of algae and corrosion.

Hazardous and Solid Waste

Sand moulding creates large amount of waste sand. Other wastes include slag, collected particulate matter, sludges from separators used in wastewater treatment, and spent oils and chemicals. Discarded refractory lining is another waste produced. The primary hazardous components of collected dust are zinc, lead, and cadmium. Solid waste consists of slag and metal scrap.

13.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the pollution preventive measures for various wastes streams generated in the Foundry industry.

13.5.1 AIR POLLUTION

Dust emission control technologies include cyclones, scrubbers (with recirculating water), baghouses, and electrostatic precipitators (ESPs). Scrubbers are also used to control mists, acidic gases, and amines. Gas flame is used for incineration of gas from core manufacture. Odor may be eliminated by using bio scrubbers.

13.5.2 WATER POLLUTION

The *effluent treatment* includes pretreatment using screening and flow equalization etc. to remove large solids. *Primary treatment* includes sedimentation/filtration for removal of suspended solids. Physical and chemical treatment includes neutralization, precipitation using lime or sodium hydroxide, and sedimentation or centrifuging followed by filtration for removing

metals, TSS as well as for pH adjustment. Oil and grease can be separated by using oil separators.

13.5.3 HAZARDOUS AND SOLID WASTE

Hazardous wastes like used oil can be incinerated before final disposal of residue in the secure landfill. Metal dross and refractory lining cane be disposed in the secure landfill. Solid waste like metal scrap and slag can be disposed in the landfill. Sand can be reclaimed to be used moulding.

13.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted with an aim of reduction in pollution generation from the Foundry industry as well as leading to resource conservation in the manufacturing process.

- Use of induction furnaces instead of cupola furnaces.
- Replacement of cold-box method for core manufacture, where feasible.
- Use of selected and clean scrap to reduce the release of pollutants to the environment.
- Preheat of scrap, with afterburning of exhaust gases.
- Storage of scrap under cover to avoid the contamination of storm water.
- Provision of hood for cupola or doghouse enclosure for EAFs and induction furnaces.
- Use of dry dust collection methods such as fabric filters instead of scrubbers.
- Use of continuous casting for semi finished and finished products wherever feasible.
- Storage of chemicals and other materials for collection of spills, if any.
- Control of water consumption by recirculation of cooling water after treatment.
- Reclaim of sand after removing binders.

13.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	Yes
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

14.0 FOOD AND FRUIT PROCESSING

14.1 PROCESS DESCRIPTION

The fruit and food processing industry generally involves following steps i.e. drying, freezing, and preparation of juices, jams, and jellies etc. In general, the process comprises of preparation of the raw material by initially sorting the sized fruits. They are then cleaned followed by trimming and peeling. The trimmed and peeled fruit then cooked, juice obtained from the fruits is canned, or freezed. Plant operation is often seasonal.

20.2 BASIC POLLUTING PROCESS

- Sorting
- Washing
- Peeling/cutting/crushing/pressing
- Juice extraction
- Retardation (sterilization)
- Cooling
- DG Sets, Boilers

14.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the fruit and food processing industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	SPM, NOx, SOx.
2	Water	BOD, suspended solids.
3	Solid	Peel-offs, rejects, cutting, packing pet bottles/cans.

14.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of the air pollution are DG sets, boilers. Generally the potential of air pollution is less from this industry. Odour problem occurs due to rotting of fruits and vegetables.

Water Pollution

The effluents contain high organic loads, cleaning and blanching agents, salt, and suspended solids such as fibers and soil particles. They may also contain pesticide residues washed from the raw materials. In case of fruit based synthetic juice/concentrates, the water pollution potential is medium to high.

Solid Waste

The main solid wastes are organic materials, including discarded fruits and vegetables. Similarly, it also contains packing pet bottles/cans used in the canning and packaging operations.

14.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the measures for treating the various types of waste generated in the fruit and food processing industry.

14.5.1 AIR POLLUTION

Particulates can be removed by the application of fabric filters, bag houses, wet scrubbers and electrostatic precipitators. Gaseous pollutants are subjected to treatment by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites).

14.5.2 WATER POLLUTION

Generally the effluent treatment includes *pretreatment* using screens (or sieves), grit chambers etc. for removing large solids, grit etc. *Primary treatment* comprises of sedimentation/filtration etc. to remove suspended solids. Chemical treatment normally involves pH adjustment. *Secondary treatment* also involves biological treatment using oxidation pond, activated sludge process etc. for removal of BOD and treated effluent can be safely discharged.

14.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution load from the food and fruit processing industry as well as leading to resource conservation in the manufacturing process.

- Use of dry methods such as vibration or air jets to clean raw fruits and vegetables. Dry peeling methods reduce the effluent volume (by up to 35 %) and pollutant concentration (organic load reduced by up to 25 %)
- Separation and recirculation of process wastewaters.
- Use of counter-current systems where washing is necessary.
- Use of steam instead of hot water reduces the quantity of the wastewater going for treatment.
- Removal of solid wastes without the use of water.
- Reuse of concentrated wastewaters and solid wastes for production of by-products.

14.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

15.0 GLASS INDUSTRY

15.1 PROCESS DESCRIPTION

The raw materials like lime, soda, silica etc. are mixed and wetted. They form a vitrifable load, to which cullet is added before it is convoyed to the furnace. The glass at 1100° C is discharged from the furnace onto a bath of molten tin, where it floats and spreads out in the form of a long strip. The Shaping process is then followed to attain desirable shape and size.

15.2 BASIC POLLUTING PROCESS

- Raw material handling
- Mixing
- Melting
- Farming
- Annealing
- Finishing –Cutting, drilling, grinding, Acid Polishing, Chemical strengthening

15.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the glass industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Fugitive emissions, SPM, SO_2, NOx, fluorides, lead.
2	Water	TDS/TSS, heavy metals, cullet washing, cutting oil, cooling water
3	Solid	Glass waste, waste residues containing heavy metals, furnace slag
4	Hazardous	Waste oil, spent solvents.

15.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The air pollutants are mainly generated from the materials handling, finishing operations like grinding, drilling etc. as well as during cleaning operations. Fugitive emissions are also generated during the manufacturing process.

Wastewaster Generation

Liquid effluents are generated from the washings and cleaning operations, mixing operations etc. Cooling waters are normally re-circulated. In general the potential of glass industry to cause water pollution is low.

Hazardous and Solid Waste

The hazardous waste generates from the furnace operations, solvents use. The solid wastes are generated from manufacturing processes, furnace use.

15.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the pollution preventive measures for various types of wastes streams generated in the Glass industry.

15.5.1 AIR POLLUTION

For removal of particulates and metals, Electrostatic Precipitators (ESPs) and Fabric filters are used. Dry scrubbing using $Ca(OH)_2$ is used to reduce SO_2, HF, and HCl emissions. Secondary measures to control NO_X control include selective catalytic reduction, selective non-catalytic reduction and certain proprietary processes such as the Pilkington 3R process.

15.5.2 WATER POLLUTION

In case of absence of CETP, the effluent treatment initiates with *pretreatment* comprising of screening and flow equalization etc. to remove large solids. *Primary treatment* utilizes sedimentation/filtration etc. to remove suspended solids. Physical and chemical treatment consists of precipitation, flocculation, and sedimentation/filtration, neutralization reactions for removal of metals, TSS, COD and BOD. *Secondary treatment* involving biodegradation processes uses oxidation ponds, trickling filters, rotational biological contactors and activated sludge systems for the removal of BOD and COD and other parameters.

15.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of pollution generation from the Glass industry as well as leads to resource conservation in the manufacturing process.

- Use of oxygen-enriched and oxyfuel furnaces in specialty glass operations to reduce emissions.
- Use of low NO_x burners, staged firing, and flue gas recirculation for energy efficiency.
- Use of natural gas rather than oil resulting in negligible sulfur oxide emissions.
- Efficiently designed furnace's use results in reduced gaseous emissions and energy consumption.
- Change in composition of raw material will lead to reduction of chloride, fluoride and sulfate used in certain specialty glasses.
- Use of outside-sourced cullet and recycled glass will reduce energy requirements.
- Minimization of use of heavy metals as refining agents and coloring or decoloring agents and potassium nitrate.
- Regular inspection for cleaning of checkers of furnace to prevent their choking by condensates and slags formed from volatilization of materials.

- Use of enclosed conveyors, pelletization of raw materials, reduced melt temperatures and blanketing of furnace melt to reduce particulate matter.
- Use of closed cooling water loop and improved "blowoff" techniques to reduce wastewater volume.

15.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

16.0 LIME KILNS

16.1 PROCESS DESCRIPTION

The raw material required for the lime manufacture are rock deposits like dolomite etc. containing 30-50% of limestone found in the quarry. After the drilling and blasting in the quarry, the raw limestones are transported to the lime plants. They are crushed and screened to prepare limestone for the coal-fired rotary kilns. In the kilns, the crushed limestone is calcined at around 1,200°C and transformed into lime. The white calcium oxide granulates that leave the kiln is commonly known as quicklime. In the process of calcination, carbon dioxide is extracted from calcium carbonate forming calcium oxide.

The calcium oxide granules are screened and pulverized to fine powder. This fine powder is then hydrated with hot water at elevated temperatures and atmosphere to form dry slaked lime in the hydration machines. The hydrates are then screened before being packed and transported to the different places.

16.2 BASIC POLLUTING PROCESS

- Open pit quarrying
- Raw material handling, loading & unloading
- Limestone & coal crushing, grinding and screening
- Calcination
- Screening & pulverising (hydrated lime)
- Bagging
- Transportation of raw and finished products.

16.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the lime kiln is as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	SPM (soot), SOx, NOx, CO, CO_2, H_2S, Organic Volatiles, dust
2	Water Pollution	Wastewater from wet scrubber
4	Noise	Pulveriser in hydrated lime plants

16.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Major sources of air pollution are open-pit quarrying operations, loading and unloading of raw material and finished product operations, transportation, crushing and firing operations in kilns,

and calcination. The blowing of ash from top of the kiln due to wind are major health hazards for workers. Due to CO_2 emissions from coal burning the brick kiln sector is a major green house gas contributor. The fugitive emissions from the lime kiln industry especially in hydrated lime plants are quite harmful for workers and nearby areas.

Noise generation

Pulverizers used in the hydrated lime plants are the major cause of noise pollution. They may create problems for the workers and the surrounding population.

16.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the preventive measures for various types of wastes generated in the lime kilns industry.

16.5.1 AIR POLLUTION

SPM and dust can be controlled by using fabric filters and wet scrubbers are used for. Gaseous emissions like SOx, NOx, CO, CO_2, H_2S etc. can be treated by dry scrubbing, condensation, absorption, adsorption (using activated carbon, silica gel, limestone, ethanol amines, activated alumina and zeolites). Volatile organics can be treated by undergoing combustion process.

16.5.2 WASTEWATER GENERATION

The wastewater treatment includes *pretreatment* i. e. screening etc. for removing large solids. *Primary treatment* involves sedimentation/filtration for removal of suspended solids. Physical and chemical treatment involves floatation, coagulation and filtration for removal of TSS and other parameters if present before final discharge of the effluent.

16.5.3 NOISE

Noise pollution can be controlled by use of efficient, sound-proof equipments. If possible, the industry should be located far from residential areas.

16.5.4 HAZARDOUS AND SOLID WASTE

There is no generation of hazardous waste in the lime kiln industry. Most of the Solid waste is like ash and rejects from various sources can be disposed in the secure landfill.

16.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of pollution from the lime plants as well as resource conservation in the manufacturing process.

- Use of fuels like natural gas in the kilns to reduce air emissions.

- Small Kilns with improved design and enhanced combustion efficiency should be promoted.
- Use of energy efficiency processes wherever feasible.
- Water spraying to be carried out to prevent dust generation.
- Location of lime kilns should be far from the residential and agricultural areas.
- Material loading and unloading operations should be carried with minimum generation of dust.
- Packing operations should be carried out by mechanically with care to avoid any spillage and dust generation.
- Development of green belt around the lime kilns

16.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

17.0 NATURAL RUBBER

17.1 PROCESS DESCRIPTION

The natural rubber is mixed with carbon black, oils and other chemicals to develop product-specific qualities in mixers called banbury mixers. The mixed rubber mass is discharged to a mill or other piece of equipment which forms it into a long strip or sheet. The rubber sheets are placed directly onto a long conveyor belt which, through the application of cool air or cool water, lowers the temperature of the rubber sheets. The rubber sheets are then subjected to the extrusion. Extruders transform the rubber into various shapes or profiles by forcing it through dies via a rotating screw. Calenders are also used. They squeeze the hot rubber strips into reinforcing fibers or cloth-like fiber matrices, thus forming thin sheets of rubber coated materials. Extruded and calendered rubber components are combined (layered, built-up) with wire, polyester, aramid, and other reinforcing materials to produce various rubber products. All rubber products undergo vulcanization (curing). Vulcanization is accomplished in heated compression molds, steam heated pressure vessels (autoclaves), hot air and microwave ovens, or various molten and fluidized bed units.

During the curing process, the polymer chains in the rubber matrix cross-link to form a final product of durable, elastic, thermoset rubber. Finishing operations may include grinding, printing, washing, wiping, and buffing.

24.2 BASIC POLLUTING PROCESS

- Extruding
- Milling
- Calendaring
- Vulcanising
- Finishing

17.2 CRITICAL POLLUTANTS

Critical pollutants typically generated in the natural rubber industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Solvent vapours (VOCs), fugitive emissions.
2	Water	Zinc, Sulphides, Ammonical Nitrogen, suspended solids.
3	Solid	Dust and rubber particles, waste rubber including rejects. sludge, metal dross, etching sludge and wastes solvents
4	Hazardous	Spent solvent solutions, used lubricating, hydraulic and process oils.

17.3 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of the air pollution are various operations carried out during processing operations. During mixing of the chemical additives, fugitive emissions are generated. Similarly during moulding, extrusions operations, VOC and fugitive emissions are generated. During finishing operations, chemical spills, leaks, VOC emissions etc. also occur. There is probability of occupational health hazards due to large amount of fugitive emissions.

Water Pollution

The effluents are also generated from the cooling, heating and vulcanizations operations as well as from finishing operations. Wastewater is also generated from the cleaning and washing operations.

Hazardous and Solid Waste

Particulate matter collected in the APC equipments (chemicals, ground rubber, etc.) from compounding areas, banburys, and grinders is a source of solid waste. Used lubricating, hydraulic, and process oils are also prevalent at most manufacturing facilities. Scorched rubber from mixing, milling, calendering, and extruding is a major solid waste source within the rubber product manufacturing facilities, as is waste rubber produced during rubber molding operations. Hazardous waste consists of spent solvent solutions, used lubricating, hydraulic and process oils.

17.4 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the measures for treating the various types of waste generated in the natural rubber industry.

17.4.1 AIR POLLUTION

Control methods like appropriate ventilation and wet dust suppression, bag house filters etc. can be used for dust particles. Gaseous emissions are treated by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites) and in some cases biofilteration, and bioscrubbing (using peat or heather, bark, composts, and bioflora to treat biodegradable organics), and thermal decomposition. Acid mists and vapors should be scrubbed with water before venting. In some cases, VOC levels of the vapors are reduced by use of carbon filters, which allow the reuse of the solvents, or by combustion (and energy recovery) after scrubbing, adsorption, or other treatment methods.

17.4.2 WATER POLLUTION

In case the unit is a member of CETP, then only primary treatment is to be done by the industry. If not, the effluent treatment initiates with *pretreatment* including screening, flow equalization,

and *primary treatment* using sedimentation/filtration to remove suspended solids. *Secondary treatment* uses physical and chemical means involving precipitation, flocculation, and neutralization for acids, TDS, COD etc. removal. Biological treatment includes biodegradation using aerobic oxidation, oxidation ponds or another aerobic process leading to 95 % removal of BOD.

17.4.3 HAZARDOUS AND SOLID WASTE

Sludges are usually thickened, dewatered, and stabilized using chemical agents (such as lime) before disposal, which must be in an secured landfill..

17.5 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution load from the natural rubber industry as well as leading to resource conservation in the manufacturing process.

- Optimization of frequency of equipments cleaning.
- Preventing solids and liquid wastes from entering the drainage systems.
- Regeneration and recovery of catalysts, spent solvents and other chemicals to the extent possible.
- Preventing solids and liquid wastes from entering the drainage systems.
- Regeneration and reuse of solvents should be carried out, if feasible.
- Reuse of sludges to the extent feasible but without releasing toxics to the environment.

17.6 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

18.0 ORGANIC CHEMICAL INDUSTRY

18.1 PROCESS DESCRIPTION

The majority of organic chemicals are initially derived from the petrochemicals industry, through the cracking of oil. The resulting fractions then undergo various secondary and tertiary reactions. Many of the processes require significant input of energy, and auxiliary operations may include production of heat, steam and compressed air to drive the reactions. Very often, organic chemicals plants may be a part of much larger chemical manufacturing works and may share common site-derived services, such as power, effluent treatment.

18.2 BASIC POLLUTING PROCESS

Key polluting processes in the industry are

- Polymerisation
- Oxidation
- Addition – Alkylation, halogenation, hydrogenation etc.

However faulty handling procedures for raw material and finished products may lead to spillage and thus are potential environmental hazard.

18.3 CRITICAL POLLUTANTS

The type of pollutant in the industry depends of feed stock, process and the product produced.

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Flue gases, Dust during material loading and unloading, VOCs and solvents from reactors, distillation unit/storage tank vents.
2	Water Pollution	Washed solvents, surplus chemicals, acids and suspended solids.
3	Solid waste	Insulation/packaging material
4	Hazardous waste	Spent catalyst/spent solvents, sludge from ETP, incinerator ash, Distillation residues, Off specification and discarded products.

18.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES.

Air emissions

Air emissions are generated in process as consequence of fuel burning in boilers and uncontrolled process emission at the time of loading of raw materials (in case of batch process) and leakage in reaction chamber. The fugitive emissions may include organic compounds (including Olefins & aromatics) and odor. These emissions may cause serious occupational

hazards to the workers. If the industry is located near the residential area or area designated to public usage, the air emissions may cause nuisance to the public.

Waste Water discharges

Waste water is mainly generated from washing & cleaning of the facility. The water may contain aromatic and olefins alcohols (including phenol), oil fractions, salts, acid and suspended solids. Depending on nature and quantity of discharge facilities requires installing an effluent treatment plant and ensure that the discharged waste water meets the prescribed standards by SPCB. If trade effluent is discharge without proper treatment, may cause serious soil and ground / surface water contamination.

Hazardous waste

Main source of hazardous waste in this industry is sludge generated from treatment of effluents. All spent catalyst/ solvents, distillation residue and off specification and discarded products are also classified as Hazardous waste as per Hazardous waste (Management & Handling) rules, 2003. Hazardous waste generated in organic chemical industries has very high potential of soil and ground water contamination, if not managed scientifically. Generally industry become member of Common Secured landfill facility and sends their hazardous waste for disposal, periodically. In absence of such facility, in close vicinity, industries are mandated by SPCB to store the waste in properly lined storage pit, till the time common disposal facility is not available.

Storage of Hazardous chemical

The process operation in this industry requires significant volumes of chemicals to be stored, for example in tank farms and drum storage compounds. Adequate measures must be taken to prevent accidental releases from entering the soil and polluting the groundwater or nearby surface waters. Chemicals can enter water courses as a result of accidental releases, such as spillages or leakages from storage vessels or pipework or from accidents during the production processes. Spillages and pollution incidents often occur in the event of poor management and maintenance of storage areas. Storage facilities should be provided with appropriate secondary containment. Hazardous chemical (Manufacturing & storage) rules, require the project proponent to inform relevant authority for quantity and characteristics of chemicals and prepare on- site emergency plan.

18.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the End-of –Pipe treatment for various waste streams, generally applied to a typical Organic chemical manufacturing unit.

18.5.1 AIR POLLUTION

- Appropriate ventilation and wet dust suppression for dust control.
- Pneumatic systems for collection and transportation of dust.
- Removal technologies such as fabric filters, ceramic filters, wet scrubbers, electrostatic precipitators are used for particulate removal.
- Gaseous releases can be minimized by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites) and in some cases bio-filteration, and bio scrubbing (using peat or heather, bark, composts, and bio flora to treat biodegradable organics), and thermal decomposition.

18.5.2 WASTE WATER / EFFLUENT

In case the unit is a member of CETP then only primary treatment is required. If not, on-site Effluent Treatment Plant (ETP) is required to be installed to meet the statutory effluent disposal standards. The ETP operations include *primary treatment* such as screening, neutralisation and sedimentation, followed by *secondary treatment* by Physio-chemical oxidation, precipitation, separation for recovery of oil, coagulation/flocculation, etc. Secondary treatment may also include treatment by biodegradation (trickling filter, anaerobic, aerated lagoons, rotating biological contactor and activated sludge). To meet the required disposal standards, effluents generated from some of the units may require *Tertiary treatment*, which involves filtration for heavy metals, air or steam stripping, granular activated carbon, ion exchange, reverse osmosis and electro dialysis for organics.

18.5.3 HAZARDOUS WASTE

In case the unit is member of common TSDF, it requires only temporary storage facilities for hazardous waste. Otherwise Combustion (proceeded in some cases by solvent extraction) of toxic organics is an effective treatment technology. Steam stripping and oxidation are also used for treating organic waste streams. Spent catalysts may be recovered by suitable physio-chemical process. In some cases, hazardous wastes may require stabilization to reduce the leachability of toxic metals before disposal of in an approved secure landfill.

18.6 CLEANER PRODUCTION OPTIONS

This section provides indicative list of cleaner production measures, which can be adopted by individual units in order to reduce load on pollution prevention infrastructure and save cost at the same time by resource conservation.

- Minimize leakages of volatile organics from valves, pump glands (through use of mechanical seals), flanges, and other process equipments by following good design practices and equipment maintenance procedures. Use of mechanical seals where appropriate.

- Minimization of losses from storage tanks, product transfer areas, and other process areas by adopting methods such as vapor recovery systems and double seals (for floating roof tanks).
- Regeneration and recovery of catalysts, spent solvents and other chemicals to the extent possible.
- Recycle cooling water and reuse of treated wastewater (separated from storm water systems) to the extent possible.
- Use of non-chrome additives in cooling water.
- Optimization of frequency of tanks and equipment cleaning.
- Preventing solids and oily wastes from entering the drainage systems.

18.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

19.0 PAINTS AND VARNISHES

19.1 PROCESS DESCRIPTION

The manufacture of paint involves the dispersion of a colored oil or pigment in a vehicle, usually an oil or resin, followed by the addition of an organic solvent for viscosity adjustment. Only the physical processes of weighing, mixing, grinding, tinting, thinning, and packaging take place. No chemical reactions are involved. These processes take place in large mixing tanks at approximately room temperature.

The manufacture of varnish also involves the mixing and blending of various ingredients to produce a wide range of products. However in this case, chemical reactions are initiated by heating. Varnish is cooked in either open or enclosed gas-fired kettles for periods of 4 to 16 hours at temperatures of 93 to 340°C (200 to 650°F).

19.2 BASIC POLLUTING PROCESS

- Milling
- Mixing
- Grinding
- Condensation
- Cleaning
- Cooling, tinting, thinning
- Extraction & filtration
- Vessel and floor washing

19.3 CRITICAL POLLUTANTS

Critical pollutants generated in the typical paints and varnishes industry is as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	SPM, solvent vapours, hydrocarbons, fugitive emissions
2	Water	Oil & Grease, alkalinity, BOD, COD, SS, phenolic compounds, heavy metals.
3	Solid	Empty containers, spilled dry material.
4	Hazardous	Chemical sludge, paint skin, wastes & residues, filler residues.

19.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of air pollution are mixing, grinding operations as well as cleaning operations. Fugitive emissions are also generated during the manufacturing process. Care should be taken in handling dry pigments, solvents used and in maintaining correct mixing temperatures. Volatile organic emissions are emitted during cooking operation in varnish products manufacture.

Wastewaster Generation

Liquid effluents are generated from the use of various solvents, oils etc. in the paints and varnish manufacture, from vessels and floor washings etc. The caustic cleaning effluents are highly alkaline and can cause adverse impact on riverine/aquatic life if it is discharged untreated.

Hazardous and Solid Waste

The hazardous waste generates from the application of various solvents, fillers, oils in the manufacturing process, wastes and residues from the processes used, sludge from the chemical reactions in the varnish manufacture. They may cause health hazards for the workers. The solid waste consists of empty containers and spilled dry materials.

19.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the pollution preventive measures for various types wastes streams generated in the Paint and Varnish industry.

19.5.1 AIR POLLUTION

Particulate matter can be controlled by using fabric filters, electrostatic precipitators. For reducing the particulate emissions, water spray and oil filter system can also be used. Afterburners can be used to reduce Hydrocarbons (especially volatile). Vapour recovery systems can be used for solvent vapours.

19.5.2 WATER POLLUTION

In case the unit is a member of CETP then only primary treatment is required. If not, the *effluent treatment* pre-treatment using screening etc.are used for removal of large solids, paper, cloths etc. *Primary treatment* consists of sedimentation/filtration for removal of suspended solids. Physical and chemical treatment involves neutralization, floatation, coagulation and filtration and pH adjustment for removing metals, TDS, COD and BOD. *Secondary treatment* involving biological treatment uses trickling filters, anaerobic, activated sludge, and rotating biological contactors for removal of BOD and COD. *Tertiary treatment* is also utilized consisting of ultrafiltration, Ion Exchange, carbon adsorption for further removal of various parameters. In certain cases, air or steam stripping is performed to remove organics.

19.5.3 HAZARDOUS AND SOLID WASTE

In case of presence of common TSDF, the unit requires only temporary storage facilities for hazardous wastes as per the required practices in pits, recommended containers etc. Chemical Sludge can be thickened, dewatered, and stabilized using chemical agents (such as lime) before disposal, which must be in an approved and controlled landfill. Other hazardous wastes can be finally disposed to the secure landfill before some pre-treatment like stabilization, if required.

19.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of pollution from the Paint and Varnish industry as well as resource conservation in the manufacturing process.

- Use of oil-based or water-based paints whichever feasible.
- Use of energy efficiency processes wherever feasible.
- Water spraying to be carried out to prevent dust generation.
- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Regeneration and recovery of chemicals to the extent possible.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.
- Regular cleaning and washing of equipments.

19.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	Yes
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

20.0 PESTICIDE

20.1 PROCESS DESCRIPTION

The principal manufacturing steps in the pesticide manufacture are (a) preparation of process intermediates; (b) introduction of functional groups; (c) coupling and esterification; (d) separation processes, such as washing and stripping; and (e) purification of the final product.

20.2 BASIC POLLUTING PROCESS

- Unit operations
- Reactor vessels and floor
- Boilers and furnace

20.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the pesticides manufacturing unit are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	BOD, COD, Acidity, solvents, volatile organics, ethyl hydrogen sulphate, Total solids, Na, Chlorides, sulphates, halomethanes, cyanides, cyanates, phenols, heavy metals & traces of pesticides, TDS.
2	Water Pollution	HCl, CH_3Cl, H_2S, SO_2, P_2O_5, NH3, NOx, SPM, CH_3OH, Cl_2, VOCs, Odour, PAH, HAPs
3	Hazardous waste	Chemical sludge from ETP, process sludge, wastes/residue containing pesticides, Date-expired and off specification pesticides, dust collected from APCDs.

20.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Gaseous emissions like H_2S, SO_2, NOx are generated from the use of fuels in boilers and furnaces causing air pollution. Air Pollutants like SPM and VOC are generated from the unit operations like stripping. Fugitive emissions take place during handling operations causing possibility of occupational hazards to the workers. This sector of industry has very high potential of air pollution.

Waste Water generation

A liquid effluent generated from equipment cleaning operations contains toxic organics and pesticide residues causing adverse effects on aquatic life. The waste water is generally has high

Chemical oxygen demand (COD) and Total Suspended Solids and Oil and Grease concentration values. High levels of organic contents may lead to eutrophication of surface water bodies.

Hazardous waste

Hazardous wastes include sludge generated from the manufacturing process and effluent treatment. Other types include residues containing pesticides, spent catalysts which are considered as hazardous wastes as per Hazardous waste (Management & Handling) rules, 2003 of MoEF. Industries are required to follow recommended practices for the storage, treatment and disposal of the hazardous wastes. In absence of a proper waste treatment and disposal facility, in close vicinity, industries are required to store the waste in properly lined storage pit, till the time common disposal facility is not available.

20.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the End-of –Pipe treatment for various waste streams, generally applied to a typical pesticide manufacturing unit.

20.5.1 AIR POLLUTION

Air pollution control methods involve removal technologies like bag houses and fabric filters for particulate matter removal. Control methods like appropriate ventilation and wet dust suppression are used for dust control. Pneumatic systems are also in use for collection and transportation of dust. Gaseous releases are minimized by dry scrubbing, condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites). Toxic organics can be destroyed using combustion operation.

20.5.2 WATER

In case the unit is a member of Common Effluent Treatment Plant (CETP), then only primary treatment is required. If not, the effluent treatment includes *pre-treatment* operation i.e. screening for removal of large solids. *Primary treatment* includes sedimentation/filtration for removal of suspended solids. Physical and Chemical treatment operations like neutralization, flocculation, coagulation are used for removal of heavy metals, TDS, COD, BOD etc. *Secondary treatment* involves biological treatment using activated sludge systems, anaerobic systems etc. for removal of BOD, COD and other parameters. *Tertiary treatment* includes carbon adsorption, oxidation (using UV systems or peroxide solutions) for the detoxification of organics. Reverse Osmosis (RO), Ultrafiltration and other filtration techniques are also used to recover and concentrate process intermediates

20.5.3 HAZARDOUS WASTE

In case the pesticide manufacture unit is a member of common Transport, Storage and Disposal Facility (TSDF), it requires only temporary storage facilities for hazardous wastes as per the

required practices in pits, recommended containers etc. Sludges from the process and ETP can be thickened, dewatered, and stabilized using chemical agents (such as lime) before disposal, which must be in an approved and controlled landfill. Contaminated wastes are generally incinerated with the remaining residue being disposed in the secured landfill. The flue gases generated, if acidic, are scrubbed. Some pre-treatment operations like solidification /stabilization, chemical treatment etc. are also employed before final disposal of the wastes to the secured landfill.

20.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted with an aim of reduction in the pollution and resource conservation.

- Measurement and control of the quantities of active ingredients to minimize wastage.
- Re-use of by-products from the process as raw materials or raw materials substitutes in other processes.
- Use of automated fillings to minimize spillage.
- Use of "closed" feed systems for batch reactors.
- Use of nitrogen blanketing where appropriate on pumps, storage tanks, and other equipment to minimize the release of toxic organics.
- Preference to non-halogenated and non aromatic solvents where feasible.
- Use of high-pressure hoses for equipment cleaning to reduce wastewater.
- Use of equipment washdown waters as makeup solutions for subsequent batches.
- Vent equipment through a vapor recovery system.
- Maintenance of losses from vacuum pumps at low levels.
- Return of toxic materials packaging to the supplier for reuse or incinerate/ destroy in an environmentally acceptable manner.
- Minimization of storage limits of off-specification products to avoid disposal problems.
- Minimization of raw materials and product inventory to avoid degradation and wastage that could lad to the formation of inactive but toxic isomers or by-products.
- Incorporation of measures to avoid release of harmful substances in the design, maintenance, and management of the plant.
- Use of suction hoods to collect vapours and other fugitive emissions.
- Labelling and storage of toxic and hazardous materials in secure and bunded areas.

20.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	Yes
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	Yes
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	Yes
8.	Public liability Insurance (Public Liability Insurance Act)	Yes
9	Submission of environmental statement (EPA,1986)	Yes

21.0 PHARMACEUTICALS

21.1 PROCESS DESCRIPTION

The pharmaceutical industry includes the manufacture, extraction, processing, purification, and packaging of chemical materials to be used as medications for humans or animals. Pharmaceutical manufacturing is divided into two major stages: the production of the active ingredient or drug (primary processing, or manufacture) and secondary processing, the conversion of the active drugs into products suitable for administration.

The principal manufacturing steps are (a) preparation of process intermediates; (b) introduction of functional groups; (c) coupling and esterification; (d) separation processes such as washing and stripping; and (e) purification of the final product. Additional product preparation includes granulation; drying; tablet pressing, printing, and coating; filling; and packaging.

21.2 BASIC POLLUTING PROCESS

- Chemical synthesis
- Reaction
- Separation
- Crystallization
- Purification
- Drying
- Natural & biological product extractions
- Mixing and washing
- Extraction
- Evaporation
- Fermentation
- Formulation, mixing & compounding

21.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the pharmaceutical industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	VOCs – HAPs emissions, halogen acids, SO_2, NOx, solvent vapour, odoriferous gases, fine particulate matter.
2	Water	High BOD, COD, TSS, TDS, spent solvents, methanol, ethanol, acetone, isopropanol, phenol, waste starches
3	Solid	Filter cake, spent raw material.
4	Hazardous	Residue rejects, spent solvent, ETP sludge, metal sludge.

21.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The principal air pollutants are Volatile organic matter (VOCs) and Particulate Matter (PM). They are generated during chemical synthesis process and also during mixing and extraction operations. There is possibility of occupational health hazards due to fugitive emissions of various pollutants.

Water Pollution

Liquid effluents resulting from equipment cleaning after batch operation contains toxic organic residues. Their composition varies, depending on the product manufactured, the materials used in the process, and other process details. The wastewater generated also contains toxic metals. The effluent generated should be treated to ensure safe discharge. The aquatic life and surface water quality can be affected due to effluent discharge of high toxicity.

Hazardous and Solid Waste

The principal hazardous wastes of concern include process and effluent treatment sludges, spent catalysts, and container residues. The solid waste comprises of reject raw material and filter cake generated in the filtration operation. Soil and groundwater can get polluted due to unsecured storage/disposal of hazardous waste.

21.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the pollution preventive measures for various wastes streams generated in the pharmaceutical industry.

21.5.1 AIR POLLUTION

Stack gas scrubbing, carbon adsorption (for toxic organics) and bag houses (for particulate matter removal) are applicable and effective technologies for minimizing the release of significant pollutants to air. In some cases, biological filters are also used to reduce emissions of organics. Combustion is used for the destruction of toxic organics. Gaseous releases can be treated by dry scrubbing, condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites).

21.5.2 WATER POLLUTION

Only primary treatment is required in case the unit is a member of CETP. If not, the *effluent treatment* initiates with *pretreatment* i. e. screening and settling etc. for removal of large solids and other parameters *Primary treatment* includes sedimentation/filtration for removal of suspended solids. *Secondary treatment* using physical and chemical means involves neutralization, floatation, coagulation and filtration for removal of metals, TDS, COD and BOD.

Secondary treatment also involves biological treatment using trickling filters, anaerobic, activated sludge, and rotating biological contactors for removal of BOD and COD. *Tertiary treatment* has Reverse Osmosis (RO) or ultrafiltration to recover and concentrate active ingredients. Ion Exchange, carbon adsorption, detoxification, wet air oxidation ultraviolet systems or peroxide solutions for removal of various parameters.

21.5.3 HAZARDOUS AND SOLID WASTE

Contaminated solid wastes are generally incinerated, and the flue gases are scrubbed. In case the unit is member of common TSDF, it requires only temporary storage facilities for hazardous wastes as per the required practices. Spent catalysts can be sent back to the suppliers. Sludge can be thickened, dewatered, and stabilized using chemical agents (such as lime) before disposal, which must be in an approved and controlled landfill. Other wastes can be finally disposed to the secure landfill before some pretreatment like incineration, stabilization, chemical treatment etc. if needed.

21.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction in pollution load from the pharmaceutical industry as well as leading to resource conservation in the manufacturing process.

- Measure and control of quantities of active ingredients to minimize wastage.
- Re-use of by-products from the process as raw materials or as raw materials substitutes in other process.
- Recovery of solvents used in the process by distillation or other methods.
- Preference to the use of non-halogenated solvents.
- Use of automated fillings to minimize spillage.
- Use of closed feed systems into batch reactors.
- Use of equipment washdown waters and other process waters as makeup solutions for subsequent batches.
- Recirculation of cooling waters.
- Use of dedicated dust collectors to recycle recovered materials.
- Venting of equipment through a vapor recovery system.
- Return of toxic materials packaging to the supplier for reuse, or incinerate/destroy it in an environmentally friendly acceptable manner.
- Enhance productive uses for off-specification products to avoid disposal problems.
- Minimization of raw material and product inventory to avoid degradation and wastage.
- Use of high-pressure hoses for equipment cleaning to reduce wastewater.
- Provision of stormwater drainage and avoid contamination of stromwater from process areas.

- Labeling and storage of toxic and hazardous materials in secure, bunded areas. Collection and reuse of spillage.

21.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	Yes [1]
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	Yes
9	Submission of environmental statement (EPA,1986)	Yes

[1] In case of Bulk Drug industries

22.0 PLASTER OF PARIS

22.1 PROCESS DESCRIPTION

Plaster of Paris manufacture uses gypsum rock deposits as the principal raw material. The gypsum boulders are obtained from the quarry by drilling and blasting. The boulders are then transported to the plants. They are crushed and screened before sent for the calcination. The calcination is carried out in coal/fuel/gas fired kilns at lower temperature converting gypsum into plaster of paris granules. The granules are then pulverized to fine powdery state. Additives and filler are mixed with the fine power based on the desired properties in the final product. The final product is then packed into the bags before transportation to the various places.

10.2 BASIC POLLUTING PROCESS

- Loading/unloading of gypsum boulders
- Crushing
- Calcination
- Furnace heating – coal/oil/wood fired
- Pulverisation/milling operation
- Discharge pits of calcinator
- PoP handling & packaging

22.2 CRITICAL POLLUTANTS

Critical pollutants generated in the typical PoP industry is as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Furnace emissions, PoP dust, Particulate matter
2	Solid	Rejects, waste material.
3	Noise	Pulveriser, crusher

22.3 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Air pollutants are emitted from quarrying operations, loading and unloading of raw material and finished product operations, transportation, crushing and firing operations in kilns, and calcination process. The emissions of PoP dust and particulate matter from the industry may cause air pollution problem within close proximity of the unit. Dry powder becomes air borne on windy days.

Noise generation

Pulverizers and crushers used in the PoP plants are the major cause of noise pollution. They may create nuisances for the workers and the nearby residential areas.

22.4 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the preventive measures for various types of wastes generated in the PoP industry.

22.4.1 AIR POLLUTION

Fabric filters, bag houses and electrostatic precipitators are used for control of particulate matter. Similarly appropriate ventilation and wet dust suppression can also be used for dust control. Gaseous emissions from furnaces can be treated by dry and wet scrubbing, condensation, absorption, adsorption (using activated carbon, silica gel, ethanol amine, activated alumina and zeolites) etc.

22.4.2 NOISE

Noise pollution can be controlled by use of efficient, sound-proof equipments. If possible, the industry should be located far from populated areas.

22.5 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of pollution load on the PoP industry as well as resource conservation in the manufacturing process.

- Use of fuels like natural gas in the furnaces to reduce air emissions.
- Industry producing PoP using phospho-gypsum, which is waste from fertilizer industries, needs to be promoted.
- Water spraying to be carried out to prevent dust generation.
- Material loading and unloading operations should be carried with minimum generation of dust.
- Packing operations should be carried out by mechanically with care to avoid any spillage and dust generation.
- Alternate methods for gypsum quarrying for production of PoP using open pit mining should be found.

22.6 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

23.0 PLASTIC PRODUCTS

23.1 PROCESS DESCRIPTION

There are many processes for plastics. Selection of a process depends on many factors including quantity and production rate, dimensional accuracy and surface finish, form and detail of the product, nature of material, Size of final product. In general, plastics processes have three phases:

- Heating - To soften or melt the plastic
- Shaping / Forming - Under constraint of some kind
- Cooling - So that it retains its shape.

There are variety of shaping processes i.e. moulding process involves heating the plastic raw material to the melting temperature and putting the melt in the iron or other material-made moulds of the desired shape under pressure. Different types of moulding operations are use i.e. injection moulding, etc. The extrusion process involves shaping the plastic raw material by forcing it through a die.

19.2 BASIC POLLUTING PROCESS

- Moulding
- Extruding
- Calendaring

23.2 CRITICAL POLLUTANTS

Critical pollutants typically generated in the plastic industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Fugitive emissions, VOCs, Dust, cadmium & lead
2	Water	Chemical additive spills/leaks, cooling & washing water, BIS (2-ethylhexile) phthalate, BOD, oil & grease, TOC, phenol, Zinc, Di-methyl phthalate.
3	Solid	Plastic pallet spills.

23.3 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Air Pollutants are generated during manufacturing operations like melting, moulding etc. Sometime the emissions released contains toxic metals which may pose health risks for the workers.

Water Pollution

Liquid effluents are generated due to the use of water in the processing operations. Due to the presence of organic species and metals, aquatic life will be affected when wastewater is discharged into surface water body. Soil can be polluted in case of land discharge.

Hazardous and Solid Waste

The solid waste is generated in the form of plastic pellets spills and hazardous wastes in the form of rejects. In case of non-biodegradable wastes, adverse impacts can occur on the environment.

23.4 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the pollution preventive measures for various wastes streams generated in the plastic industry.

23.4.1 AIR POLLUTION

Dust particles can be controlled by using appropriate ventilation and wet dust suppression. Removal technologies like fabric filters, wet scrubbers and electrostatic precipitators are used for suspended particulate matter and metals. Gaseous pollutants can be treated by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites).

23.4.2 WATER POLLUTION

The effluent treatment includes *pretreatment* consisting of screening, and flow equalization to remove large solids and *primary treatment* involving sedimentation/filtration etc. for removing suspended solids. *Secondary treatment* uses physical and chemical means including precipitation, flocculation, and sedimentation/filtration, neutralization for metals, TSS, COD and BOD removal. Removal of oil and grease is also done using appropriate removal technologies. *Secondary treatment* also involves biodegradation using trickling filters, rotational biological contactors and activated sludge systems and packed bed reactors for the removal of BOD, COD and Di-methyl phthalate. *Tertiary treatment* involves carbon adsorption, precipitation, filtration, and ultrafiltration for further removal of the various parameters before final discharge.

23.5 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reducing the pollution load from the plastic industry as well as leading to resource conservation in the manufacturing process.

- Use of energy efficiency processes wherever feasible.
- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.

- Minimization of unplanned or un-routined discharges of wastewater caused by equipment failures, human errors, and faulty maintenance procedures.
- Regeneration and recovery of chemicals to the extent possible.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.

23.6 REGULATORY OBLIGATIONS

Sl. No	**Requirements under Indian Environmental Legislations**	**Applicable (Yes/ No)**
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

24.0 PAPER AND PULP

24.1 PROCESS DESCRIPTION

Pulp and paper are manufactured from raw materials containing cellulose fibers, wood, recycled paper, and agricultural residues. Pulps are made by cooking (digesting) the raw materials, using the kraft (sulfate) and sulfite processes. Wood chips are cooked with caustic soda to produce brownstock, which is then washed with water to remove cooking (black) liquor for the recovery of chemicals and energy. The finished pulp may be dried for shipment (market pulp) or may be used to manufacture paper on site (in an "integrated" mill).

24.2 BASIC POLLUTING PROCESS

- Raw material handling
- Cooking section - Black liquor
- Pulp washers (poucher)
- Beater section
- Screening and centricleaners
- Bleaching
- Thickener
- Paper Machine

24.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the paper and pulp industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Boiler emissions, VOCs, odour, particulate matter
2	Water	BOD, COD, TSS, Lignin, Sodium, AOx, organic chloro compounds
3	Solid	Rejects, coal/boiler ash.
4	Hazardous	ETP primary & secondary sludge,

24.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of the air pollution are DG sets etc. In the kraft pulping process, highly malodorous emissions of reduced sulfur compounds, measured as Total reduced sulfur (TRS) and including hydrogen sulfide, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide, are emitted. Black liquor oxidation also emits VOCs.

Other pulping processes, such as the mechanical and thermomechanical methods, generate significantly lower quantities of air emissions. Steam- and electricity-generating units using coal or fuel oil emit fly ash, sulfur oxides, and nitrogen oxides. Coal burning also emits fly ash.

Water Pollution

The effluents are also generated from the various pulping operations containing BOD, COD, SS, organics etc. Phosphorus and nitrogen are also released into wastewaters. The main source of nutrients, nitrogen, and phosphorus compounds is raw material such as wood. The use of peroxide, ozone, and other chemicals in bleaching makes it necessary to use a complexing agent for heavy metals such as manganese. Effluent is toxic due to release of chloro lignin Discharge of black liquor causes colour problem & higher oxygen demand.

Hazardous and Solid Waste

The principal solid wastes of concern include wastewater treatment sludges. Solid materials that can be reused include waste paper, which can be recycled, and bark which can be used as fuel. Lime sludge and ash may need to be disposed of in an appropriated landfill.

24.5 RECOMMENDED POLLUTION PREVENTION MEASURES

24.5.1 AIR POLLUTION

Gaseous emissions are treated by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites) and in some cases biofilteration, and bioscrubbing (using peat or heather, bark, composts, and bioflora to treat biodegradable organics), and thermal decomposition. In some cases, VOC levels of the vapors are reduced by use of carbon filters, which allow the reuse of the solvents or by combustion (and energy recovery) after scrubbing, adsorption, or other treatment methods. SO_X emissions are scrubbed with slightly alkaline solutions and are colleted using headers, hoods, and venting equipment. Electrostatic precipitators are used to control the release of particulate matter into the atmosphere.

24.5.2 WATER POLLUTION

In case the unit is a member of CETP, then only primary treatment is to be done by the industry. If not, the treatment includes *pretreatment* using screening and *primary treatment* using sedimentation/filtration to remove suspended solids. *Secondary treatment* using physical and chemical means includes neutralization, flotation, hydrocloning and flocculation for removal of suspended solids and chemical precipitation to remove certain cations. *Secondary treatment* also includes biological treatment involving activated sludge, aerated lagoons and anaerobic fermentation achieving BOD reduction by over 99 % and COD reduction by 50 % - 90 %. *Tertiary treatment* may be performed to reduce toxicity, suspended solids, and other.

24.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution load from the paper and pulp industry as well as leading to resource conservation in the manufacturing process.

- Use of energy efficiency pulping processes wherever feasible.
- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Reduction of effluent volume and treatment required by using dry instead of wet debarking.
- Recovering pulping chemicals by concentrating black liquor and burning the concentrate in a recovery furnace.
- Recovery of cooking chemicals by recausticizing the smelt from the recovery furnace.
- Use of high-efficiency washing and bleaching equipment.
- Minimization of unplanned or unroutined discharges of wastewater and black liquor, caused by equipment failures, human errors, and faulty maintenance procedures.
- Reduction of bleaching requirements by process design and operation.
- Minimization of sulfer emissions to the atmosphere by using a low-odor design black liquor recovery furnace.
- Use of energy-efficient processes for black chemical recovery, preferably aiming for a high solid content.
- Reduction of use of hazardous bleaching chemicals by extended cooking and oxygen delignification.

24.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

25.0 RICE MILLS

25.1 PROCESS DESCRIPTION

The rice processing initiates with cleaning operation where foreign objects, such as hey, straw, stone, tree stump, and snail shell are removed from the paddy. It is followed by husking operation which rubs excessive husks off cleaned paddy. Once removed, brown rice is separated from the husks through the ventilation process. The brown rice is taken to Paddy Separator which separates some unhusked paddy from brown rice by applying a difference in gravitational pull and surface friction The unhusked paddy, then, re-enters the husking process. The brown rice is subjected to the Milling which strips off the bran layer from brown rice. The bran layer is separated by air ventilation. This process usually takes 2 to 3 cycles, depending on the required milling degree. After milling, the milled rice undergoes grading where milled rice (mixture of different sizes: whole grain, head rice, and broken rice) is separated by a sieve grader. The finished rice will be stored in individual bags, according to its grade. And the rice is ready for delivery.

27.2 BASIC POLLUTING PROCESS

- Milling
- Cleaning
- Soaking (parboiled rice)
- Paddy washing
- Polishing
- Husk/paddy separation
- Hulling (parboiled rice)

25.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the rice mill industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Dust and SPM, SO_2, fugitive emissions
2	Water	Boiler Blow down, Rejects from water softener, COD, BOD, O&G, phosphate.
3	Noise	During Grinding, milling

25.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Husking, cleaning, milling operations and boilers are the major sources of air pollution. The ambient air quality can be affected due to dust and SPM from burning of husk. There is possibility of occupational health hazards due to fine dust and noise.

Water Pollution

The effluent contains BOD, COD, oil and phosphates etc. The various sources are boiler blow down, rejects from water softener, processing operations etc. Wastewater from parboiled rice mills is generally discharged into river/water body, agriculture field or low-lying areas which may deteriorate water quality of recipient body. Land discharge of wastewater affects SAR.

25.5 RECOMMENDED POLLUTION PREVENTION MEASURES

25.5.1 AIR POLLUTION

Dust particles can be controlled by using appropriate ventilation and wet dust suppression. Equipments like fabric filters, bag house filters, wet scrubbers and electrostatic precipitators are used for particulate removal. Gaseous emissions are can be treated by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites).

25.5.2 WATER POLLUTION

In case the unit is a member of CETP then only primary treatment is required. If not, the wastewater treatment includes *pretreatment* involving preliminary screening using bar screens and communiters and *primary treatment* using sedimentation/filtration etc. for removal of large quantities of solids. *Secondary treatment* using physical-chemical mediums like oxidation/reduction, neutralization, precipitation etc. removes a large portion of solids, BOD, COD and phophate. Separation techniques for recovery of oil are also used. Secondary treatment also includes biodegradation (trickling filter, anaerobic, aerated lagoons, rotating biological contactor and activated sludge) for removal of COD and COD and biological phosphate removal (BPR) systems before final discharge of the effluent.

25.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution load rice mill industry as well as leading to resource conservation in the manufacturing process.

- Use of energy efficiency processes wherever feasible.
- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Minimization of unplanned or unroutined discharges of wastewater caused by equipment failures, human errors, and faulty maintenance procedures.
- Use of low sulphur oils as burning fuels.
- Regeneration and recovery of chemicals to the extent possible.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.
- Regular cleaning and washing of equipments.

- Effective measures to control noise pollution including provision of soundproof cabins for noise producing equipments use of silencers etc.

25.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

26.0 SOFT DRINKS

26.1 PROCESS DESCRIPTION

The raw materials used in the soft drinks manufacture are water, carbon dioxide, and syrup made by blending sugar with cold drink concentrate. These raw materials are blended with other additives and other substances as per the requirements of the products. After the blending operation, the soft drinks are filled in the glass bottles or PET containers using automatic filling machines.

26.2 BASIC POLLUTING PROCESS

- Syrup preparation
- Filter press
- Blending
- Bottle filling
- Washing

26.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the soft drink industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Boilers and DG Sets emissions such as SPM, NOx.
2	Water	Vessel cleaning, bottle washing, BOD, O&G, Spills

26.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of the air pollution are DG sets, boilers. Generally the potential of air pollution is less from this industry.

Water Pollution

The effluents are generated from the vessel cleanings, bottles washings, etc. Aquatic life can be adversely affected due to discharge of the wastewater on surface water bodies. It may also cause soil contamination due to discharge on land.

26.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the measures for treating the various types of waste generated in the soft drink industry.

26.5.1 AIR POLLUTION

Equipments like fabric filters, wet scrubbers and electrostatic precipitators can be used for particulate removal. Gaseous releases are treated by condensation, absorption, adsorption (using activated carbon, silica gel, activated alumina and zeolites).

26.5.2 WATER POLLUTION

The effluent treatment includes *pretreatment* like screening etc. to remove large solids. *Primary treatment* uses sedimentation/filtration etc. to remove suspended solids. Chemical treatment includes pH adjustment. *Secondary treatment* also involves biological treatment using activated sludge process etc. for removal of BOD.

26.5.3 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution load from the soft drink industry as well as leading to resource conservation in the manufacturing process.

- Use of good and treated if required quality of raw water.
- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Minimization of unplanned or unroutined discharges of wastewater caused by equipment failures, human errors, and faulty maintenance procedures.
- Regeneration and recovery of chemicals to the extent possible.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.
- Regular cleaning and washing of equipments.

26.6 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

27.0 SPORTS GOODS INDUSTRY

(Soccer Balls, Cricket Bats & Gears, Hockey Sticks)

27.1 PROCESS DESCRIPTION

Different processes are used for the variety of products. For instance, the process for making the cricket bat involves air-drying of the wood i.e. timber, initial shaping of the wood using circular saw followed by the pressing using a hardwood mallet. After inserting the handle and making the grips in the bat, final shaping is done using drawknives and wooden blockplanes, followed by the sanding on a pneumatic sanding drum. Finally threads are bound on the handle and rubber grip is rolled.

27.2 BASIC POLLUTING PROCESS

- Chemical treatment of wood
- Sawing
- Painting & polishing
- Carpentry shop
- Cutting & sewing
- Leather conditioning

27.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the typical sports goods industry are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Saw Dust, SPM
2	Water Pollution	Washing, suspended solids.
3	Solid waste	Rejects, wood chipping, waste cloth/paper

27.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Air emissions are generated during sawing operations releasing saw dust. These emissions may cause occupational hazards to the workers. This industry has low potential for causing the air pollution.

Waste Water generation

Liquid effluents are generated in the washing and leather conditioning operations during the making of various products. In general, the potential of the industry to cause water pollution is low.

Hazardous and Solid waste

Solid waste is mainly generated in the form of rejects, wood chipping, waste cloth/paper from the various operations like sawing, carpentry shop, cutting, etc. These are not hazardous in nature and do not pose potential threats.

27.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the End-of –Pipe treatment for various types of wastes generated in the sports goods industry.

27.5.1 AIR POLLUTION

Since major air pollutants are in the form of saw dust generated from the sawing of the wooden items, Control methods like appropriate ventilation and wet dust suppression are used for dust control. Dust can be collected and transported using Pneumatic systems. Control technologies like fabric filters, wet scrubbers etc. are used for the control of particulate matter.

27.5.2 WATER

In case the unit is a member of CETP then only *primary* treatment is required. If not, the effluent treatment begins with *pre-treatment* i.e. screening for removal of large solids. *Primary treatment operation* involves sedimentation/filtration for removal of suspended solids. Physical and Chemical treatment if needed, may include flocculation, coagulation for further removal of suspended solids and other perimeters before final disposal of the treated effluent.

27.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted from the point of view of reduction in the pollution as well as resource conservation.

- Use of efficient and automated equipments, where feasible to minimize the generation of waste and avoidance of child labor.
- Water spraying to be carried out to prevent dust generation in the places of dust generation.
- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Regeneration and recovery of chemicals, if used to the extent possible.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.

27.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

28.0 SOAPS AND DETERGENTS

28.1 PROCESS DESCRIPTION

The soaps are made from fats and oils or their fatty acids which are reacted with inorganic water-soluble bases in the process called saponification. Vacuum spray drying is used to convert the neat soap formed in the saponification process into dry soap pellets. The first unit in the line is a mixer, called an amalgamator, in which the soap pellets are blended together with fragrance, colorants and all other ingredients. The mixture is then homogenized and refined through rolling mills and refining plodders to achieve thorough blending and a uniform texture. Finally, the mixture is continuously extruded from the plodder, cut into bar-size units and stamped into its final shape in a soap press.

For detergent manufacture, *spray drying* process is used. In the *spray drying* process, dry and liquid ingredients are first combined into a slurry, or thick suspension, in a tank called a crutcher. The slurry is heated and then pumped to the top of a tower where it is sprayed through nozzles under high pressure to produce small droplets. The droplets fall through a current of hot air, forming hollow granules as they dry. The dried granules are collected from the bottom of the spray tower where they are screened to achieve a relatively uniform size

28.2 BASIC POLLUTING PROCESS

- Boiler & furnace
- Mixing & heating
- Washing & cleaning
- Leaks from transfer pumps
- Leakage and liquid materials/acid slurry

28.3 CRITICAL POLLUTANTS

Critical pollutants typically generated in the typical soap and detergent industry is as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Boiler/DG set emission, SPM, NOx, SOx.
2	Water Pollution	Acid slurry (synthetic detergents, boiler blow-down, washings and leaks).
3	Solid waste	Rejects, packing material, discarded containers, boiler ash

28.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Air emissions like gaseous emissions, dust, odor are emitted from boiler operations, *spray drying* process, mixing and heating operations, finishing operations etc. The odor is the another major problem caused due to storage and handling of the liquid ingredients, vent lines, product storage and waste streams. In general, the potential of the soap and detergent industry to cause air pollution is not low.

Waste Water generation

Liquid effluents are generated in the washing, blow-down operations as well as from the synthetic detergents. The wastewater generated contains inorganic constituents, phosphates, suspended solids etc. which requires treatment before discharge. In general, the potential of the industry to cause water pollution is low.

28.5 RECOMMENDED POLLUTION PREVENTION MEASURES

28.5.1 AIR POLLUTION

The gaseous emissions generated from boilers/DG sets, SO_2, NOx etc. are controlled by dry scrubbing, condensation, absorption, and adsorption (using activated carbon, silica gel, activated alumina and zeolites). Some VOCs are also generated which are controlled by incineration. For the control of the dust, fabric filters, electrostatic precipitators are used for particulate removal. For large size particulates, cyclone separators are also used.

28.5.2 WATER POLLUTION

In case pf absence of CETP, the effluent treatment begins with *pretreatment* using screens for removal of large solids etc. This is followed by *Primary treatment* involving process sedimentation/filtration for removal of suspended solids. Physical and Chemical treatment includes neutralization, flocculation, coagulation for removal of metals, and other constituents. *Secondary treatment* involving biological treatment uses activated sludge systems, anaerobic systems etc. for removal of BOD, COD, nutrients and other materials before the disposal of the treated effluent.

28.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reducing the load of pollution on the system as well as resource conservation in the manufacturing process.

- Use of efficient mechanical equipments, where feasible to minimize the generation of waste.
- Use of oil / natural gas for reduction in gas emissions.

- Minimization of the generation of effluents through process and recycle wastewaters, aiming for total recycling.
- Regeneration and recovery of chemicals to the extent possible.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.
- Sufficient ventilation and exhaust systems for odor removal.

28.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

29.0 STONE CRUSHERS

29.1 PROCESS DESCRIPTION

Stone crushers are generally laced near the stone queries and are used for converting stone blocks to uniform size aggregates. The process includes screening, grinding and sieving.

29.2 BASIC POLLUTING PROCESSES

- Crushing and grinding
- Screening
- Material handling and transport

29.3 CRITICAL POLLUTANTS

Sl. No	Type of pollution	Critical pollutants
1	Air	SPM, Dust
2	Water	
3	Noise	Crushing/grinding, loading & unloading operations

29.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air pollution

Fugitive emissions during the grinding, screening and material handling operations are main occupational hazard in this industry. Fugitive emissions from these units may also be objectionable to the local communities.

29.5 RECOMMENDED POLLUTION PREVENTION MEASURES

29.5.1 AIR POLLUTION

Sprinkling of water, wherever possible, to reduce fugitive emissions. Use of pneumatic systems and enclosed conveyers should be encouraged for transportation of material and products. Removal technologies like fabric filters, ceramic filters, wet scrubbers, electrostatic precipitators are used for particulate removal.

29.6 CLEANER PRODUCTION OPTION

- Emphasis on the minimal generation of dust by modern and efficient crushing and loading/unloading equipment.
- Regular water spray should be done in the crushing area to minimize the spread of dust particles.

- Efforts should be made to minimize noise pollution including provision of soundproof systems.
- Development of green belt around the stone crusher area.
- Optimization of frequency of equipment cleaning.

29.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
4.	Hazardous waste authorization (EPA, 1986)	No
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes

30.0 TANNERY

30.1 PROCESS DESCRIPTION

In the tanning process raw skins are treated to remove hair and non structured fats. The hides are then preserved by impregnation with tanning agents. A wide range of chemicals and process are used in the tanning and finishing process and includes the following

- Soaking and washing to remove salts, restore the moisture content of the hides, and remove any foreign material such as dirt and manure.
- Liming to open up the collagen structure by removing interstitial material.
- Fleshing to remove excess tissue from interior of the hide.
- Dehairing or dewooling to remove hair or wool by mechanical and chemical means.
- Bating and picking to delime the skins and condition the hides to receive the tanning agents.
- Tanning to stabalize the hide material and impart basic properties to the hide.
- Retanning, dying and fat-liquoring to impart special properties to the leather, increase penetration of tanning solution, replenish oils in the hides and impart colour to the leather.
- Finishing to attain final product specifications.

30.2 BASIC POLLUTING PROCESS

- Soaking – wastewater containing high suspended solids, TDS, BOD
- Unhairing & liming - Suspended solids, TDS, BOD & sulphides
- Pickling & tanning – Chrome, vegetable tans
- Chrome splitting – Chrome containing organic wastes
- Shavings – Shaving wastes containing chrome
- Finishing – VOCs, solid & liquid residues

30.3 CRITICAL POLLUTANTS

Key pollutants likely to be generated from a typical tanning unit are as follows

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Ammonia, Solvent vapours (VOCs)
2	Water Pollution	TDS, suspended solids, BOD, Chromium, Boron, sulphides
3	Solid waste	Fleshing / hairs.
4	Hazardous waste	Chrome containing organic wastes, solid residues, ETP sludge.

30.4 SUMMARY OF KEY ENVIRONMENTAL ISSUE

Air Pollution

Foul Odour from raw skins / hides creates unhealthy working conditions for workers. Hydrogen sulphide and ammonia is released during dehairing and deliming process respectively, which pose significant occupational hazard. This sector of industry has relatively low potential of off – site air pollution.

Waste Water generation

Effluent form any tannery unit contain high levels of chromium, which may pose serious environmental risk if it is discharged without proper treatment. The waste water is generally has high Chemical oxygen demand (COD) and Bio- chemical oxygen demand (BOD), thus if untreated effluent is discharged in surface water body, may leads to depletion of dissolved oxygen levels and is treat to aquatic life. High levels of organic contents may lead to eutrophication of surface water bodies. Effluent may also contains traces of pesticides, applied to the raw skin during transportation.

Water Consumption

Tanneries are generally high water intensive units and rate of water consumption varies from 20 -80 cubic meters per tonne of raw skin. Due to this reason lot of these units in India are located near the perennial source of surface water bodies. The units which are dependent on common source of portable water such as river/ lake, has potential of conflicts with local communities over the issue.

Hazardous waste

Large quantity of sludge is generated from Effluent treatment plant which mainly contains hairs and other trimming, degraded hides and hairs. The waste is high concentration of chrome and thus has high potential of soil and water contamination.

30.5 RECOMMENDED POLLUTION PREVENTION MEASURES

This section summarises the End-of –Pipe treatment for various waste streams, generally applied to a typical tannery unit.

30.5.1 AIR POLLUTION

Use of carbons adsorption beds for collecting and treating vapours. Use of wet scrubbers, water spray/foam to control ammonia vapours.

30.5.2 WATER

In case the unit is a member of CETP then only primary treatment is required. If not, the wastewater treatment includes pre-treatment involving preliminary screening using bar screens, etc. for removal of large quantities of solids. Primary treatment includes floatation/sedimentation, Secondary treatment includes physical-chemical treatment like oxidation/reduction, neutralization using acids, precipitation and coagulation/flocculation, to remove metals, a large portion of solids, BOD and COD. Units should have their own chrome recovery or be member of common chrome recovery plant where chrome tanning is practiced. Secondary treatment involving biological degradation using aerators, rotating biological contactors etc. is required to reduce BOD load. Tertiary treatment, if required (in case statutory discharge standards are not met with treatment up to secondary level) may involve air or steam stripping, granular activated carbon treatment etc.

30.5.3 HAZARDOUS WASTE

In case the unit is member of common TSDF, unit requires only temporary storage facilities for hazardous wastes as per the required practices like lined pits, containers etc. Otherwise, besides storage, combustion (preceded in some cases by solvent extraction) of toxic organics is an effective treatment technology. Chrome containing organic waste shall be disposed in a secured landfill after stabilization.

30.6 CLEANER PRODUCTION OPTIONS

- Process of fresh hides or skin to reduce quantity of salt in wastewater, where feasible.
- Use of salt or chilling methods for preservation of hides instead of persistent insecticides and fungicides.
- Use of flesh green hides instead of limed hides and split, in case of limed hides to reduce amount of chrome needed for tanning.
- Use of trivalent chrome for tanning. Recovery and recycle of chrome from the wastewater.
- Alternatives to chrome in tanning such as titanium, aluminium, iron, zirconium, and vegetable tanning agents.
- Use of non-organic solvents for dyeing and finishing.
- Recovery of hairs from wastewater.
- Use of photocell-assisted paint-spraying techniques to avoid over spraying.
- Monitoring and control of process waters. Use of batch washings. Recycle liming, pickling and tanning floats.
- Reuse of wastewater for washing.
- Recycle hide trimmings for use in the manufacture of glue, gelatin and similar products.

- Recycle wastes to the extent feasible in the manufacture of fertilizer, animal feed, and tallow, provided the quality of these products is not compromised.
- Control odour problems by good housekeeping methods such as minimal storage of flesh trimmings and organic material.

30.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	Yes
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	Yes
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	Yes
8.	Public liability Insurance (Public Liability Insurance Act)	Yes
9	Submission of environmental statement (EPA,1986)	Yes

31.0 TEXTILE (DYING & PRINTING)

31.1 PROCESS DESCRIPTION

Dying & printing operations in a textile production unit has relatively high pollution potential. Dying operation involves use of organic / inorganic dyes, which are mixed in solvent (generally water) and is applied to the yarn / cloth. The dying operations may be semi- automated or fully – automated depending on scale of operations. Fully- automated processes however are, relatively less water consuming as compared to manual or semi- automated process.

31.2 BASIC POLLUTING PROCESS

- Bleaching
- Mercerising
- Dyeing/printing
- Washing

31.3 CRITICAL POLLUTANTS

Sl. No	Type of pollution	Critical pollutants
1	Air	Emission from boilers and DG Sets.
2	Water	Heavy metals, phenolic compounds, spent caustic and other chemicals, COD, TDS, BOD, colour
4	Solid waste	Fibers, waste pieces of cloth and yarns, packaging material, boiler ash,
5	Hazardous waste	ETP sludge

31.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air

Main source of air pollution in textile dying & printing units are emission from boilers and DG sets. The height of stack provided for their vent needs to be sufficient to ensure efficient dispersion in ambient air such that, their effect on ground level concentration of these pollutants is minimal. Appropriate stack height is generally indicated in "Consent to operate" provided by SPCBs.

Water

Water utilization, treatment and disposal of effluent represent the key environmental issues associated with textile dying units. Hence, the risk factors are primarily associated with the principle wet processes, including scouring, desizing, mercerizing, bleaching, dyeing and finishing (in particular, large quantities of wastewater are produced from desizing, scouring and

bleaching process). The waste water typically is high in COD and may also contains solids, oil, toxic organics (including phenols) and halogenated organics from process such as bleaching. Dye waste water is generally highly colored and may contain heavy metals. The colored effluent discharged from the industry, may or may not be polluting, is generally objectionable to the local community, if it is being discharged in potable water source. The method of removing color from the wastewater varies according to the class of dye.

Hazardous waste

Sludge generated from effluent treatment is hazardous. Unscientific storage / disposal may pose serious risk of soil and water contamination.

31.5 RECOMMENDED POLLUTION PREVENTION MEASURES

Air Pollution

Height of stack attached to DG sets and boiler should be sufficient to facilitate dispersion of pollutants

Water Pollution

In case the unit is a member of CETP, then only primary treatment is to be done by the industry. If not, the treatment includes pre-treatment includes screening, flow equalization. Primary treatment like sedimentation is used to remove suspended solids. Physical-chemical treatment includes control of pH, addition of coagulant such as alum before settling. Biological treatment includes biodegradation using aerobic oxidation, oxidation ponds or another aerobic process for removal of BOD. Tertiary treatment if used includes carbon adsorption, precipitation, filtration, and ultra-filtration for further removal of pollutants. Disinfection of wastewaters from wool processing units may be required to reduce coliform levels.

Hazardous waste

In case the unit is member of common TSDF, unit requires only temporary storage facilities for hazardous wastes as per the required practices like lined pits, containers etc. The ETP sludge generally does not have required calorific value to facilitate Incineration, thus containment after stabilisation is the most appropriate technology.

31.6 CLEANER PRODUCTION OPTIONS

- Matching of the process variables to the type and weight of fabric and management of batches to minimize waste at the end of cycles.
- Avoid non- degradable or less degradable surfactants (for washing and scouring) and spinning oils.
- Avoid of the use of the ozone-depleting substances and organic solvents.

- Use of water printing for synthetics to reduce water consumption.
- Use of pad batch dyeing to save energy and water consumption and reduce dye and salt usage.
- Avoid use of chlorine-based & Benzedrine-based azo dyes and those containing cadmium and other heavy metals.
- Use of less toxic dye carriers and finishing agents.
- Replacement of dichromate oxidation of vat dyes and sulfer dyes with peroxide oxidation. Refusal of dye solution form dye bath.
- Use of peroxide bleaches instead of chlorine-based bleaches, where feasible.
- Control of makeup chemicals. Reuse and recovery of process chemicals such as caustic.
- Replacement of non-degradable spin finish and size with degradable alternatives.
- Use of biodegradable textile preservation chemicals.
- Control of quantity and temperature of water. Use of counter current rinsing.
- Recovery of heat from wash water to reduce steam consumption.

31.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF (EIA Notification 1994)	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes
4.	Hazardous waste authorization (EPA, 1986)	Yes
5.	Payment of Water Cess (The Water Cess Act, 1977)	Yes
6.	Safety reports to concerned authorities (Manufacture, storage and import of hazardous chemical rules, 1989)	No
7.	On-site emergency plan (Manufacture, storage and import of hazardous chemical rules, 1989)	No
8.	Public liability Insurance (Public Liability Insurance Act)	No
9	Submission of environmental statement (EPA,1986)	Yes