

SECTORAL GUIDEBOOK

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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, 39 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 to 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 Credit Officer (CO). 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 Credit Officer (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 Issues**, 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. Credit Officer (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, Credit Officer (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	L	M	L	E-II
2	Brick kilns	H	L	L	E-I
3	Ceramics	H	L	L	E-I ¹
4	Cement Plant	H	L	L	E-I
5	Dairy and Dairy products	M	H	L	E-I
6	Distilleries	M	H	H	E-I
7	Dye & Dye intermediates	H	H	H	E-I
8	Edible Oil & Vanaspati	L	M	M	E-I
9	Electroplating	H	H	H	E-I
10	Engineering units (Cutting and shaping)	L	L	L	E-III
11	Engineering units (Metal surface treatment)	H	H	H	E-I
12	Flour and Pulse mills	M	L	L	E-II
13	Foundry	H	L	M	E-I
14	Food & fruit processes	L	M	L	E-II
15	Glass	H	L	L	E-I
16	Lime Kilns	H	L	L	E-I
17	Natural Rubber	M	L	L	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 (bulk drugs)	H	H	H	E-I
22	Pharma (Formulation)	L	M	M	E-II
23	Plaster of Paris	M	L	L	E-II
24	Plastic Products	M	L	L	E-III
25	Pulp and Paper	H	H	M	E-I
26	Rice mills	L	L	L	E-III
27	Soft Drinks	L	M	L	E-II
28	Sports Good Industry	L	L	L	E-III
29	Soaps and Detergents	L	H	L	E-I
30	Stone Crushers	M	L	L	E-II
31	Tannery	L	H	H	E-I
32	Textiles (Dying & Printing)	L	H	H	E-I
33	Cosmetic Products	L	M	L	E-II

¹Air pollution is the major issue. If the unit uses PNG, the category will be categorized as E-II

Sl. NO	SECTORS	AIR EMISSIONS	WASTE WATER	HAZARDOUS WASTE	CATEGORY
34	Meat & Fish Processing / Slaughter House	L	H	L	E-I
35	Refractory (without PNG)	H	L	L	E-I
36	Wood & Wood Products	L	L	L	E-III
37	Electronic & Electrical Goods	L	L	L	E-III
38	Garments & Apparel Manufacturing	L	L	L	E-III
39	Paper & Paper Board Products	L	L	L	E-III

H- High, M- Medium, L-Low

1.0 BAKERIES AND CONFECTIONARIES

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	SPM, SO ₂ , NO _x from Boilers, Baking Ovens, and DG Sets emissions
2	Water	Floor washings, vessel cleanings containing BOD, TSS& O&G
3	Solid Waste	Rejects, dough spills, packing paper, Bread crumbs.
4.	Hazardous Waste	Used oil from maintenance of DG sets

SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of the air pollution are DG sets, Baking Ovens, boilers releasing SPM, SO₂ and NO_x. Generally the potential of air pollution is relatively less from this industry.

Water Pollution

The effluents are generated from the floor washing, vessel cleanings, etc. Waste water may contain high Biochemical oxygen demand, Total Suspended Solid (TSS), Oil & Grease. Thus untreated waste water can adversely affect surface water bodies, if discharged without treatment.

Solid Waste

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

Hazardous Waste

Used oil from maintenance of DG sets

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

Air pollution equipments like fabric filters, bag houses, wet scrubbers and multicyclone separators are used for control of particulate matter emissions.

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 and dosing of lime/alum. *Secondary treatment* involves biological treatment using activated sludge process / anaerobic systems.

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 of 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.
- Use agricultural residue like rice husk and bagasse as fuel in boilers
- Use of natural gas or liquefied petroleum gas (LPG) for heating of baking oven and boilers.
- Use of anaerobic treatment systems for biogas generation, which can be used as fuel.

1.2 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	No
2.	Valid Air Consent (Air Act, 1981)	Yes

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
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

Note:* - if Piped Natural Gas (PNG) or Liquefied Petroleum Gas (LPG) is used for heating of Baking Ovens and Boilers

2.0 2.0 BRICK KILNS

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 1000 to 1200°C. After exiting the kiln, the brick is allowed to cool prior to handling. The finished fired bricks are transported to the different places.

BASIC POLLUTING PROCESS

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

CRITICAL POLLUTANTS

Typically pollutants generated from brick manufacturing units are as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	SPM, SO _x , NO _x , , CO, CO ₂ , smoke, fugitive dust emissions kiln and coal crushing handling.
2	Solid waste	Ash, rejects from kiln
3	Noise	From mechanised brick moulding, coal crushers, handling fired bricks

SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Major sources of air pollution are coal crushing and burning of coal during firing operations of kiln, loading and unloading operations of fired bricks, firing operations in kilns. Some of the Kilns have movable chimneys, they cause fugitive emissions during change in their positions. These chimneys are banned under the Indian regulations. Due to CO₂ emissions from coal burning the brick kiln sector is a major green house gas contributor.

Noise generation

Mechanized brick moulding, coal crushers and fired bricks handling cause of noise pollution. High noise may create problems for the workers and the surrounding population.

RECOMMENDED POLLUTION PREVENTION MEASURES**2.1.1 AIR POLLUTION**

SPM, NO_x and CO, CO₂ can be controlled by use of energy efficient kiln for improved combustion, sufficient height of stack (as per CPCB) and gravity settling chamber to capture SPM and coarse dust particles.

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.

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 SO₂ emissions.
- Promotion of vertical shaft brick kiln technology for brick kilns.
- Use of energy efficiency firing to control NO_x, CO and CO₂.
- Gravity settling chamber to control dust generation.
- Sufficient height of fixed stack as per CPCB guidelines to achieve natural dispersion.
- Location of brick kilns should be far from the residential, agricultural and areas with gardens and fruits trees.

2.2 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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 manufacturing of cement involves mining, crushing, and grinding of raw materials (principally limestone and clay); calcining the raw materials in a rotary kiln; cooling the resulting clinker; grinding 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° 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
- Crushers
- 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, SO _x , SO ₂ , CO, CO ₂ , NO _x , fugitive emissions of dust and coal, trace elements in dust. Stack emissions from DG sets
2	Noise	Cement Mill, Kilns, Crushers
3	Solid Wastes	Off Specification clinker and spillage of products
4.	Hazardous Wastes	Used oil from DG sets maintenance,

3.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of air pollution are clinker rotary kiln, crushers, material-handling equipments, grinding mill operations. CO₂ emissions from combustion of fossil fuels and limestone calcining are a major green house gases source. Use of Petroleum coke results higher emissions of SO₂ 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. Fabric filter systems are options for collection and control of fine particulates. Lime content of the raw materials can be used to control sulphur dioxides. Gaseous releases can be treated by dry scrubbing, condensation, absorption and adsorption. 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 / pre-calciner 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.
- By providing, stack of appropriate height to achieve natural dispersion of controlled emissions.
- 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.
- Installation of equipment covers and multicyclone and bagfilters for crushing, grinding and milling operations.

3.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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)	Yes
8.	Public liability Insurance (Public Liability Insurance Act)	No
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, mixing, forming, machining, drying, presinter thermal processing, glazing, firing, final processing, and packaging.

The raw materials used in the manufacture of ceramics range from relatively kaolin, china clay, silica, sand, potash feldspar, quartz, flint, etc, mined from natural deposits. Calcined animal bones are used to manufacture bone china. Zinc Oxide, Zirconium Silicate, Nickel Oxide, Barium Carbonate, Cobalt Oxide, Magnesium Oxide, Alumina, Iron Oxide, etc are also used to develop various properties in the ceramics. Different types of glazes are also used to develop colours in ceramic items.

4.2 BASIC POLLUTING PROCESS

- Calcining
- Crushing and grinding
- Sieving
- Filter pressing
- Wet finishing
- Drying/baking
- Firing in Kiln
- Material handling and transportation

4.3 CRITICAL POLLUTANTS

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

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	SPM, Smoke, Sox, Nox, CO, CO ₂
2	Water	Heavy metals, wastewater containing suspended solid, pH
3	Noise	From Crusher, grinder, blender, ball mills, hydraulic press operations
4	Solid Waste	Defective ceramic items, rejects (fired and unfired scrap, etc.)
4	Hazardous Waste	Small quantities of waste containing heavy metals due to discarded glaze which may contain heavy metals,; Used oil from DG sets maintenance.

4.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Quartz calciners emit particulate matters, gaseous pollutants like SO₂, SPM, NO₂, CO, CO₂ etc. Dry ball milling operations are source of fugitive dust emissions. Particulate matter emissions consisting of silica, alumina and mineral oxides also arise during mixing and handling of fine raw materials. From the coal fired kilns, particulate matters, SO₂, NO₂, CO, CO₂ are emitted, however, from Piped natural gas and LPG fired kilns, mainly NO_x is emitted.

Water Pollution

The effluent contains pH, TSS, turbidity, heavy metals etc. The various sources of effluent generation are grinding, moulding, glazing and washing operations etc. If effluent from the industry is discharged without treatment into river/water body it may deteriorate water quality of recipient body.

Hazardous and Solid Waste

The various hazardous wastes and solid wastes generated from ceramic industries are defective ceramic items, rejects (fired and unfired scrap, etc.), small quantities of waste containing heavy metals due to discarded glaze which may contain heavy metals; used oil from DG sets maintenance, etc.

4.5 RECOMMENDED POLLUTION PREVENTION MEASURES

4.5.1 AIR POLLUTION

Bag filters and multi cyclone etc. are used to control particulate matters. Gaseous pollutants releases are controlled by wet scrubbers using Ca(OH)₂ for NO_x and acidic gases.

4.5.2 WATER POLLUTION

The effluent treatment includes *pre-treatment* 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..

4.6 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.
- 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.
- By providing, stack of appropriate height to achieve natural dispersion of controlled pollutants.
- Frequent cleaning of equipment should be done.
- Recycle treated wastewater, if feasible.
- Reuse of rejects (fired and unfired scrap, etc.)

4.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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)	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

Note:* - if Piped Natural Gas (PNG) or Liquefied Petroleum Gas (LPG) is used for firing of kiln

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) spray drying of milk (f) packing, storage and distribution.

5.2 BASIC POLLUTING PROCESS

- Separation and Skimming
- Pasteurisation
- Homogenisation
- Spay Drying
- 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 and DG sets emissions include SPM, SO ₂ , NO _x , CO and CO ₂ , emissions of fraction of dry milk powder from spray drier vent.
2	Water	BOD, COD, Total suspended solids, O&G, dissolved sugars & protein, fats, nitrogen, phosphorus.
3	Solid	Ash from coal or husk fired boilers. waste dry milk powder, etc
4.	Hazardous Waste	Used oil from DG sets

5.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

A dairy often generates boilers, spay driers and DG sets emissions, which need to be controlled. Boiler and DG sets emissions include SPM, SO₂, NO_x, CO and CO₂ while fraction of dry milk powder is emitted from spay driers.

Water Pollution

Due to high Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), TSS and Oil & Grease in the wastewater, aquatic life may be affected when wastewater is discharged into

surface water body with out treatment. Soil pollution can occur in case of land discharge of untreated effluent.

5.5 RECOMMENDED POLLUTION PREVENTION MEASURES

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

5.5.1 AIR POLLUTION

Bag filters and multi cyclones are used to control particulate matters. Gaseous pollutants releases are controlled by wet scrubbing using lime or alum as per type of fuel used. Emissions of milk powder are controlled by bag filters.

5.5.2 WATER POLLUTION

In case of absence of CETP, the wastewater treatment comprises *pretreatment* involving preliminary screening using bar screens, 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.

5.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reducing the pollution load from the dairy and dairy products 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.
- Heat recovery system from waste hot flue gases.
- Installation of efficient air pollution control systems
- Installation of efficient water treatment plant for reuse of treated waste water.
- Use of risk husk and bagasse as clean fuel instead of coal and diesel in boilers
- Recovery of energy by using heat exchangers for cooling and condensing.

- 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&CC/SEIAA	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

6.0 DYE AND DYE INTERMEDIATES

6.1 PROCESS DESCRIPTION

Dyes and dyes intermediates manufacturing process steps cover sulphonation, oxidation, reduction, isolation, filtrate and drying. 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.

BASIC POLLUTING PROCESS

- Charging
- Reaction
- 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	SPM, NO _x , SO _x , Ammonia, Cl ₂ , Br ₂ , H ₂ S, VOCs, HCl, HI, HBr, fugitive emissions.
2	Water	BOD, COD, pH, TSS, TDS, Oil & Grease Colour, chlorides, sulphides, phenolic compounds, heavy metals, toxic trace metals, aromatic amines, etc
3	Solid Wastes	Ash from boilers, inert packing materials, etc
4	Hazardous Waste	Primary chemical sludge from ETP, Sodium sulphate/sulphite sludge, naphthalene bearing sludge, process waste sludge/residues containing acid or other toxic metals or organic compounds, iron sludge, dust from air filtration system, incinerator ash, used oil from DG sets.

SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Mostly, in dye manufacturing volatile organic compounds (VOCs), nitrogen oxides (NO_x), hydrogen chloride (HCl), and sulfur oxides (SO_x) are emitted. Moreover, air pollution is also caused by particulates and gaseous emissions, boilers, DG sets, material transport, grinding or drying material such as spray drier.

Wastewater Generation

The main liquid effluent is generated, from equipment washing after batch operation. Mostly, wastewater from dye manufacturing is highly variable in composition and contains a large number of different compounds such as raw materials (e.g. anilines, solutes, etc intermediate products, and even the dyes themselves). They are considered as a more dangerous source of environmental problems. High chemical oxygen demands (COD), biochemical oxygen demands (BOD), suspended solids and intense color due to dye intermediates or residues and auxiliary chemicals characterize from the dye production process.

Hazardous and Solid Waste

The hazardous waste generates from, wastes and residues of the processes, sludge from the chemical reactions and primary sludge from ETP, incinerator ash and dust from APC equipments, used oil from DG sets, etc.

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 bag filters and wet scrubbers. 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 NO_x, SO_x, 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 *pre-treatment* 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, 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 isolated covered & impervious pits / recommended containers as per SPCB guidelines. Various types of sludges can be thickened, dewatered, and stabilized using chemical agents 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. Flue gases formed from incinerator are scrubbed if they are acidic in nature.

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.
- Separation of entrained liquid from reactors.
- Separation of dust from dryers, pulverizers.
- Condensation of organic vapours.
- Adsorption of uncondensed organic.
- Scrubbing of HCl by multiple scrubbers to get concentration HCl from 1st Scrubber
- Scrubbing of lean HCl, Cl₂ with alkali.
- Recovery of NaSH, Na₂SO₃ by scrubbing H₂S, SO₂ by NaOH
- Treatment of scrubber solution.
- Incineration of toxic gases.
- Segregation of effluent streams and recycling wherever possible.

- Recovery of sodium sulphate from aqueous effluent.
- Recovery/Reuse of H₂SO₄.
- Removal of non-biodegradable sulphonic acids by extraction.
- Removal of heavy metals by precipitation
- Removal of colour by adsorption/oxidation
- Recovery of salts such as sodium sulphite, sodium sulphate
- Manufacture of pigment from iron sludge.
- Regeneration of spent carbon
- Return of toxic materials packaging to supplier for reuse, where feasible.
- Provision of productive uses for off-specification products to avoid disposal problems.

6.4 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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

7.0 DISTILLERY

7.1 PROCESS DESCRIPTION

The general process of beverage/alcohol manufacture consists of dilution, malting, fermentation, distillation. 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.

For manufacturing of Alcohol from Molasses, Molasses is first diluted to bring down concentration of sugar level from 40-45 % to 10 -15 %. Using a diluted portion of Molasses, yeast culture is developed from inoculums. When a culture is developed fully remaining molasses is mixed and allowed to ferment for 30 to 40 hours. pH is maintained 4 to 4.5 by adding sulphuric acid. This reaction is exothermic therefore fermentation tank temperature is maintained 35-37 °C by spinning of cold water on fermentation tank. When fermentation is complete, yeast sludge is collected from bottom and fermentor wash is fed to analyser column for distillation using steam. Alcohol mixed steam is collected from top and alcohol free spent wash is collected from bottom. Alcohol and steam steams are fed to rectification column where alcohol is separated from steam,

7.2 BASIC POLLUTING PROCESS

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

7.3 CRITICAL POLLUTANTS

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

Sl. No	Type of pollution	Critical pollutants
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1	Air pollution	Boiler and DG Sets Emissions, SPM, NO _x , SO ₂ , Odour from fermentation.
2	Water Pollution	BOD, COD, Suspended Solids, Chlorides.
3	Solid waste	Broken bottles, ETP sludge.

7.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Air emissions are emitted from boiler and DG sets operations, fermentation and other operations. Dust is generated in the grinding operations prior to mashing operations. Odor from fermentation is common problem of this industry.

Waste Water generation

Liquid effluents are generated from spent wash and washing operations. The wastewater generated contains BOD, COD, suspended solids etc which requires treatment before discharge. Distilleries are highly water pollution industries.

Hazardous and Solid Wastes

Hazardous waste from distillery plant includes ETP sludge and used oil from DG sets.

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 SO₂, NO_x etc. can be minimized by dry scrubbing, condensation, absorption, adsorption. For the control of SPM, multicyclone and bag filters are used. Odour problem can be addressed by the green belt and siting manufacturing units far from residential areas.

7.5.2 WATER

In distillery, generally anaerobic digestion (Biomethanation) is widely used for wastewater treatment for production of bio methane which is used as fuel in boilers.

Some places anaerobic digestion (Biomethanation) followed by secondary treatment is also followed and treated water from secondary treatment is used for irrigation or surface disposal. In

the secondary treatment, biological treatment uses extended aerators, oxidation ponds, activated sludge systems, etc. for further removal of BOD and COD before final discharge of the effluent.

7.5.3 HAZARDOUS AND SOLID WASTE

Activated sludge from ETP can be thickened, dewatered, and stabilized. Other wastes like containers can be sent to the recycling industry. Used oil from DG set is sent for recycling.

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.
- Anaerobic digestion (biomethanation) of spent wash for biomethan which can be used as fuel in boilers.
- Activated Sludge from ETP can be used as manure.
- Reuse of treated wastewater to the extent possible in industry and for irrigation purpose.
- Control of odour through plantation of odour absorbing species.

7.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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)	Yes
8.	Public Liability Insurance (Public Liability Insurance Act)	Yes
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
- Hydrogenation

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 Primary sludge, used oil from DG sets.

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 also generated during the processing operations.

Water Pollution

The effluent contains BOD, COD, SS, oil and fat residues etc. Seed dressing and edible fat and oil processing generate wastewater. The aquatic life can be affected in case of discharge of effluent without treatment 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, which is hazardous waste 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 various types of waste generated from Edible Oil and Vanspati Industries.

8.5.1 AIR POLLUTION

Particulate matter and dust control are provided generally by fabric bag filters and multicyclones. Odor control is done by ventilation and by plantation. Gaseous emissions can be treated by condensation, absorption, adsorption and wet scrubbers.

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 oil trap. In absence of CETP beside primary treatment also involves *secondary treatment* using biological treatment consisting of aerator, 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 need 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 TSDF. 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. Used oil from DG sets is given to MOEF /SPCB authorised used oil recyclers.

8.6 CLEANER PRODUCTION OPTIONS

This section includes the cleaner production measures which can be adopted for reduction of the pollution load from the Edible Oil and Vanspati Industries 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/m³ of air.
- Provision of dust extractors to maintain a clean workplace.
- Recovery of solvent vapours to minimize losses.
- Use of agriculture residue like husk for boiler operation.
- 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&CC/SEIAA	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)	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

9.0 ELECTROPLATING

9.1 PROCESS DESCRIPTION

Electroplating involves deposition of thin protective layer (usually metallic) onto a pre-prepared 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 acids and alkalis. 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, pickling
- 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	Total and Hexavalent Chromium, Nickel, Lead Acid Mist, cyanides, heavy metals in vapour form.
2	Water Pollution	Total metals, trichloroethane, trichloroethylene, ammonical nitrogen, acid and alkali residues, cleaning agents, spent bath, Zinc, Copper, Total and hexavalent chromium, nickel, cadmium, cyanides, sulphates, sulphites, chlorides, phosphates, Irons, fluorides, lead.
3	Hazardous wastes	Sludge from bath containing chromium, nickel, cyanide, toxic metals, plating metal sludge, chemical sludge from ETP.

9.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air pollution

From plating bath, total and hexavalent chromium, nickel, lead, acid mist, cyanides, heavy metals in vapour form are emitted. 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). Effluents from electroplating industries may contain total metals, trichloroethane, trichloroethylene, ammonical nitrogen, acid and alkali residues, cleaning agents, spent bath, Zinc, Copper, total and hexavalent chromium, nickel, cadmium, cyanides, sulphates, sulphites, chlorides, phosphates, irons, fluorides, lead, etc. The effluent generated from any electroplating unit are toxic and 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 baths/tanks. The sludge contains chromium, nickel, cyanide, toxic metals, plating metal sludge and chemical sludge from ETP.

9.5 RECOMMENDED POLLUTION PREVENTION MEASURES

9.5.1 AIR POLLUTION

Exhaust suction hoods and ventilation systems are used efficiently to protect the workplace environment from electroplating emissions. Acid mist, cyanides and heavy metals in vapour form should be collected and scrubbed to permissible emissions standards with suitable media before venting into the atmosphere.

9.5.2 WATER POLLUTION

If the unit is member of CETP only primary treatment i.e neutralisation and sedimentation may be required. Cyanide reduction, flow equalisation, neutralisation and metal removal are common treatments processes applicable to any electroplating units. If hexavalent chromium is occurs in waste water then 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 covered lined impervious pits, containers etc. Otherwise, electroplating wastes are treated using metal recovery, neutralisation, de-ionisation, stabilisation and encapsulation techniques.

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.
- Metal recovery from cleaning of electroplating baths.
- Agitation of rinse water to increase rinsing efficiency.
- Use of multiple counter-current rinses and spray rinses.
- Recycle of process baths after concentration and filtration.
- Recycle of rinse waters after filtration.
- 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&CC/SEIAA	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)	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 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, cutting shearing, bending, drawing, rolling & spinning 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 Machine oil (cutting & cooling)
3	Noise	Machining operations, material handling, etc.

10.4 KEY ENVIRONMENTAL ISSUE

Air Pollution

Metal dusts are generated during buffing and grinding operations and may pose serious health risk to the workers.

Water Pollution

Emulsion of 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 high noise 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, cutting and grinding machines.

10.5.2 WATER POLLUTION

A typical effluent treatment plant for metal fabrication unit will consist of oil & grease traps separation and settling of metal particles followed by physio - chemical treatment such as coagulation & flocculation and sedimentation.

10.6 CLEANER PRODUCTION OPTION

- Noise preventive measures should 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.
- Provide dust arrester /hoods followed by bag filter to capture metal dust particles.
- Preventing solids and oily wastes from entering the drainage systems by providing ETP.

10.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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

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
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1	Air pollution	Heavy metal bearing mists, acid mists, solvent & VOCs, metallic and acidic fumes.
2	Water	Acidic and basic wastewater, cyanide, heavy metal bearing wastewater, solvent wastes
3	Hazardous	ETP sludge, metal & cyanide wastes, 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, which is 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 wastes., finishing operations like anodizing, electroplating etc. produces acid, metal wastes. Aquatic life and quality of water 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 Phosphating etc. and solvent wastes from solvent degreasing etc. Finishing operations also produces wastes like base metals and spent solutions, cyanides, 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/mist collection hoods and ventilation systems protect the working environment. Acid mists and vapors should be scrubbed with suitable media (lime or caustic) before venting into the atmosphere. 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.

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. The treatment process for effluents generated from surface treatment units include equalization, neutralisation, precipitation, flocculation and sedimentation and filtration.

11.5.3 HAZARDOUS AND SOLID WASTE

In case the unit is member of TSDF, unit requires only temporary storage facilities for hazardous wastes as per the required practices like covered lined impervious pits, containers etc. Otherwise, electroplating wastes are treated using metal recovery, neutralisation, de-ionisation, stabilisation and encapsulation techniques. .

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.
- Metal recovery from cleaning of electroplating baths.
- De-ionisation of waste water from surface treatment
- 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.

11.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	No
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	Yes

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
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)	Yes
8.	Public liability Insurance (Public Liability Insurance Act)	Yes
9	Submission of environmental statement (EPA,1986)	Yes

12.0 FLOUR AND PULSE MILLS

12.1 PROCESS DESCRIPTION

The flour and pulse mills involve dehusking, aspiration, separation of pulse and grading. After bringing the grains, they are cleaned to make them free of dust and 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 bag filters 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 bag filters 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 matter and dust can be removed by using fabric bag filters, wet scrubbers. 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.
- Use of bag filters for dust/product recover from fugitive emissions.
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.
- Regular cleaning and washing of equipments.

12.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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)	No
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	No

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
	hazardous chemical rules, 1989)	
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 (metals ingots or scrap).
- Preparation of molds
- Metal Melting in Cupola Furnace , Arc Furnace or Induction Furnace
- Casting in moulds
- Finishing (which includes fettling and tumbling).

The metals ingots or scraps 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. cupola furnace, arc furnace, induction furnace, 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 scrap or ingots melting
- Slag removal
- Casting
- 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	Particulate matter, metal oxides & fumes, fugitive dust emissions
2	Water	No effluent generation, only sewage generation from workers
3	Solid	Slag, silica wastes and metal dross, discarded & defective refractory linings

13.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Particulate matter, metal oxides & fumes, fugitive dust emissions are generated at the time of loading and melting of metal scrap.

Wastewater Generation

No process effluents are generated from foundry. Closed circuit cooling system is used. Hence there is no waste water generation from the cooling also. Sewage is generated by workers

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. Discarded refractory lining is another waste produced from foundries. The primary hazardous components of collected dust are metal dusts. 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 emissions control technologies include cyclones, wet scrubbers (with recirculating water) and bag filters..

13.5.2 WATER POLLUTION

Process effluents are not generated from foundry unit. Sewage generated at unit is treated in septic tank followed by soak pit.

13.5.3 HAZARDOUS AND SOLID WASTE

Metal dross and refractory lining can be disposed in the secure landfill. Solid waste like metal scrap can be recycled and slag can be used for land filling. Sand can be reclaimed and reused for 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 particulate emissions, fugitive dust collection and pass through cyclone, bag filters or wet scrubber.
- Use of continuous casting for semi finished and finished products wherever feasible.
- 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&CC/SEIAA	Yes
2.	Valid Air Consent (Air Act, 1981)	Yes
3.	Valid Water Consent (Water Act, 1974)	No
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.

14.2 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, NO _x , SO ₂ , Odour
2	Water	BOD, COD, Total Suspended Solids.
3	Solid	Peel-offs, rejects, cutting, packing pet bottles/cans.
4.	Hazardous	Used oil from DG sets

14.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of the air pollution are DG sets and 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 fruits. 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 Matter from boilers can be removed by the installation of multi cyclone, fabric bag filters and wet scrubbers. Gaseous pollutants like SO₂ are subjected to treatment by wet scrubber.

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 or used for irrigation purpose.

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.
- Use of multi cyclone, fabric bag filters and wet scrubbers for particulate matter control from boilers. Gaseous pollutants like SO₂ from boilers can be treated by wet scrubber.

14.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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

15.0 GLASS INDUSTRY

15.1 PROCESS DESCRIPTION

The raw materials like lime, soda, silica etc. are mixed. They form a vitrifiable load, to which cullet is added before it is conveyed 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.

For bottles other hollow items, molten glass is fed in hot moulds and hot air is blown to give shape to molten glass.

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, NOx, fluorides.
2	Water	TSS, cullet washing, cutting oil, cooling water
3	Solid	Glass waste, waste residues containing heavy metals
4	Hazardous	Used oil

15.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The air pollutants are mainly generated from the materials handling, glass furnace, etc.. Fugitive emissions are also generated during the manufacturing process. In piped natural gas (PNG) and LPG fired glass furnaces only NOx is emitted.

Wastewater Generation

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

Hazardous and Solid Waste

The solid wastes are generated from manufacturing processes and furnace use. The hazardous waste is not directly generated from glass industry. However, used oil generated from machines and DG sets is considered hazardous waste.

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, fabric bag filters are used. In piped natural gas and LPG fired glass furnaces only NO_x is emitted, which is controlled by low NO_x burners by control of fuel and air mixing ratio

15.5.2 WATER POLLUTION

Waste water is generated from the washings and cleaning operations of cullets. For treatment of waste water, mixing and settling tanks are required. Treated waste water can be reused for cullets.

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.
- 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&CC/SEIAA	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)	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

Note:* - if Piped Natural Gas (PNG) or Liquefied Petroleum Gas (LPG) is used for firing of furnace.

16.0 LIME KILNS

16.1 PROCESS DESCRIPTION

The raw material required for the lime manufacture are rock deposits like lime stone, dolomite etc. containing 30-50% of limestone found in the quarry. From 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 1200°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 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

- 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 from the lime kiln is as follows:

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	SPM (soot), SO ₂ , NO _x , CO, CO ₂ , H ₂ S, Limedust
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 unloading of raw material , 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 CO₂ 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 bag filters and wet scrubbers are used for gaseous emissions like SO₂, NO_x, CO, CO₂, H₂S etc..

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 kiln 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.
- Use of dust collectors fitted with bag filters.
- 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&CC/SEIAA	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.

17.2 BASIC POLLUTING PROCESS

- Extruding
- Milling
- Calendaring
- Vulcanising
- Finishing

17.3 CRITICAL POLLUTANTS

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

Sl. No	Type of pollution	Critical pollutants
1	Air pollution	Polycyclic Aromatic Hydrocarbon, Odour, fugitive emissions.
2	Water	Colour & odour, pH, BOD, COD, Oil and Grease, Sulphides, Total Kjeldahl Nitrogen, Dissolved phosphate (as P), Suspended Solids, Dissolved solids (inorganic), Ammonical Nitrogen as N, Free Ammonia (as NH ₃).
3	Solid	Dust and rubber particles, waste rubber including rejects. sludge, metal dross, etching sludge and wastes solvents
4	Hazardous	Used lubricating oil.

17.4 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, Polycyclic Aromatic hydrocarbon, Odour and fugitive emissions are generated. There are 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. Waste water from natural rubber industry contains colour & odour, pH, BOD, COD, oil and grease, sulphides, total kjeldahl nitrogen, dissolved phosphate (as P), suspended solids, dissolved solids (inorganic), Ammonical nitrogen as N and Free Ammonia (as NH₃).

Hazardous and Solid Waste

Particulate matter collected in the air pollution control equipment (APC) equipments (chemicals, ground rubber, etc.) from compounding areas, banburys, and grinders are a source of solid waste. Used lubricating and hydraulic 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 used oil and hydraulic oils.

17.5 RECOMMENDED POLLUTION PREVENTION MEASURES

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

17.5.1 AIR POLLUTION

Control methods like appropriate ventilation and wet dust suppression, bag house filters etc. can be used for control of dust particles and fugitive dust and gaseous emissions. .

17.5.2 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 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.

17.5.3 HAZARDOUS AND SOLID WASTE

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

17.6 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.
- Preventing solids and liquid wastes from entering the drainage systems.
- Reuse of sludges to the extent feasible but without releasing toxics to the environment.
- Appropriate ventilation and wet dust suppression, bag house filters etc. can be used for control of dust particles, fugitive dust and gaseous emissions.
- ETP comprises mainly rubber trap, equalisation, neutralisation, clarification, extended aeration activated sludge process for treatment of effluent and reuse of treated waste water.

17.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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 materials and finished products may lead to spillage and thus resulting 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 from boilers and DG sets, process vents, particulates emissions from material unloading and handling, VOCs and solvents from reactors, distillation unit/storage tank vents.
2	Water Pollution	Concentrated organic streams, washed solvents, surplus chemicals, acids and suspended solids.
3	Solid waste	Insulation/packaging materials
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 from the unit as result of fuel burning in boilers and DG sets and uncontrolled process emission at the time of charging 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 from storage, transfer through piping and manual handling at the plant. These emissions may cause serious occupational hazards to the workers and surrounding environment. 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, solvents, 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/CPCB. If trade effluent is discharged without proper treatment, may cause serious soil and ground / surface water contamination.

Hazardous waste

Main source of hazardous wastes in this industry are sludge generated from treatment of effluents. All spent catalyst/ solvents, distillation residue and off specification and discarded products are classified as Hazardous wastes as per Hazardous Waste (Management, Handling and Tranboundary Movement) rules, 2008. 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 (TSDF) and sends their hazardous waste for ultimate disposal, periodically. In absence of such facility (TSDF), in close vicinity, industries are mandated by SPCB to store the hazardous waste in properly covered lined impervious 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 fire & explosion or entering in 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 pipe network 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. The Manufacture, Storage, Import of Hazardous Chemical Rule, 1989 amended in 2000, requires the project proponent to inform and obtained license from relevant authority (PESO/CCE) 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 bag filters, ceramic filters, wet scrubbers, are used for particulate and gaseous pollutant removal.
- Gaseous releases can be minimized by condensation, absorption, adsorption and in some cases bio-filtration, and bio scrubbing 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, 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 in covered lined impervious storage pit. 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 (TSDF).

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.
- Reduction of quantities of hazardous wastes/effluent using available technologies, like, multi effect evaporators.
- Storage facilities for hazardous waste in covered lined impervious storage pit
- Risk mitigation measures for safe storage and handing of hazardous chemicals.

18.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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

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.

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 resin, paint and varnish.
4	Hazardous	Chemical sludge, paint skin, wastes & residues, filler residues. Off the specification paint and varnish

19.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major sources of air pollution are mixing, milling and 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 heating operation in varnish products manufacture.

Wastewater 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 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, hydrocarbons and VOCs can be controlled by using fabric bag filters. 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, extended aeration activated sludge process, 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 in covered lined impervious storage pit as per SPCB guidelines. Paint and

Varnish sludge can be thickened, dewatered, and stabilized before disposal, which must be in an approved and controlled landfill. Incinerators fitted with wet scrubbers are also used for incineration of paint and varnish wastes at the unit.

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.
- Proper handling and storage of paints and varnish, to reduce spillage.
- Minimization of the generation of paint and varnish wastes through process.
- Reuse of off specifications paints and varnish
- Regeneration and recovery of solvents 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&CC/SEIAA	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)	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	HCl, CH ₃ Cl, H ₂ S, SO ₂ , P ₂ O ₅ , NH ₃ , NO _x , SPM, CH ₃ OH, Cl ₂ , VOCs, Odour, PAH, HAPs
2	Water 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.
3	Hazardous waste	Chemical sludge from ETP, process sludge, wastes/residue containing pesticides, Out dated-expired and off specification pesticides, dust collected from air pollution control devices.

20.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Gaseous emissions like SPM SO₂, NO_x are generated from the use of fuels in boilers and furnaces causing air pollution. Air Pollutants like HCl, CH₃Cl, H₂S, SO₂, P₂O₅, NH₃, NO_x, SPM, CH₃OH, Cl₂, VOCs, Odour, PAH, HAPs are generated from the unit operations of pesticides depending upon nature of pesticides being manufactured. Fugitive emissions take place during storage and 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), Total Suspended Solids, Oil and Grease and trace of pesticides.

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 and Transboundary Movement) Rules, 2008. Industries are required to follow recommended practices for the storage, treatment and disposal of the hazardous wastes containing pesticides. In absence of a proper waste treatment and disposal facility in close vicinity, industries are required to store the hazardous waste in properly covered lined impervious 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 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, wet scrubbing, condensation, absorption, adsorption. 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, 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 pesticides 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 followed 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.
- Use of automated fillings of pesticides 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.
- Proper ventilation in work floor area.
- Installation of pesticide vapour collection and scrubbing system,
- 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 lead 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.
- Installation of ETP from treatment of effluents generated from pesticide plant.
- 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&CC/SEIAA	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

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 bulk drug (primary processing, or manufacture) and secondary processing, the conversion of the active drugs into products suitable for administration (formulation).

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
- 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	SPM, SO ₂ , HCl, NO _x , CO, solvent vapours, process emissions, odoriferous gases, fine particulate matter as fugitive dust emissions, solvent vapours, VOCs
2	Water	High BOD, COD, TSS, TDS, oil & grease, spent solvents, mercury, arsenic, chromium, lead, cyanide, phenolics, sulphides and phosphate
3	Solid	Ash from boilers, packing materials
4	Hazardous	Residue rejects, spent solvent, spent catalyst, ETP sludge, spilled chemicals, incinerator ash, used oil from DG sets, etc

21.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The principal air pollutants are Particulate Matter (PM) and volatile organic matter (VOCs). They are generated during chemical synthesis process and also during mixing and extraction operations. Particulate Matter (PM), SO₂ and NO_x, CO and CO₂ are generated from boilers and DG sets. From the incinerator, Suspended Particulate Matter (SPM), SO₂, CO and HCl and total organic carbon are emitted. 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 residue rejects, spent solvent, spent catalyst, ETP sludge, spilled chemicals, incinerator ash, used oil from DG sets etc. 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, wet scrubbing condensation and absorption, adsorption).

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 before discharge into the atmosphere. 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 closed feed systems into batch reactors.
- Use of equipment washdown waters and other process waters as makeup solutions for subsequent batches.
- Segregation of high organic concentrated streams and treat them separately.
- 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 stormwater from process areas.
- Labeling and storage of toxic and hazardous materials in secure, bunded areas. Collection and reuse of spillage.
- Risk mitigation measures for safe storage and handling of hazardous materials.

21.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	Yes ²
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

² 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. 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.

22.2 BASIC POLLUTING PROCESS

- Unloading of gypsum boulders at the plant
- Crushing
- Calcination
- Furnace heating – coal/oil/wood fired
- Pulverisation/milling operation
- PoP handling & packaging

22.3 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, SO ₂ and NO _x
2	Solid	Rejects, waste materials.
3	Noise	Pulveriser, crusher

22.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Air pollutants are emitted from unloading operations at the unit, crushing, pulverizing 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 plant and in 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.

22.5 RECOMMENDED POLLUTION PREVENTION MEASURES

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

22.5.1 AIR POLLUTION

Fabric bag filters 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 wet scrubbing.

22.5.2 NOISE

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

22.6 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.

22.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
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 to manufacture of 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	Toxic fumes including formaldehyde, acetaldehyde, hydrocarbons, carbon monoxide, and volatile organic compounds (VOCs)
2	Water	Cooling & washing water,
3	Solid	Plastic pallet spills.

23.3 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

Toxic air pollutants are generated during manufacturing operations like melting, moulding etc. which may pose health risks for the workers.

Water Pollution

Very small quantity of liquid effluents are generated due to the use of water in cooling and washing operations. Due to the presence of organic compounds 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 fume extraction system. Removal technologies like wet scrubbers can be used for suspended particulate matter. Gaseous pollutants can be treated by condensation, absorption and adsorption.

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 and COD removal.

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 emissions of toxic fumes including formaldehyde, acetaldehyde, hydrocarbons, carbon monoxide and volatile organic compounds (VOCs) during heating process by installing efficient fume extraction system.
- Providing wet scrubber or absorption /adsorption for controlling toxic fumes.
- Provide proper ventilation for indoor air change in plastic moulding and extruding.
- 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&CC/SEIAA	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

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 digesting the raw materials, using the kraft (sulfate) and sulfite processes. Wood chips are digested with caustic soda/sodium sulfide to produce brownstock, which is then washed with water to remove digested (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	Sulfur Dioxides (SO ₂), Oxides of Nitrogen (NO _x), CO, CO ₂ Volatile Organic Carbons (VOCs) include ketone, alcohol and solvents such as carbon disulfide methanol, acetone and chloroform. Methylene Ketone Organo Chlorine Compounds.
2	Water	High organic content (BOD), COD, TSS, Lignin, dark brown coloration, adsorbable organic halide (AOX), toxic pollutants, etc.
3	Solid	Rejects, coal/boiler ash.
4	Hazardous	ETP primary & secondary sludge, Use oil from DG sets

24.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

The major air emissions from pulp & paper industry come from sulfite mills as recovery furnaces and burners, sulfur oxides (SO_x), from Kraft operation as reduced sulfur gases and odor

problems, from wood-chips digestion, spent liquor evaporation and bleaching as volatile organic carbons (VOCs), and from combustion process as nitrogen oxides (NO_x) and SO₂. VOCs also include ketone, alcohol and solvents such as carbon disulfide, methanol, acetone and chloroform,

Water Pollution

The wastewaters generated from production processes of pulp and paper include high concentration of chemicals such as sodium hydroxide, sodium carbonate, sodium sulfide, bisulfites, elemental chlorine or chlorine dioxide, calcium oxide, hydrochloric acid, etc. The major problems of the wastewaters are high organic content, dark brown coloration, adsorbable organic halide (AOX), toxic pollutants, etc.

Hazardous and Solid Wastes

The principal hazardous wastes of concern include wastewater treatment plant sludges. Solid materials that can be reused and recycled include waste paper. Ash may need to be disposed of in an appropriated landfill. Used oil should be given to use oil recyclers.

24.5 RECOMMENDED POLLUTION PREVENTION MEASURES

24.5.1 AIR POLLUTION

In pulp and paper industry, air pollution is controlled through venturi scrubbers, multi cyclonic separator and bag filters. From risk husk and bagasse fired boiler multi cyclonic separator followed by bag filters are used to control particulate matters. In coal fired boilers, wet (venture) scrubbers are used to control SO₂ and NO_x. Gaseous pollutants like VOCs and other organic compounds can be treated by condensation, absorption and adsorption.

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 pre-treatment using screening and primary treatment using sedimentation/filtration to remove suspended solids. Secondary treatment using physical and chemical means includes neutralization, flotation, dosing, flocculation for removal of suspended solids and chemical precipitation to remove certain cations. Secondary treatment includes biological treatment involving activated sludge, extended 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 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 digestion 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 sulfur 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.
- Installation of venturi scrubbers, multi cyclonic separator and bag filters with boilers.

24.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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

25.0 RICE MILLS

25.1 PROCESS DESCRIPTION

The rice processing initiates with cleaning operation where foreign objects, such as 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 , NO _x 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, boilers and DG sets 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 from rice mills contains BOD, COD, TSS and phosphates etc. The various sources of effluent generation 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 which may deteriorate water quality of recipient body, if not meeting permissible discharge standards.

25.5 RECOMMENDED POLLUTION PREVENTION MEASURES

25.5.1 AIR POLLUTION

Dust particles in work environment can be controlled by using appropriate ventilation and dust extraction system followed by bag filters. Equipments like bag filters, multi cyclone separator wet scrubbers are used for particulate matter removal. Gaseous emissions from boilers are can be controlled by bag filters, multi cyclone separator or wet scrubbers..

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 *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 phosphate. 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 from rice mill 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.
- Use of husk in boiler to minimise gaseous pollutants,
- Reuse of treated wastewater (separated from storm water systems) to the extent possible.
- 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&CC/SEIAA	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

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, SO ₂ ,NO _x .
2	Water	Vessel Cleaning, Bottle Washing, BOD, O&G, Spills
3.	Hazardous Wastes	Primary Treatment Sludge andUsed oil from DG Sets

26.4 SUMMARY OF KEY ENVIRONMENTAL ISSUES

Air Pollution

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

Water Pollution

The effluents are generated from the vessel cleanings, bottles washings, spillage of soft drinks, 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

The equipments like fabric bag filters and wet scrubbers can be used for removal of particulate matter and gaseous pollutants.

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 and COD.

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.

- 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 and faulty maintenance procedures.
- 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&CC/SEIAA	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

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ 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 cutting and 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 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 bag filters, 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.

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.
- 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.
- Saw dust collection system to collect fugitive saw dust emissions.

27.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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 emissions, SPM, NO _x , SO _x .
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 particulate matter, gaseous emissions are emitted from boiler operations, spray drying process, mixing and heating operations, finishing operations etc. The odor is 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 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, SPM, SO₂, NO_x etc. are controlled by scrubber and fabric bag filters are used for particulate removal.

28.5.2 WATER POLLUTION

In case of 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 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 odour removal.

28.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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 placed 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	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 crushed aggregate. For fugitive dust emissions control, water sprinkling is carried out at the crusher.

29.6 CLEANER PRODUCTION OPTION

- Emphasis on the minimal generation of dust by modern and efficient crushing and loading/unloading equipment.
- Regular water spraying 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.

29.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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 of animals 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 pickling to delime the skins and condition the hides to receive the tanning agents.
- Tanning to stabilize the hide material and impart basic properties to the hide.
- Retanning, dyeing 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, H ₂ S, Solvent vapours (VOCs), Odour
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 delimiting process respectively, which pose significant occupational hazard. This sector of industry has relatively low potential of off – site air pollution.

Waste Water generation

Effluents from 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), Bio- chemical oxygen demand (BOD), Oil & Grease, TSS, and chromium 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 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.

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 covered impervious 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 (TSDF) 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 materials.

30.7 REGULATORY OBLIGATIONS

Sl. No	Requirements under Indian Environmental Legislations	Applicable (Yes/ No)
1.	Clearance from MoEF&CC/SEIAA	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)	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, Used Oil from DG Sets

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. The gaseous emissions generated from boilers are SPM, SO₂, NO_x etc., which are controlled by scrubber and fabric bag filters used for particulate removal.

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. 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 covered impervious lined pits, containers etc.

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.
- 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 sulfur 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&CC/SEIAA	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