

Industrial Estates

Industrial Estate Development

Industrial estates are specific areas zoned for industrial activity in which infrastructure such as roads, power, and other utility services is provided to facilitate the growth of industries and to minimize impacts on the environment. The infrastructure may include effluent treatment; solid and toxic waste collection, treatment, and disposal; air pollution and effluent monitoring; technical services on pollution prevention; quality management (quality assurance and control); and laboratory services. There should be appropriate emergency preparedness and prevention plans and liaison with local fire and emergency services. This document covers the management of activities on an established estate.

Selection of sites for industrial estates should take into account social and environmental issues, as well as economic considerations. The key document would normally be an industrial estate development plan covering issues such as:

- Details of the location
- Mix of industries on the site (to ensure that the industries are compatible—for example, that neighbors of food processing plants do not pose a risk of contaminating food products)
- Layout and design
- Transport services
- Fuel storage
- Air quality management
- Water quality management, including the provision of common effluent treatment facilities, as required
- Solid waste management, including recycling
- Management of hazardous materials and hazardous wastes
- Noise control

- Occupational health and safety
- Hazard and emergency planning and response.

Industrial estates should maintain safe distances from residential areas (for example, 100 meters for small industries with minimal environmental hazard and at least 1 kilometer for very polluting industries). Definition of institutional responsibilities is an essential component of a development plan. The key environmental issues to be addressed in the development plan should be identified through an environmental assessment process.

Pretreatment and Common Treatment

A significant environmental benefit of industrial estates is the opportunity to take advantage of economies of scale by providing common effluent and waste management facilities. Individual units, however, must still meet specific discharge or pretreatment guidelines.

The guidelines at a particular estate will depend on the industry mix and the type and scale of common facilities. The guidelines for each plant should be described in detail as part of the plant's contract with the estate.

Target Pollution Loads

The following measures have been recommended for industries on industrial estates:

- Encourage the use of vapor recovery systems, where applicable, to control losses of volatile organic compounds (VOCs) from storage tanks and achieve 90–100% recovery.
- Encourage the use of low-nitrogen oxide (NO_x) burners in combustion systems. Plants should

be encouraged to use fuel with low sulfur content (or an emissions level of 2,000 milligrams per normal cubic meter, mg/Nm³) for sulfur oxides, SO_x). A sulfur recovery system may be feasible for large facilities when the hydrogen sulfide concentration in the tail gases exceeds 230 mg/Nm³.

- Institute spill prevention and control measures. Liquid fuels and chemicals should be stored in areas where there are provisions for containment of spills.
- Encourage the segregation of stormwater from process water. Cooling water should generally be recycled. Sewage effluent should be segregated from wastewaters containing heavy metals.

Emissions Guidelines

Emissions levels for the design and operation of each project must be established through the environmental assessment (EA) process on the basis of country legislation and the *Pollution Prevention and Abatement Handbook*, as applied to local conditions. The emissions levels selected must be justified in the EA and acceptable to the World Bank Group.

The guidelines given below present emissions levels normally acceptable to the World Bank Group in making decisions regarding provision of World Bank Group assistance. Any deviations from these levels must be described in the World Bank Group project documentation. The emissions levels given here can be consistently achieved by well-designed, well-operated, and well-maintained pollution control systems.

The guidelines are expressed as concentrations to facilitate monitoring. Dilution of air emissions or effluents to achieve these guidelines is unacceptable.

All of the maximum levels should be achieved for at least 95% of the time that the plant or unit is operating, to be calculated as a proportion of annual operating hours.

Air Emissions

For individual or common stacks, the maximum emissions levels presented in Table 1 should be achieved.

Table 1. Air Emissions from Facilities in Industrial Estates

(milligrams per normal cubic meter)

Parameter	Maximum value
PM ^a	50 for large facilities Up to 150 for small facilities with energy consumption of less than 10 gigajoules per hour (fuel used)
Nitrogen oxides	750 (solid fuels) 460 (liquid fuels) 320 (gaseous fuels)
Sulfur oxides	2,000
Hydrogen sulfide	15

a. For facilities emitting significant quantities of toxic metals, the emissions limit should be 20 mg/Nm³.

Liquid Effluents

The maximum effluent levels presented in Table 2 should be achieved by discharges from common effluent treatment units:

Common effluent treatment units should be designed to handle the characteristics and load-

Table 2. Effluents from Industrial Estates

(milligrams per liter, except for pH and temperature)

Parameter	Maximum value
pH	6–9
BOD	50
COD	250
TSS	50 (20 if toxic metals are present at significant levels)
Oil and grease	10
Cadmium	0.1
Chromium	
Hexavalent	0.1
Total	0.5
Copper	0.5
Lead	0.1
Nickel	0.5
Zinc	2
Phenol	0.5
AOX	1
Benzene	0.05
Benzo(a)pyrene	0.05
Sulfide	1
Temperature increase	≤ 3°C ^a

a. The effluent should result in a temperature increase of no more than 3° C at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, use 100 meters from the point of discharge.

ing of wastewaters generated from the industrial estate. In some cases, different types of treatment units will be needed to handle different types of wastewaters. (For example, chemical precipitation units may be required to handle toxic metallic wastewaters, and biological treatment units for handling organic wastewaters.)

Solid Wastes and Sludges

Where possible, generation of sludges should be minimized. Sludges must be treated, and if toxic metals are present, the sludges must be stabilized.

Ambient Noise

Noise abatement measures should achieve either the levels given below or a maximum increase in background levels of 3 decibels (measured on the A scale) [dB(A)]. Measurements are to be taken at noise receptors located outside the project property boundary.

<i>Receptor</i>	<i>Maximum allowable log equivalent (hourly measurements), in dB(A)</i>	
	<i>Day</i>	<i>Night</i>
	<i>(07:00–22:00)</i>	<i>(22:00–07:00)</i>
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Monitoring and Reporting

Frequent sampling should be recommended to plants during start-up and upset conditions. Once a record of consistent performance has been established, sampling for the parameters listed in this document can be as described below.

Daily monitoring of particulate emissions from stacks, using an opacity meter (with a target level of less than 10%), is recommended. Monthly monitoring of the sulfur content of the fuels used in combustion sources is also recommended.

Daily monitoring of liquid effluents is recommended for all the applicable parameters cited

above, except for aromatics, metals, and sulfides, which should be monitored at least monthly.

Industrial estates should encourage units to analyze monitoring data, review it at regular intervals, and compare it with the operating standards so that any necessary corrective actions can be taken. Records of monitoring results should be kept in an acceptable format. The results should be reported to the responsible authorities and relevant parties, as required. Industrial estates should maintain a record of accidental releases of pollutants to the environment and should take appropriate corrective action to be better prepared for future occurrences. Where feasible, industrial estates should educate the industrial units on ways to mitigate environmental problems.

Key Issues

Good environmental practices for industrial estates can be summarized as follows:

- Encourage the use of vapor recovery systems to reduce VOC emissions.
- Encourage the use of sulfur recovery systems where considered feasible.
- Encourage the use of low-NO_x burners.
- Encourage the recovery and recycle of oily wastes.
- Encourage the regeneration and reuse of spent catalysts and solvents.
- Encourage the recycling of cooling water and the reuse of wastewaters.
- Institute segregation of stormwater from process wastewater.
- Encourage the use of nonchrome additives to cooling water.
- Institute spill prevention and control measures.
- Include properly designed storage facilities for hazardous chemicals and wastes, including provision for containment of contaminated water in case of fire.

Source

World Bank. 1995. "Industrial Pollution Prevention and Abatement: Industrial Estates." Draft Technical Background Document. Environment Department, Washington, D.C.