

Multilateral Investment Guarantee Agency

Environmental Guidelines for

Industrial Estates

Industrial Estate Development

Industrial estates are specific areas zoned for industrial activity where infrastructure (such as roads, power and other utility services) is provided to facilitate the growth of industries and to minimize the impacts on the environment. Industrial estates 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.

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 which would cover issues such as: details of location; mix of industries on the site (for example, avoid the contamination or fouling of food products by making sure that adjacent and nearby units are compatible); layout and design; transportation services; fuel storage; air quality management; water quality management including the provision of common effluent treatment facilities as acquired; solid waste management including recycling; hazardous materials and hazardous waste management; noise control; occupational health and safety; and hazard and emergency planning and response. *Note:* Industrial estates should maintain safe distances (such as 100 meters for small industries with minimal environmental hazard and at least 1

kilometer for very polluting industries) from residential areas. Definition of institutional responsibilities is also 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.

Details of issues related to the location and design of industrial estates will be addressed in a separate document. This guideline covers the management of activities on an established estate.

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. At the same time, however, individual units must meet specific discharge or pretreatment guidelines.

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

Target Pollution Loads

The following have been recommended for industries in the industrial estate. Encourage the use of vapor recovery systems, where applicable, to control losses of volatile organic compounds (VOCs) from storage tanks to achieve 90 to 100 percent recovery.

Encourage the use of low nitrogen oxide (NOx) burners in combustion systems. Plants should be encouraged to use fuel with low

sulfur content (or an emission 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. Storage of liquid fuels and chemicals should be in areas where there is a provision 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

Emission levels for the design and operation of each project must be established through the Environmental Assessment (EA) process, based on country legislation and the *Pollution Prevention and Abatement Handbook* as applied to local conditions. The emission levels selected must be justified in the EA and acceptable to MIGA.

The following guidelines present emission levels normally acceptable to the World Bank Group in making decisions regarding provision of World Bank Group assistance, including MIGA guarantees; any deviations from these levels must be described in the project documentation.

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 following maximum emissions levels should be achieved:

Air Emissions from Industrial Estates

<i>Parameter</i>	<i>Maximum value milligrams per normal cubic meter (mg/Nm³)</i>
Particulate matter (PM)*	50 for large facilities and up to 150 for small facilities

with energy consumption of less than 10 Giga Joules per hour in fuel used

Nitrogen oxides (NO _x)	750 (for solid fuels) 460 (for liquid fuels) 320 (for gaseous fuels)
Sulfur oxide (SO _x)	2000
Hydrogen sulfide	15

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

Liquid Effluents

The following maximum effluent levels should be achieved by discharges from common effluent treatment units: Effluents from Industrial Estates

<i>Parameter</i>	<i>Maximum value milligrams per liter (mg/L)</i>
PH	6 - 9
Five day biochemical oxygen demand (BOD ₅)	50
Chemical oxygen demand (COD)	250
Total suspended solids	50 (20 mg/L if toxic metals are present at significant levels)
Oil and grease	10
Cadmium	0.1
Chromium (hexavalent)	0.1
Chromium (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	less than or equal to 3°C ¹

¹The effluent should result in a temperature increase of no more than 3 degrees Celsius at the edge of the zone where initial mixing and dilution takes place. Where the zone is not defined, use 100 meters from the point of discharge.

Note: Common effluent treatment units should be designed to handle the characteristics and loading 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

Wherever 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 following levels or a maximum increase in background levels of 3 dB(A). Measurements are to be taken at noise receptors located outside the project property boundary.

Ambient Noise

Receptor	Maximum Allowable L _{eq} (hourly), in dB(A)	
	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The emission requirements given here can be consistently achieved by well-designed, well-operated and well-maintained pollution control systems.

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 above can be as detailed below.

Daily monitoring of particulate emissions from stacks using opacity meter (with a target level of less than 10 percent) is recommended. Monthly monitoring of sulfur content of fuel 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 sulfide which should be monitored on at least a monthly basis.

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 are recommended to be kept in an acceptable format. These should be reported to the responsible authorities and relevant parties, as required, and to MIGA if requested. Industrial estates should maintain a record of accidental releases of pollutants to the environment and 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

The following box summarizes good environmental practices.

- 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 storm water from process wastewater.
- Encourage the use of non-chrome additives to cooling water.

- Institute spill prevention and control measures.
- Include properly designed storage facilities for hazardous chemicals and wastes, including containment of contaminated water in the event of a fire.

Further Information

The following are suggested as source of additional information (this sources is provided for guidance and is not intended to be comprehensive):

World Bank, Environment Department. 1995. "Industrial Pollution Prevention and Abatement: Industrial Estates." Draft document.