

Sectoral guidelines for Environmental Reports—Industrial Estates

	Contents	Page
1	Introduction	3
	1.1 Scope of guidelines	3
	1.2 Context of guidelines	4
	1.3 Linkages between environmental assessment and other laws and procedures	5
	1.3.1 General	5
	1.3.2 Economic and physical planning	5
	1.3.3 Occupational health	6
2	Environmental impact issues	6
	2.1 General	6
	2.2 Area of influence	6
	2.3 Cumulative issues	7
	2.4 Assimilative capacity	7
	2.5 Induced development	7
3	Negative impacts and mitigation measures	7
	3.1 General	7
	3.2 Site selection issues	8
	3.2.1 Displacement of existing land use and other environmental resources	8
	3.2.2 Destruction of environmentally sensitive and critical areas	8
	3.2.3 Existence of adverse natural conditions	9
	3.2.4 Impact on adjoining land users	9
	3.2.5 Displacement of existing population	10
	3.2.6 Destruction of resources of historic or cultural significance	10
	3.2.7 Availability of existing infrastructure and services	10
	3.2.8 Exclusion criteria	10

3.3	Local site scale issues and project design issues	11
3.3.1	General	11
3.3.2	Integrated waste treatment and disposal facilities	12
3.3.3	Grouping of industries	12
3.3.4	Other design criteria for industrial estates	12
3.4	Construction issues	13
3.5	Operation stage issues	14

4	Emission Requirements	14
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5	Monitoring management and training	14
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5.1	Baseline conditions	14
5.2	Construction Monitoring and reporting	14
5.3	Monitoring management and training during operations	15

References		15
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Appendices	Description	Page
Appendix I	Checklist of environmental parameters Industrial estates	16
Appendix II	National reference manual on planning & infrastructure standards 1986 Chapter 5.3	18

1 INTRODUCTION

1.1 Scope of Guidelines

Finding sites for new industries is an important economic issue for both Federal and Provincial authorities. Certain policies, procedures and guidelines are already in place to assist in this process. The grouping together of industrial users in industrial zones and allocated areas has become a popular way of encouraging and controlling industrial development. According to figures from the Ministry of Industry and Investment there were 69 Provincially operated Industrial estates in Punjab, Sindh, NWFP and Baluchistan as of mid 1997.

Historically industrial sites have been selected on the basis of economic and technical factors. There are strong economic reasons for grouping together industries; transportation, utilities and support services can all be provided communally. More recently the siting of industries has taken into consideration environmental impacts both positive and negative. There is now more awareness of the public health effects and degradation of air, water and land which can be associated with industrial plants, and communities are less tolerant of disturbance from noise, traffic, odours and the visual intrusion of large plants. Public awareness in this regard has also been heightened by widely publicised disasters such as Bhopal which have indicated the potential hazards of locating industry too close to residential developments.

Industries are also becoming increasingly aware of the costs associated with environmental measures such as pollution control, waste disposal, accident response and remedial clean-up activities. The cost of mitigation measures is increasingly being integrated into the decision-making process of companies looking for sites for new plant. This in turn means that proper costing for environmentally sensitive sites can turn out to be prohibitive. On the other hand pre-planned industrial estates with waste treatment and disposal systems and other necessary infrastructure offer distinct advantages. From an environmental viewpoint the sources of pollution are concentrated in one area, avoiding the mixture of potential sources of pollution with other land uses, particularly residential. It does, however, mean that an industrial estate itself has a concentration of users in one location and that the question of site selection for the estate becomes even more sensitive and critical.

Industrial estates are categorised as projects representing a significant threat to the environment. They automatically require full Environmental Impact Assessment (EIA) treatment (Category A Projects). These guidelines cover all new industrial estate proposals where land is developed and managed by a coordinating authority and serviced lots are leased off to smaller industrial users. Services can include roads, rail link, water, electricity, gas and telephone. Most importantly industrial estates have the opportunity to provide properly managed treatment facilities for liquid and solid wastes.

In Pakistan industrial estates have traditionally been under the control of Provincial Governments. Estates have been developed and managed by Development Corporations or Boards under the Provincial powers. There have been two levels of provision for both small and larger scale establishments. NWFP has a Small Industries Development Board for smaller industries, while the Sarhad Development Authority looks after the land requirements of larger industries. There are similar arrangements in other Provinces such as in Punjab which has a Small Scale Industries Corporation and a Punjab Industrial Development Board.

The recent trend towards privatisation of activities has seen the setting up of private industrial estates in Pakistan. A 1000 acre site has been operative in Rawalpindi for two years under the control of the Rawalpindi Division of the Chamber of Commerce and Industry. There are also private sites in Karachi and Lahore.

Federal Government has also been involved in encouraging industrial development with the setting up of Export Processing Zones under the Export Processing Zone Authority Ordinance 1980. A zone is already in operation in Karachi and two more have recently been

approved in Rawalpindi and Sialkot. The Ordinance allows for the development of master plans, zoning, and community and infrastructure services. The setting up of such zones should have environmental assessment in the same way as other industrial estates.

These guidelines therefore relate to all new public and private industrial estates. They also relate to any extension or new phase of an existing estate. Cumulative impacts will be discussed later, but, it is important that the site is evaluated on the basis of the combined effects of the existing estate plus the new extension. The incremental increase in atmospheric and effluent discharge may make extension of the site unacceptable or mitigation so costly as to make the choice of a new site preferable.

The guidelines will assist proponents to identify the key environmental issues that need to be assessed as well as mitigation measures and alternatives that should be considered at all stages in the process of siting, design, construction and operation of a new industrial estate. Readers are advised not to apply a mechanistic approach based on these guidelines. No technique can replace the thoughtful consideration of the proposal, its siting and the physical and cultural environment in which it is proposed.

The environmental issues discussed in these guidelines are not exhaustive and the degree of relevance of each will vary from proposal to proposal. The environmental report should only deal with issues relevant to the specific proposal. The focus of the environmental report should be on key environmental issues.

Community participation must be incorporated in the EIA process and the reader is referred to "*Guidelines for public consultation*". Properly conducted the consultation exercise can lead to far better mutual understanding and it can be the basis of productive community relations instead of hostility.

1.2 Context

This guideline is part of a package of regulations and guidelines which include:

- The Pakistan Environmental Ordinance 1997
- Policy and procedures for filing, review and approval of environmental assessments
- Guidelines for the preparation and review of Environmental Reports
- Guidelines for public consultation
- Guidelines for sensitive and critical areas
- Pakistan environmental legislation and the National Environmental Quality Standards (NEQS)
- Sectoral guidelines for Environmental Reports: ***Industrial Estates***

This guideline should not be read on its own, but in the context of the overall package. In relation to industrial estates the reader is referred to guidelines produced as part of this series of sectoral guidelines for *Sewerage treatment* and for *Major chemical and manufacturing plants*.

1.3. Linkages between environmental assessment impact and other laws and procedures

1.3.1 General

Policy decision, legislation and procedures in other areas will be relevant in considering and dealing with the environmental impacts for industrial estates. The main considerations are in the following areas:

- economic planning policy decisions,
- physical planning - zoning and planning regulations at the site selection and operation stage,
- occupational health for the workers in industrial units and involved in any utilities and services at the construction and operational stages of the project.

Major industrial plants, such as steelworks, cement factories, power stations, hazardous chemical plants and the like are not intended to be located within an industrial estate. Industrial estates are established for smaller scale groupings of similar industries, often comprising light and service industries.

1.3.2 Economic and physical planning

Industrial sites are often "preselected" with little reference to environmental issues. Preselection is often undertaken as part of economic policies at Federal level. Industrial sites have for instance been earmarked at junctions along the new Islamabad - Lahore motorway as part of industrial development policy.

Physical planning is a Provincial function and the Provinces have developed their own Ordinances which allow for the creation of plans, planning controls and Building Regulations. Regional plans, master plans and site development schemes have been produced for certain Municipalities and land may have been set aside (preselected) for industrial development in such plans. For instance, as at 1997 all towns in Punjab with populations over 50,000 have master plans each with areas defined for industrial use. Reference should be made to the relevant Provincial Physical Planning authority for existing physical plans.

Where sites are identified as part of the planning and zoning process there may be no need for additional siting analysis and the studies required may be limited to particular issues, such as the need to pretreat a plant's proposed wastewater. Care should be taken to examine what environmental criteria have been taken into consideration in zoning land. In cases where Master plans have been prepared and approved it is likely that economic and engineering feasibility criteria alone have been employed to earmark land for industrial development. To ensure that environmental objectives are met an environmental analysis of possible sites may have to be conducted anyway.

In terms of the reports required to satisfy Government requirements, the same project description material can be used in environmental reports as is used in the submission for physical planning. The town planning and detailed subdivision plans required for physical planning approval will be particularly helpful in identifying the level of spatial impacts in the environmental report.

The design of industrial estates is undertaken by the relevant Development Authority or Small Scale Industries Board in the Province. Approval is required through the Department responsible for the P&D process in the Provinces before the scheme can be adopted in the Provincial development program. Environmental assessment can be incorporated in the earliest stages of this planning process.

1.3.3 Occupational health

There are various labour laws and rules which affect the operation of individual industrial establishments in Pakistan. The Factory Act 1934 covers such areas as health, safety, daily hours of work and overtime. There are Federal rules covering different hazardous occupations under the following categories - (1) Aerated waters, (2) Cellulose Sodium Spraying, (3) Chromium, (4) Lead, (5) Miscellaneous, (6) Petrol Gas Generating Plant, (7) Rubber, (8) Sand Blasting and (9) Sodium & Potassium Bichromate.

Factory rules have also been put in place at the Provincial level. NWFP, for instance, has enacted the Factory Rules 1975 and the Canteen Rules 1979. The former provides for shelters (rest rooms) for industries with more than 150 workers and rooms for child care where more than 50 females are employed. The Canteen Rules require canteen facilities where 250 workers are employed. The reader is referred to the Labour Code of Pakistan, Labour Laws & Rules of Pakistan with Commentary, 1994 issued by the Bureau of Labour Publications for full coverage of the relevant Federal and Provincial laws, rules and regulations.

The laws and rules for occupational health and safety cover separate factory establishments; the existing legislation is comprehensive and Provincial Factory Inspectors have wide discretionary powers. In practice implementation is weak and penalties for non-compliance are nominal having not been revised since the Factory Act was first put in place in 1934. Industrial estates have many industrial operations, some of which may be very labour intensive. This can mean that an industrial estate has many thousands of workers and consideration has to be given to the provision of infrastructure on a wider scale than individual factories. The relationship with town planning design and the need to provide land for shops and eating areas is discussed later.

2 ENVIRONMENTAL IMPACT ISSUES

2.1 General

The concentration of numerous potential sources of pollution at one site inevitably raises the possibility of severe impacts and environmental damage. This Chapter discusses some of the general issues involved; Chapter 3 then goes on to consider the specific negative impacts of the various stages of the project.

2.2 Area of Influence

The impact upon immediate land uses around a site are discussed in Section 3.2.4. The area that may be impacted by industrial uses can, however, extend well beyond the site of the industrial estate and its immediate vicinity. The area of influence and the severity of impact will depend on the type of industrial facilities, the discharges involved and the receiving environment (plant, animal and human communities). In this regard, factors which must be taken into consideration in looking at site selection include:

- the effects on water availability to other users at the point of withdrawal and on receiving water quality for some distance downstream of the point of discharge.
- the characteristics of the natural resources and land uses in the airshed for long distances downwind,
- the impacts which will occur along transportation corridors,
- the characteristics of water catchment and airsheds of new developments where such developments are required to support the new industrial estate or are an induced development (see 2.4 below) e.g. resettlement sites, workers

dwelling, new port facilities, new road and rail links, new asphalt plants at quarry sites.

2.3 Cumulative issues

Cumulative impacts can result in the context of the regional environment in which a project is to be placed and the possible build up of impacts. Cumulative impacts related to the effluent discharge from sewerage schemes are discussed in Guidelines for "Major Sewerage Schemes" and cumulative issues for atmospheric emissions are covered in the Guidelines for "Thermal Power Stations".

2.4 Assimilative capacity

For industrial estates with many individual users of water and the potential generators of large quantities of effluent, it is important to have a full understanding of the existing capacity of natural systems to absorb new levels of discharge. In many cases where river flows are small, and particularly if the flow of a receiving stream is at anytime less than the quantity of effluent produced by the estate, there can be costly mitigation required. Unless the effluent can be treated (or cooled in the case of cooling water) to be of equal or better quality than the receiving water, disturbance of the aquatic ecosystem is inevitable. Such treatment, if technically achievable at all, is likely to be extremely costly. Alternative sites with receiving waters capable of accepting properly treated effluent without significant degradation, could lead to lower costs over the life of the facility. The same can be true of sites where water supply is limited or where meteorological conditions (e.g. frequent atmospheric inversions) would necessitate unusually stringent treatment practices.

Another relevant aspect in relation to assimilation ability is the impact of non-routine operations such as process upsets, failure of pollution control systems and accidental releases. Proximity to sensitive natural areas or human settlement may necessitate extraordinary measures to prevent or respond to such events.

2.5 Induced development

Employment opportunity on a large scale draws in immigrant workers and thus the growth of local communities. The community may well experience induced land development and it may be ill-prepared to manage its impact. Such impacts range from overloading of municipal infrastructure and services to cultural conflicts between existing residents and immigrant workers. Particular care is needed to prevent unplanned settlements immediately adjoining the new estate and this has to be done through the institution strengthening of local government and the development of zoning rules and their enforcement. Industrial estates require full EIA reports and full public participation; the involvement of the local community is essential to assist in minimising such induced adverse impacts.

3. NEGATIVE IMPACTS AND MITIGATION MEASURES

3.1 General

Negative impacts are considered in these guidelines in four distinct areas.

- site selection stage
- design stage
- construction stage
- operations stage

To assist proponents putting together an Environmental Report, impacts and mitigation are discussed in a systematic way under the four distinct project stages identified above.

Appendix I is a checklist for proponents of the impacts and relevant mitigation, which are

discussed item by item below, and which should be considered by a proponent when putting together an Environmental Report for an industrial estate.

The result of impact assessment may be to recommend the rejection of a particular site and point to the choice of alternatives. All the impacts identified in this Chapter can be present in varying degrees at a site. If an impact does not rule out the site altogether, certain mitigation measures may be necessary.

3.2. Site selection issues

The process of site selection for industrial estates is one area where environmental assessment can be most useful, but this is only the case where assessment is included early in the process and before decisions regarding siting options are taken. The Environmental Report should be started at the earliest possible stage so that real alternatives can be considered. Identifying the potential impacts associated with each site and comparing sites on that basis causes environmental issues to come to light early in the process. It allows project planners and designers to properly consider all possible ways of avoiding potential impacts. Where it is possible to avoid impacts and mitigation is accepted as part of the project costs, the opportunity to select a more appropriate alternative site can lead to the increased efficiency of measures designed to mitigate impacts and a reduction in the associated costs of such measure.

For impact identification to be effective at site selection level it is important that certain information is available at a regional level. It is important that sites of special importance are first of all identified and the long term value of such sites is recognised. Where possible it will help if some quantification is given to the value of the resource. The loss or disruption of such resources can then be recognised and valued in relation to the need for industry and jobs. Adequate Provincial/regional planning policies are required to provide a framework which can assist in the site selection process. Measures which could be employed include:

- zoning or identification of land of prime agricultural importance
- identify sites which have special habitat significance or species diversity
- identify sites of special cultural and historical interest
- identify areas of land with constraints upon development— land liable to flooding etc.

To avoid siting of industrial estates in sensitive, difficult or unsafe areas a database should, therefore, be developed to identify and map the principal environmental resources. This is probably best done at Provincial level and would identify and map environmental resources such as major drainage patterns, freshwater and coastal wetlands, forests and other important natural habitats, prime agricultural land etc. An analysis of this nature can eliminate from consideration the least suitable sites. Exclusion Criteria are developed in **3.2.8** below.

3.2.1. Displacement of existing land use and other environmental resources

Important land uses and economic activity can be lost to industrial estates. One of the most important uses to protect is prime agricultural land and it is vital that such land is identified and mapped to assist planners in making optimal choices.

3.2.2. Destruction of environmentally sensitive and critical areas

Wetlands, forests, major water bodies and other areas containing rare and endangered species can all be threatened by new industrial estates. Such environments have a value to society as a whole and should be given special consideration. The value of such resources has to be weighed against the positive benefits of income and job generation. The reader is referred to "*Guidelines for sensitive and critical areas*" which is part of this package of Guidelines (see Section **1.2**)

The value of such resources to society as a whole must, therefore, be weighed against the positive benefits of job creation and the site should be rejected if there are particular impacts for instance to endangered species.

3.2.3. Existence of adverse natural conditions

A number of adverse natural conditions will need to be examined, such as slope of the land, unstable soil and subsurface conditions, land prone to landslide activity and land prone to volcanic or seismic activity. Availability of water supply is considered separately. The main considerations for industrial sites in relation to natural conditions is to avoid:

- poorly drained low lying land and particularly land in flood plains which are liable to flooding,
- coastal zones liable to inundation from tidal and storm activity,

Industrial estates are attracted to large areas of flat land and such land is often most available in flood plain and coastal locations. Care must therefore be taken to assess the likely impacts of regional flooding and the incidence of coastal inundation. The impact of the surface water drainage from the site on the existing drainage pattern must also be considered.

At site selection level, the aim should, therefore, be to avoid project locations subject to severe natural constraints and particularly land subject to:

- flooding - particularly flood plains,
- coastal inundation,

Where mitigation is viable then measures will be required at both the site and infrastructure level and at estate design level. Adverse conditions such as low lying land can increase the costs of water supply and waste disposal services. Pumping stations may be required for water-supply and sewerage systems to be effective.

These design measures are relevant to the layout and design phase of the project; but the costs associated with such mitigation measures must also be factored into the overall project costs to determine the viability of individual sites and allow the realistic consideration of alternative sites.

3.2.4 Impact on adjoining land users

The assessment of environmental impacts on land uses immediately adjoining the proposed site will be important in assessing the relative merits of alternative sites. There may be high population concentrations in the immediate area or there may be agricultural production or other resources which could be affected by heightened levels of pollution. The quantification of environmental impact should be incorporated in the alternative site assessments. This should be done in terms of any health impacts and any human welfare impacts (e.g. loss of income from reduced crop yields) which will result from increased levels of pollution. The reduction in adjoining land and property values that may result from the placing industrial users next to other users, and particularly the affect on residential land values in the area, should be assessed.

Existing background levels of pollution in the area may already be high and the advisability of adding new potential sources in such a situation may be unacceptable. Background levels of air, water and noise pollution resulting from adjoining land users should all be measured to allow assessment of cumulative impacts.

Local micro-climatic conditions can result in temperature inversion. Such climatic conditions can exacerbate atmospheric pollution, and lead to the formation of photochemical smog. The likely effects of air pollution on local communities should be assessed.

If health and human welfare impacts are great, proper quantification and costing of impacts can make certain sites totally unacceptable e.g. those close to high population

concentrations and other affected economic activities. Sites should be rejected where there are severe pollution impacts to local communities from:

- the sheer size of local population concentrations and the impact on human health
- high levels of existing background pollution of the atmosphere and/or water, the existence of micro-climate conditions with frequent temperature inversions.

3.2.5 Displacement of existing population

Serious consideration must be given to the issues and practical problems involved with any relocation of population occupying the site. Where the clearance of existing settlements is involved it is necessary to investigate where such displaced persons will go. It may be that the removal of people will result in the unanticipated deterioration of the environment elsewhere, as the site users, particularly if they are squatters, find new sites.

Any resettlement should be done in accordance with proper standards. If displacement is on a large scale, a full environmental impact of the wider effects of resettlement on a new site will be necessary. If resettlement is likely to lead to increased densities and pressures on existing services in the immediate urban area, then provision must be made for infrastructure to meet the needs of such increased densities. The reader is referred to Chapter 3 of World Bank EIA Guidelines "*Involuntary Resettlement and Induced Development*" for a fuller discussion of the issues involved.

3.2.6 Destruction of resources of historic or cultural significance

Sites and areas of importance from an historic or cultural viewpoint need to be identified in the same way as is the case for sites in sensitive and critical areas. Significant sites such as those at Taxila and Mohenjo Daro should be fully protected and they should be particularly protected from any industrial emissions.

For some sites of historic and/or cultural value, it is may possible to set aside the land required to preserve the particular site and zone the land accordingly. The project design may then be adapted to include the historic or cultural resource.

3.2.7 Availability of existing infrastructure and services

The availability of existing services to the site must be investigated. Supply of water, gas and electricity may be deficient and transportation links may also be inadequate. The absence of institutions for communication and accident response may make hazard management impossible at a particular site. This may be particularly true when it is necessary to transport hazardous and explosive material through existing residential areas.

Water may be a constraint and if new water supply schemes are required to enable a new development to proceed, the costs and environmental impacts of the new water supply scheme must be investigated.

Mitigation needs the involvement of economic and physical planning authorities to ensure additional infrastructure and service requirements through Federal and Provincial programmes. Existing services should be upgraded where possible to avoid strain upon the existing user network. This will ensure that safety services are in place to cope with industrial accidents and to facilitate emergency response plans.

3.2.8 Exclusion Criteria

A set of criteria for site selection can be adopted bearing in mind some of the impacts and mitigation discussed above. It is recommended that the following locations are automatically avoided in the consideration of alternative sites for industrial estates:

- prime agricultural land,

- within 25 kms of an ecologically or otherwise sensitive areas (including religious and historic places and archaeological monuments, scenic, beach resorts, coastal areas and estuaries which are important breeding grounds, national parks and sanctuaries, natural lakes and swamps and tribal settlements),
- within 0.5 km of the high tide line in coastal areas,
- within 0.5 km of natural or modified flood plain boundary,
- within 25 kms of the projected growth boundary of major settlements (population of 3 million or larger)

3.3 Local site scale issues and project design issues

3.3.1 General

When it is decided to progress to the detailed design phase of a project, one or more of the problems identified in the site selection process above may be present. All the impacts identified at site selection stage must now be taken into consideration in the detailed design process. Detailed site investigation studies should be undertaken to look at the particular local conditions which can include one or more of the factors identified in **3.2** above plus other factors which are more local site design issues.

Many of the impacts for the design and operations phase of industrial estates are those common to:

- individual manufacturing industries, and,
- sewerage treatment schemes.

Sector guidelines produced as part of this package have already gone into detail with regard to impact identification and mitigation in these two areas and the reader is referred to the two guidelines:

- Guidelines for Environmental Reports, Major chemical and manufacturing plants,
- Guidelines for Environmental Reports, Major sewerage schemes.

The following areas of concern should be considered for possible impacts and mitigation measures should be addressed where impacts are identified:

- **Hazardous materials** - if there are such materials on the estate, measures should be in place for adequate treatment, storage and disposal facilities. Disposal should be in accordance with EPA Regulations.
- **Liquid waste emissions** - mitigation should be discussed in terms of waste water minimisation, surface water measures, ground water measures and flood mitigation measures. The sensitivity of the receiving water must be assessed along with the types of emissions and quality and quantity of the emissions.
- **Gaseous waste emissions**
- **Noise**
- **Transport and traffic**
- **Aesthetics**
- **Flora and fauna**

3.3.2 Integrated waste treatment and disposal facilities

Individual industries will have to meet NEQS for their emissions (see Chapter 4. **Emission requirements**) with the development of primary treatment facilities. A site must be identified on the estate or on adjoining land which can treat combined sewerage discharges from all industrial estate users to an appropriate standard with a view also to the re-use of such water.

The estate must be designed with separate systems for stormwater and process water collection. Waste water minimisation techniques must be encouraged by the estate management to reduce impacts to receiving waters. This can include:

- recycling of water from one process and one industry to another inside the estate;
- using treated effluent as make-up water wherever possible;
- design systems that recycle water repeatedly for the same purpose e.g. cooling towers.

Contaminated liquid process wastes should be collected and treated separately from sewerage effluent.

Adequate solid waste disposal facilities must also be available to the estate users. If there are not proper solid waste disposal facilities close by a solid waste storage site must be provided on site. If industries producing hazardous waste are present, there must be arrangements for the handling and disposing of such waste.

3.3.3 Grouping of industries

The existing Provincial organisations responsible for the management of industrial estates already segregate industries according to pollution potential. Some existing estates were developed on the fringe of townships e.g. Peshawar industrial estate, but have subsequently been surrounded by urban expansion and residential areas. Many estates already discriminate against certain users. Some will not permit the development of industries producing chemicals and hazardous wastes. The Capital District does not allow any polluting industry in Islamabad. The National Reference Manual on Planning and Infrastructure Standards 1986 makes some recommendations with regard to a zoning of industrial estates according to different categories of industry (see 5.3.2.4 Zoning and Phasing in Appendix I of the NRMPIS).

The planning and design of the estate and its integrated sewerage treatment facility will be tied to the levels of liquid discharge which are acceptable. This will relate to the seasonal quantity and quality of receiving waters. Policies in regard to the grouping of industries must, however, be flexible according to the assimilative capacity of the receiving environment in terms of both liquid and atmospheric discharges. There may be sound reason to mix different types of industrial processes. Certain processes use large amounts of water which, with little if any treatment, can be reused in other processes. This is a matter of creative planning by industrial estate managers and plant designers to ensure the maximum use of water resources and the incorporation of waste minimisation techniques.

3.3.4 Other design criteria for industrial estates

The following is a list of suggested criteria for development of industrial estates

- no conversion permitted of forest land to non-forest activity to sustain individual industries,
- sufficient space must be provided on site for the storage and disposal of solid waste and the treatment and reuse of wastewater,

- provision of greenbelt buffer zones around the perimeter of a site; there should be at least 500 metres between an industrial estate and any existing residential areas (* see note below),
- the detailed design of the facility should adapt to the landscape, so that scenic features are not altered by the development
- provision of land centrally located in the industrial estate for informal eating places to establish to provide for workers needs

* Note: This criteria is taken from the National Reference Manual on Planning and Infrastructure Standards (NRMPIIS) issued in 1986 by the then Ministry of Housing and Works Urban Affairs Division which discuss detailed layout considerations (see Appendix II).

3.4 Construction issues

Construction is the time when impact can be most severely felt and when the project site is particularly vulnerable to environmental disturbance. The reader is referred to ADB Environmental Guidelines Annex III/1 "*Environmental Constraints for Projects Involving Major Construction Operations*" for a full list of considerations which should be taken into consideration at this stage of the project. The main factors to bear in mind are as follows:

- 1 **Run off erosion** during rains from unprotected excavated areas resulting in excessive soil erosion
- 2 **Dangers to workers** from accidents, hazardous materials, quarrying, communicable disease and emissions
- 3 **Local flooding** from watering of excavations, flushing of pipes etc.
- 4 **Loss or degradation of vegetation** from unnecessary removal or mechanical damage,
- 5 **Disruption of local traffic patterns**, congestion and blocking of access to adjoining activities.

Mitigation during the construction stage must be carefully planned and measures to minimise impacts must be tied to monitoring and management plans. Proper phasing of activities can help reduce disruption and degradation.

Temporary erosion control plans must be put in place; such plans should include:

- temporary silt fencing
- temporary ponding or silt trap basins,
- short term seeding or mulching of exposed soil areas and particularly on sloping land,
- limitation of access for heavy machinery and the storage of materials to avoid soil compaction.

Topsoil must be properly stripped and stored for future use and not illegally removed from site.

Areas can be protected by temporary fencing and limitation of access for heavy machinery and material storage. This will help protect vegetation and avoid exposing larger areas to erosion and run off risks.

3.5 Operation stage issues

During the operation stage of the life of an industrial estate there will be possible impacts from:

- **Pollution, health hazards and nuisance** to workers and affected residents and other land users,
- **Occupational health** impacts to workers on the industrial estate,
- **Inadequate operation and management** - the lack of proper procedures management and training of personnel can greatly exacerbate the level of hazard and occupational health impacts..

Monitoring during the operation of the life of housing estates is closely linked with management and public participation of concerned residents and this is discussed in Chapter 5.

Monitoring for the environmental impacts involved in town service provision (sewerage treatment and solid waste disposal) and occupational health issues are covered in other sector guidelines and the reader is referred to them.

4 EMISSION REQUIREMENTS

All separate industrial project on an industrial estate will have to submit to the relevant EPA for an individual Operating Approval. Each industry will have to comply with the National Environmental Quality Standards for effluents and gaseous emissions. The effluent emissions from the treatment facilities of the industrial estate itself will also have to meet NEQS.

The list of environmental legislation and regulatory requirements in Pakistan, and the NEQS will be provided in a new document entitled "*Sectoral Guidelines for Environmental Reports - Regulatory Requirements and NEQS*". The reader of this draft will find this material as an Appendix to Major Thermal Power Stations at present.

Some of the NEQS levels are currently undergoing revision and as updates are made available these guidelines will be amended.

The requirements represent the basic minimum standards that should apply to all projects. More stringent emission requirements will be appropriate if the environmental assessment indicates that the benefits of additional pollution controls as reflected by ambient exposure levels and by other indicators of environmental damage outweigh the additional costs involved.

5 MONITORING MANAGEMENT AND TRAINING

5.1 Baseline conditions

The potential for impacts in townships schemes is large and it is important that baseline conditions are determined at the earliest possible time i.e. prior to the design stage of the project. Data should be collected with respect to each significant impact identified and it will then be possible to confirm predicted impacts and ensure mitigation measures are acceptable.

Baseline data collection methodology is covered in Section 3.4 of the "Guidelines for the Preparation and Review of Environmental Reports".

5.2 Construction monitoring and reporting

Monitoring should be restricted to what is essential to protect the environment. The list of environmental parameters to be monitored should be specified. The design and management for a monitoring plan is discussed in Section 5.2 of the "Guidelines for the Preparation and Review of Environmental Reports".

The parameter which must be considered for inclusion in the monitoring report are discussed in **.3.4 Construction issues** of this report and in more detail in ADB Environmental Guidelines Annex III/1 Environmental Constraints for Projects Involving Major Construction Operations. Temporary erosion control plans and project development phasing plans should be included in the construction monitoring plan. There should be regular reporting to the Responsible Authority during the construction phase.

5.3 Monitoring management and training during operations

Each of the industries established on an industrial estate will require its own monitoring program which will have been incorporated in the Operational Approval to set up the industry. The sort of program required by individual industries is described in the Guidelines for "Major chemical and manufacturing plants" and appropriate monitoring and management procedures are described for manufacturing plants in terms of air, water, solid waste, noise and control measures.

The management of the industrial estate has the ongoing responsibility of overseeing the monitoring activity of the industries on site. The industrial estate will also have its own monitoring plan which will have been included as a condition of the EIA approval. The management of the estate will have to work closely with the relevant Government Agencies. The agencies concerned will be:

- the staff of the EPA, NWFP for example intend to station Environmental Protection Officers (EPO's) at each of the industrial estates in the Province,
- industrial development officers in the Ministry responsible for industry in the Province - such officers are based at District level,
- the Provincial office responsible for occupational health and safety measures on the estate and particularly the factory inspector.
- local government services responsible for safety measures and emergency procedures

Emergency response capacity can be strengthened by providing equipment and training. The reader is referred to the section in World Bank EIA Guidelines on "Industrial Hazard Management".

References

This, and other guidelines in the package, rely heavily on existing sources, which include::

- Government of Pakistan EIA Guidelines 1986
- ADB Guidelines 1993
- World Bank EIA Guidelines 1994
- National Reference Manual on Planning and Infrastructure Standards 1986

Actions Affecting Environmental Resources and Values	Damages to Environment	Recommended Feasible Measures
A. Problems Related to Site Selection	A. Depends on Nature of Problem	A. Depends on Nature of Problem - Reject site if inappropriate
<ol style="list-style-type: none"> 1. Displacement of existing land use e.g. agricultural land 2. Destruction of sensitive areas 3. Natural adverse site conditions 4. Adjoining land owners 5. Displacement of existing population 6. Impairment of historical/cultural resources 7. Availability of existing infrastructure and services 	<ol style="list-style-type: none"> 1. Loss of economic resource 2. Loss of natural habitat 3. Impact on human welfare 4. Impact on human health/welfare 5. Social inequities 6. Loss or impairment of these values 7. Overloading of existing infrastructure 	<ol style="list-style-type: none"> 1. Proper quantification of impacts. 2. Proper valuation of impacts. 3. Design accordingly. 4. Design accordingly. 5. Adequate resettlement planning & budgeting 6. Careful planning/design, plus offsetting measures 7. Expanding infrastructure where possible
B. Problems Related to Design Phase	B. Depends on Nature of Problem	B. Depends on Nature of Problem
<ol style="list-style-type: none"> 1. Hazardous materials 2. Liquid waste emissions 3. Gaseous waste emissions 4. Solid waste emissions 5. Noise 6. Transport and traffic issues 7. Aesthetics 8. Loss or impairment of flora and fauna 	<ol style="list-style-type: none"> 1. Hazards to workers & adjoining population 2. Impairment of downstream water quality and use 3. Impairment of community & regional air quality 4. Impacts on human health 5. Damage to workers and neighbours 6. Air pollution & noise effect human health 7. Visual intrusion 8. Loss of environmental resource 	<ol style="list-style-type: none"> 1. Careful planning & emergency procedure 2. Careful planning/design and O&M, plus operating/monitoring 3. Careful planning/design and O&M, plus operating/monitoring 4. Careful planning, O&M and monitoring 5. Careful planning and O&M 6. Careful traffic and circulation planning 7. Careful planning/design/landscaping 8. Careful layout and design

Actions Affecting Environmental Resources and Values	Damage to Environment	Recommended Feasible Mitigation Measures
C. Problems During Construction Stage	C. Unnecessary Environmental Damages	C. Careful Construction Planning and Monitoring
1. Silt runoff from construction operations	1. Soil erosion with damage to property and aesthetic values	1. Erosion control planning and careful monitoring
2. Dangers to workers from accident, disease quarrying, & emissions	2. Injuries to workers and nearby residents	2. Careful construction planning and monitoring
3. Local flooding from watering excavations, flushing of pipes	3. Local flooding damages	3. Careful construction planning and monitoring
4. Loss/degradation of vegetation from mechanical damage	4. Loss of vegetation, forest and habitat in general	4. Careful construction planning and monitoring
5. Traffic congestion and blocking of access	5. Loss of time and fuel and accidents	5. Careful construction planning/monitoring
D. Problem During Operation Stage	D. Depends on Nature of Problem	D. Careful O&M, plus Operation Stage Monitoring
1. Pollution, health hazards & nuisance	1. Damage to workers & adjoining residents	1. Competent O&M
2. Occupational health inadequacies	2. Damage to worker safety and health	2. Occupational health plan plus monitoring
3. Inadequate O&M performance	3. Damage to worker safety	3. Occupational health plan plus monitoring

5.3 INDUSTRY

5.3.1.3 Land use Distribution

The recommended land use distribution for medium sized estates is given in Table 5.6.

TABLE 5.6 : LANDUSE IN INDUSTRIAL ESTATES

Category	Percentage
Factory Plots	60 - 65
Roads	Up to 20
Open Spaces	Up to 20
Administration & Other Buildings	5 - 10

Source: UNIDO, 1978

5.3.1.4 Set-Backs

Location of industries along the roads should be consistent with Highway Ordinance, according to which it would be unlawful without the consent of the Highway Authority:

- a) to construct or layout any means of access to or from highway: and,
- b) to erect any building upon land within two hundred and twenty feet (67 metres) from the middle of the highway.

Industrial agglomerations, generate/attract lot of traffic and to separate industrial traffic from the general traffic, it is necessary to provide service roads for industrial estates. It is also desirable that the setback from the existing road should be more than the minimum in the Highway Ordinance (67 metres).

It is proposed that:

- 1) Setback from any primary road be at least 200 metres from the road edge.
- 2) The industrial estate should be separated from existing and proposed residential areas by at least 150 metres (medium sized units of light industry and warehouses) or at least 500 metres (large units of light and general industry)
- 3) Small scale and non-offending cottage industries may be allowed in low-income residential areas. They may operate within dwelling units or a separate Nursery Industrial Estate may be provided for them. These nursery estates may vary in size, from about 0.4 hectares to about 3 hectares.

5.3.1.5 Access

- 1) The industrial areas should have access to power and water supplies.
- 2) The industrial areas should also have good access to primary and secondary roads, but no access to individual plots from primary roads.

5.3.1.6 Plot Sizes

In order to achieve the flexibility as an in-built character of an industrial area, it is proposed that a dominantly Modular Approach be adopted for physical planning. The Modular Approach permits the adoption of an optimum size of space unit, various numbers of which can be combined to generate plots of varying sizes. The dimensions of the basic module may be 25m x 50m. This versatile size with a length/breadth ratio of 2.0 permits its combination into a large number of industrial plots of varying sizes. Fig. 5.2 gives six basic combinations.

The Modular Approach, however, may not be strictly followed. Corner plots and those at the peripheries may have non-modular dimensions.

5.3.2 Guidelines

5.3.2.1 Planning Principles

Industrial areas should be planned in accordance with following guidelines:

1. Plots of smaller size should be grouped as to separate small workshops from large scale industry.
2. Larger plots should be positioned in the most visible locations.
3. Where site conditions permit, a grid pattern road layout should be used, with staggered T-junctions on the local roads in the industrial area.

5.3.2.2 Location

The following are partial guidelines to be considered while selecting locations for industrial estates.

- 1) Areas of reasonably flat land to allow large plots and buildings with large spans.
- 2) Areas which do not have substantial natural vegetation.
- 3) On the downside of existing or proposed residential areas for the prevailing wind; and
- 4) Separated from orchards and other valuable agricultural areas.

5.3.2.3 Industrial Waste

Industrial wastes should be treated prior to disposal. Processing is intended to reduce their volume and weight and to ensure their hygienic safety by reducing BOD toxicity and poisonous quality of the effluent/emission to the required standard.

After processing, the wastes may be discharged into receiving waters, more rarely onto receiving soils, or reclaimed for industrial water supply.

5.2.3.4 Zoning and Phasing

It is desirable that industrial estates be zoned according to a broad categorisation of industrial units. One useful categorisation is as follows:

- 1) Iron and Steel
- 2) Electrical & light engineering
- 3) Chemicals
- 4) Less polluting processes and small industries
- 5) Less mechanical processes.

Such categorisation allows rational zoning, reflecting the varied traffic generation and pollution caused by different types of industries. Heavy traffic generators should be placed near the main entrance/exit, while heavy polluters leewards. Less mechanised processes can conveniently adjust to rolling topography.

However, zoning will almost inevitably clash with the objective of compact development at every phase of growth. Compact development at each phase minimizes the lengths of idle services.

The planner should recognise this dilemma and attempt design solutions such that every phase of growth is relatively compact, while maintaining zoning to an acceptable degree.