SEAM PROGRAMME

Guidance Manual for Industrial Estate Management

Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency

Enec UK Ltd., ERM
UK Department for International Development

SEAM Programme

Guidelines for Environmental Management Of The Industrial Estates

Developed by SEAM Programme
In Association with Environics

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Ministry of State for Environmental Affairs
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GUIDELINES MANUAL PRODUCED BY THE SEAM PROGRAMME

WITH CONTRIBUTIONS FROM:
Mr. Philip Jago (SEAM Programme Manager)
Prof. Dr. El-Sayed Khater (SEAM consultant)
Dr. Linda Timothy (SEAM consultant)
Eng. Shahenaz Fouad (SEAM consultant)
Dr. Prasad Modak (SEAM consultant)
Eng. Rahul Datar (SEAM consultant)

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Egyptian Environmental Affairs Agency (EEAA)
Support for Environmental Assessment and Management (SEAM)
30 Misr Helwan Agriculture Rd, Maadi
Tel: 20(02) 5259648 Fax: 20(02) 5246162
http://www.seamegypt.org

About the SEAM Programme

The SEAM Programme – An Introduction

Support for Environmental Assessment and Management (SEAM) is a major environmental programme implemented by the Egyptian Environmental Affairs Agency (EEAA), Entec UK Ltd and ERM with support from the UK Department for International Development (DFID).

The SEAM Programme aims at improving environmental planning and services for the poor and strengthening decentralized environmental management. It has four components focussing on environmental management issues. These include developing Governorate Environmental Action Plans (GEAP) in four Governorates in Egypt (Sohag, Dakahleya, Qena, Damietta and South Sinai), delivering community environmental projects (CEPs) that benefit the poor, improving solid waste management and implementing cleaner production (CP) projects in industry to enhance competitiveness and reduce pollution.

The Cleaner Production Component

The main goal of the Cleaner Production component is to show that significant financial savings and environmental improvements can be made by relatively low-cost and straight-forward interventions, such as good housekeeping, waste minimization, process modification and technology changes. This approach was recognized as having two benefits – valuable materials can be recovered and reused, rather than being wasted, and industries move towards environmental (legislative) compliance.

1994-99 - Cleaner Production initiatives were successfully undertaken in medium to large scale Egyptian industrial units in the textiles, food processing and edible oil and soap sectors. 32 factories were audited and 21 Demonstration Projects implemented at a cost of LE16 million, with an average pay back of 6 months. Examples of interventions included water and energy conservation, ecolabelling for textile exports, oil and fats recovery, HACCP, recovery of cheese whey, etc.

2000-05 - The programme focused primarily on micro, small and medium size enterprises (MSMEs) in Egypt. It focused on 4-5 main priority sectors in five governorates which are the food, metal foundries, textile, furniture and other miscellaneous small industries. About 100 audits and 30 demonstration projects are to be undertaken in MSME priority sectors including food processing, metal foundries, furniture, textiles, and other miscellaneous projects. The aim here is to enhance efficiency, reduce pollution, yield financial savings and improve the environment for surrounding communities.

More information on various sector manuals and case studies may be procured from http://www.seamegypt.org.

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INTRODUCTION

- **PURPOSE OF THE GUIDELINES**
  The Guidelines aim at:
  - Improving environmental performance of industrial estates.
  - Improving the working conditions and safety throughout industrial estates.
  - Reducing the impacts of the estate on the surrounding area and nearby residents.

- **GUIDELINES DEVELOPMENT PROCESS**
  The guidelines were developed by taking into consideration the views of the industrial estate's management and regulatory authorities. Workshops among concerned industrial development entities were conducted to propose role of the estate management in different fields.

  It is intended to hold a workshop to introduce the guidelines to the stakeholders and acquire feedback for finalization and a final workshop will be held for dissemination.

- **GUIDELINES TARGET GROUPS**
  The guidelines target the management personnel in estates that are affiliated to the governorate. Nation-wide, the management of these estates have the same responsibility, mandates and almost the same organization structure. Other estates affiliated to the Ministry of Housing have different nature since they have regulatory responsibilities and are mandated to enforce laws.

- **ORGANIZATION OF THE GUIDELINES MANUAL**
  The document is divided into five parts, each with relevant annexes:
  - Chapter 1 is a general section that introduces the different entities in the environmental management of industrial estates and their roles and responsibilities.
  - Chapter 2 addresses the planning activities of the estate including all activities undertaken to establish the estate and locate the facilities within it.
  - Chapter 3 is dedicated to the environmental management of existing estates. It includes different chapters each addressing a common environmental aspect of the estate
  - Chapter 4 addresses emergency preparedness and response at the estate level
  - Chapter 5 provides case studies from industrial estates in other countries and the best available practices.

CHAPTER 1: GENERAL

1.1. INTRODUCTION

The industrial estate management is the authority responsible for managing all activities related to the establishment of facilities within the boundaries on the estate. The estate management is usually formed after the planning and design of the estate.

The estates management is affiliated to the Governorate Board of Directors for Industrial Estates headed by the governor, established by decree no 97/2002 of the Prime Minister. The board is composed of:

- Heads of the estates management in the governorate
- Representative of the Ministry of Industry
- Representative of the General Authority for Investment
- Three investors in each industrial estate in the governorate
- Other members that the board may designate.

The board of directors has the following responsibilities:

- Setting general policies for the development of the management of industrial estates in the governorate
- Setting unified procedures for the estate's management in the governorate regarding general conditions for land acquisition and costing.
- Supervising the investment policy and plan in the estates of the governorate
- Planning for the required infrastructure and finance in the estates
- Reviewing the applications for establishment of projects in the industrial estates
- Discussing the recommendations submitted by the management of industrial estates in the governorate
- Following-up on the projects in the industrial estates
- Enhancing the services in the estates and setting conditions for environmental protection
- Preparing investment promotion plan for the industrial estate
- Evaluating the performance of the estate financially, technically and administratively

The mandates of the estate management include:

- Implementing all decisions of the Governorate Board of Directors for Industrial Estates
- Provision of land to investors
- Engineering follow-up on the construction activities in the estate
- Operation and maintenance of the industrial estate
- Provide recommendations to the Board of Directors for estate development

1.2. PARTIES INVOLVED IN THE ENVIRONMENTAL MANAGEMENT OF INDUSTRIAL ESTATES

1.2.1 Responsibilities of the Different Entities

It is important that each entity assumes its responsibility towards environmental management of the industrial estate. Different partners include:

- **Industrial Estate Management**

  The estate management is responsible for ensuring a sound environmental management of the industrial estate. As a principle, the estate management does not duplicate the responsibilities of any other entity.

  The estate management is not directly responsible for the environmental performance of the facilities as long as it does not affect the external environment. It is rather concerned with environmental issues at the industrial estate level (its impacts on the vicinity as well as the impacts of neighboring activities on the estate). Such issues sometimes negatively affect the facilities and it's required that the facilities should resolve these issues.

- **Facilities**

  Facilities are responsible for the compliance with:
  - Requirements of the environmental regulations
  - Conditions and mitigation measures included in the facility and estate EIA approval
  - Contractual requirements of the estate management

  The Egyptian environmental legal system includes a number of environment-related regulations that go back to the 1950s. The environmental laws and regulations relevant to industry include:
  - Law 4/1994, law of the environmental and its executive regulations (ER)
  - Law 48/1982 for the discharge on water bodies and its
  - Law 93/1962, and the Ministerial decree no 44/2000 for the discharge on the public sewer system
  - Law 12/2003, law of labor, and the Ministerial decrees implementing it (Decree 126/2003, Decree 134/2003, Decree 211/2003)
  - Law 453/1954 concerning the conditions for industrial and commercial facilities

  Annex (1.1) provides a summary of the requirements of the laws and regulations.

- **Regulatory Agencies**

  The regulatory agencies are responsible for ensuring that the facilities comply with environmental regulations. The agencies monitor to check the compliance of the facilities and enforcement measures are taken in cases of non-compliance.

- **Service Entities**

  The service entities are responsible for providing required service to the facilities in return for an indicated fee. They are also responsible for the maintenance and management of the service-related utilities such as electricity cables, wastewater network water pipelines etc.

1.2.2 Understanding Among Different Entities

- **Relation of the Estate Management with Industrial Facilities**

  The relation between the estate management and the industrial facilities is indicated by the contract between the two parties. In general, it is a cooperative relation aiming at maintaining a sound level of environmental management in the estate.

  In principle:

  - The facility should undertake its responsibilities according to the contractual agreement with the estate management and should take actions needed to comply with applicable environmental laws and regulations
  - The estate management will not interfere in the facility's internal affairs unless it has an impact on the environment in the estate.
  - The estate management should maintain the confidentiality of the information provided by the facilities regarding its environmental status and will not report the violations by facility to the regulatory agencies unless they are persistent and having negative impact on the estate
  - The facilities are expected to cooperate with the estate management regarding activities that are aimed at ensuring sound environmental management within the estate

- **Relation of the Estate Management with Regulatory Agencies**

  The regulatory agencies are responsible for ensuring that the facilities comply with applicable environmental laws and regulations. The estate management should not be an "insider" whose responsibility is to provide information to the regulators regarding the environmental status of the facilities. Its role should be oriented towards supporting the facilities to comply.

  The estate management, however, has the right to inform the regulatory agencies on the violations in case they are persistent and negatively affect the estate.

  The estate keeps the right to report contractors violating e.g. solid waste management contractors, as a public complaint.

  The estate management could also seek the help of these agencies, especially for ambient environmental monitoring.

- **Relation of the Estate Management with Service Providers**

  The estate management could acquire information regarding the service supply from the service agencies. They could also inform the service agencies of needs for maintenance, service improvement or modifications based on the analysis and identification of needs they will undertake. The expertise of the service agencies could also be sought for awareness raising among the facilities.

- **Establishment of an Environmental Unit in the Estate Management**

  The environmental management of the estate level is the responsibility of the estate management. The estate management could prefer to establish a dedicated environmental unit responsible for the environmental activities. However, it is not a necessity that such a separate unit is established.

  This part will be filled in later with the establishment of the environmental unit in Qeft

  Number of employees

  Qualifications and technical background

  Needed equipment

  Needed training

  Annex (1.2) provides a background on the institutional framework for environmental management at the industrial estate.

1.3 TOOLS UTILIZED BY THE ESTATE MANAGEMENT

The estate management has no legal power on the facilities and thus cannot impose any requirements on the facilities by law. However, the estate management can use the Contractual Agreement signed by the facility before its establishment effectively for this purpose.

Contractual enforcement is a tool that is currently being used in the estate, although it does not always include environmental conditions. There is a high potential for using such tool to ensure that facilities abide by environmental considerations of the estate. The tool is essential especially to ensure the continual cooperation and information exchange of the facility.

Other tools that could be assumed by the estate management include:

- Awareness and promotion for adopting environmental management measures
- Moral incentives for facilities implementing environmental protection measures
- Public pressure could be mobilized towards facilities with high pollution loads
- Seeking finance programs and donors to help facilities to implement pollution control measures

Provision of environmental services that assist in the environmental management activities such as common wastewater treatment plants, solid waste transfer stations, etc.

ANNEX 1.1 ENVIRONMENTAL LAWS AND REGULATIONS

***Table 1**: Laws Related to Air Protection*

Law	Regulated Aspect	Regulated Community	Regulatory Instrument											Regulatory Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/Equipment Specifications	Management/ Handling/ Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/ Prohibition	To be Addressed in Registers	
Law 4/1994 for the Environment and its executive regulations	Fuel burning	All establishments			L40 ER42		ER42	ER42			ER42			Governorates
	Open burning	Establishments in residential areas and industrial areas										ER42 ER38		Governorates
	Emissions from industrial establishments	Industrial establishments			ER42	ER42								Governorates
	Vehicles Exhaust Emissions	Vehicle, machines or engines			L36 ER37									Governorates/Ministry of Interior
	Ambient air emissions	All establishments			ER34	ER34								
	Ambient Noise	All establishments			L42 ER44	L42 ER44								Governorates
	Petroleum industry specifications	Petroleum production and refining facilities						L41 ER43	L41 ER43	L41 ER43	L41 ER43			Ministry of Petroleum
	Radioactive material	All establishments			L47 ER49									Ministry of Electricity and Energy
	Air emissions from all sources	All establishments											L22 ER18	
	Air protection in	Establishments	L21											EEAA/CAAs

Law	Regulated Aspect	Regulated Community	Regulatory Instrument											Regulatory Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/Equipment Specifications	Management/ Handling/ Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/ Prohibition	To be Addressed in Registers	
	new establishments or expansions	included in Annex 2	ER10 ER12											
Decree no 495/2001	Emissions from bricks kilns	Bricks facilities			1									Governorates
Law 453/1954 and its decrees concerning general conditions in commercial and industrial establishments and its decrees	Fuel burning	All establishments					L25	L24	L24 L25	L25	L24			- Ministry of Housing, Utilities and Urban Communities - Governorates
Law 66/1973 for Traffic modified by law 155/1999	Environmental aspects related to vehicles including noise, solid waste and emissions	All vehicles		L11								L44 ER65		Ministry of Interior/Governorates
Law 45/1949 concerning noise pollution from sound amplifiers	Ambient noise	All establishments		L1				L1				L1,4		Governorates

Table 2: Laws Related to Water Protection

Law/Decree	Regulated Aspect	Regulated Community	Regulatory Instruments											Competent Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/ Handling/ Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/ Prohibition	To be Addressed in Registers	
Law 48/1982 and related decrees concerning the discharge on waterways and its executive regulations(decree no 3/1983)	Discharge of wastewater on Nile and Canals	All establishments		L6 ER12-20	ER61		ER4	L9,10				ER5		-Ministry of Water Resources and Irrigation, Ministry of Interior -Monitoring: Ministry of Health
	Discharge of wastewater or fuel leaks to waterways	Boats and other mobile sources		L6	ER5							L5		-Ministry of Water Resources and Irrigation, Ministry of Interior -Monitoring: Ministry of Health
	Discharge of wastewater on drains	All establishments		ER66	ER66			ER67						-Ministry of Water Resources and Irrigation, Ministry of Interior -Monitoring: Ministry of Health
	Discharge to underground reservoirs	All establishments		ER6 ER12	ER6 ER61			ER67			ER6 ER8			-Ministry of Water Resources and Irrigation, Ministry of Interior -Monitoring: Ministry of Health
Law 93/1962	Discharge of	All		L6,7	14 in			10 in				10 in		-Ministry of Housing,

Law/Decree	Regulated Aspect	Regulated Community	Regulatory Instruments											Competent Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/ Handling/Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/ Prohibition	To be Addressed in Registers	
modified by the decree 44/2000 concerning the discharge on public sewer systems	wastewater on public sewer system	establishments			decree			decree				decree		utilities and New Communities - Monitoring: Ministry of Health
	Reuse of wastewater in irrigation	All establishments	10 in decree	10 in decree	10 in decree			10 in decree	10 in decree		10 in decree	10 in decree		- Ministry of Health for permits - EEAA for EIA
Law 4/1994, law of the environment	Discharge of wastewater on marine water	All establishments		L70	L70 ER 59			L72 ER57	ER57		L72 ER57	L69		- Governorates - Monitoring: Ministry of Health
	Discharge of wastewater to any receptor	All establishments											L22 ER18	EEAA/Governorates
	Water protection in new establishments and expansions	Establishments in Annex 2	L21 ER10 ER12											EEAA/CAAs
Law 453/1954 and its decree (380/1975)	General conditions for sewer connections and network	All establishments		L19				L11	L20	ER10	ER10			- Ministry of Housing

Table 3: Laws Related to Work Environment Parameters

Law	Regulated Aspect	Regulated Community	Regulatory Instruments											Regulatory Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/Handling / Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/Prohibition	To be Addressed in Registers	
Law 4/1994	Noise	All establishments			ER44	ER44		L42 ER44		L42 ER44				Ministry of Manpower
	Work Environment Emissions	All establishments			ER45	ER45		L43 ER45		ER45	ER45			Ministry of Manpower
	Humidity	All establishments			ER46	ER46		L44 ER46		L44 ER46	L44 ER46			Ministry of Manpower
	Temperature	All establishments			ER46	ER46		L44 ER46		L44 ER46	L44 ER46			Ministry of Manpower
	Ventilation	All establishments			ER45 ER47	ER45 ER47		ER45 ER47						Ministry of Manpower
	All work environment parameters	All establishments											L22 ER18	EEAA/Governorate
	Work environment protection in new establishments and extensions	Establishments in annex 2	L21 ER10 ER12											CAA/EEAA
Law 137/1981 regarding safety and occupational health and its ER decree no 55/1983	Work Environment emissions/chemical risks	All establishments			ER5	ER5		ER5		ER5	ER5	ER 5		Ministry of Manpower
	Humidity				ER5			ER5		ER5				Ministry of Manpower

Law	Regulated Aspect	Regulated Community	Regulatory Instruments											Regulatory Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/Handling / Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/Prohibition	To be Addressed in Registers	
	Lighting	All establishments			ER5			ER5	ER5					Ministry of Manpower
	Temperature	All establishments			ER5	ER5		ER5		ER5				Ministry of Manpower
	Noise	All establishments			ER5	ER5		ER5		ER5				Ministry of Manpower
	Fire	All establishments							ER2	ER2				Ministry of Manpower
	Radioactive Material	All establishments		ER5						ER5				Ministry of Health
	Mechanical Risks	All establishments							ER5	ER5				Ministry of Manpower
Decree no 48/1979	Work environment emissions	All establishments			2				2					Ministry of Manpower
	Humidity	All establishments			1									Ministry of Manpower
	Lighting	All establishments			1									Ministry of Manpower
	Temperature	All establishments			1	1								Ministry of Manpower
	Noise and vibrations	All establishments			1									Ministry of Manpower
Decree 265/1989 of law 59/1960 regulating the use of ionizing radiation	Use of ionizing radiation	- Radiographic Industrial Photography - Health facilities		1	5,7	7		3	3,7	2,3,7		7		Ministry of Health
Law 46/1958 addressing work in mines and quarries	Working conditions in mines and quarries	All mines and quarries							14	14	14	14		Ministry of Manpower Ministry of Industry

Table 4: Law Related to Hazardous Waste Management

Law	Regulated Aspect	Regulated Community	Regulatory Instrument											Regulatory Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/ Handling/ Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/Prohibition	To be Addressed in Registers	
Law 4/1994	Hazardous waste	All establishments generating/handling hazardous wastes											L33 ER33	EEAA/Governorates
	Hazardous waste handling	All establishments generating/handling with hazardous wastes		L29 L31 ER25 ER26 ER29				ER28	L30 L31 ER28	L33 ER28	ER28			-Governorate -Permit is granted by one of the 6 line ministries responsible for permits[1]
	Hazardous waste management (reduction, identification and segregation)	All establishments generating/handling with hazardous wastes						ER28	ER28					Governorates
	On-site storage	All establishments generating/handling with hazardous wastes							ER28	ER28	ER28			Governorates
	On-site treatment	All establishments generating/handling with hazardous wastes		L29 L31 ER25 Er26 ER27 ER28				L31 ER20						Governorates/EEAA approval
	Collection and transportation	Transportation facilities		L29 ER25 ER26				ER28	ER28	ER28				Governorates

[1] Ministry of Electricity, Ministry of Petroleum, Ministry of Agriculture, Ministry of Interior, Ministry of Industry, Ministry of Health

Law	Regulated Aspect	Regulated Community	Regulatory Instrument											Regulatory Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/ Handling/ Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/Prohibition	To be Addressed in Registers	
				ER28										
	Treatment of hazardous waste	Treatment facilities		L29 L31 ER25 ER26 ER28 ER29				ER28	ER28	ER28	ER28			Governorates[2]
	Disposal of hazardous waste	Disposal facilities		L29 L31 ER25 ER26 ER28 ER29				ER28	ER28	ER28	ER28			Governorates[3]
	Hazardous waste importing	All establishment										L32 ER30		Ministry of Finance (Customs)
	Hazardous waste management in new establishments and expansions	Establishments in annex 2	L21 ER10 ER12											EEAA/CAAs
Law 48/1982 and its decrees	Discharge of hazardous and toxic wastes to waterways	All establishments										ER4 ER6		Ministry of Irrigation
	Storage of toxic wastes on the banks of waterways	All establishments		ER3										Ministry of Irrigation
	Discharge of toxic wastes to underground reservoirs	All establishments										ER8		Ministry of Irrigation

[2] License is granted after discussions with Ministry of Manpower, Health and the Ministry concerned with the type of waste as well as EEAA

Table 5: *Laws Related to Hazardous Substances*

Law	Regulated Aspect	Regulated Community	Regulatory Instruments											Regulatory Authority
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/Handling / Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/Prohibition	To be Addressed in Registers	
Law 4/1994	Hazardous substances handling	All establishments		L29 ER25 ER26				ER31	ER31	ER31	ER31			- Governorates/EEAA - License is granted by one of the six ministries[3]
	Hazardous substances containers	All establishments							ER32	ER32				Governorates/EEAA
	Hazardous substances management in new establishments and expansions	Establishments in annex 2	L21 ER10 ER12											EEAA/CAA
Decree 215/1985 of law 53/1966	Use and handling of pesticides	All establishments		6					14 15	15		1		Ministry of Agriculture
Decree no 48/1977 of law 53/1966	Safety procedures for handling pesticides	All establishments								1				Ministry of Agriculture
Law 137 and its decrees (decree 48/1967)	Awareness of workers of the hazardous nature of substances	All establishments								2				Ministry of Manpower
	Storage of hazardous material	All establishments							13	13				Ministry of Manpower
	Substitution of hazardous substances whenever possible	All establishments					2							Ministry of Manpower

[3] Ministry of Electricity, Ministry of Petroleum, Ministry of Agriculture, Ministry of Interior, Ministry of Industry, Ministry of Health

Table 6: Laws Related to Solid Wastes

Law	Regulated Aspect	Regulated Community	Regulatory Instrument											Regulatory Authorities
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/Handling / Storage Conditions	Safety Consideration	Pollution Control Conditions	Restriction/Prohibition	To be Addressed in Register	
Law 4/1994	Solid waste treatment and disposal sites			L37 ER38				ER38	E38	E38	E38			Governorates
	Solid waste burning in special incinerators	All establishments		ER38	ER38	ER38	ER38	ER38	ER38	ER38	ER38			Governorates
	Solid waste open burning	All establishments										ER38		Governorates
	Solid waste transportation	Vehicles						ER39	ER39	ER39	ER39			Governorates
	Construction and demolition waste management and storage on site	All establishments							ER41					Governorates
	Construction waste transportation							ER41	ER41	ER41				Governorates
	Construction and demolition waste disposal	Solid waste disposal facilities		ER41				ER41	ER41					Governorates
	Solid waste management	All establishments											L22 ER18	EEAA/Governorates
	Solid waste management in new	All establishments in annex 2	L21 ER10 ER12											EEAA/CAAs

Law	Regulated Aspect	Regulated Community	Regulatory Instrument											Regulatory Authorities
			To be Addressed in EIA	License/Permit	Allowable Limits	Exposure Time	Input Conditions	Technological/ Equipment Specifications	Management/Handling / Storage Conditions	Safety Considerations	Pollution Control Conditions	Restriction/Prohibition	To be Addressed in Register	
	establishments and expansions													
Law 38/1967 concerning cleanliness and sanitation and its executive regulations (decree 134/1968)	Collection, transportation of solid waste	Vehicles						L6 L12 L14 L15	L5 L13 L16	L10				Governorates
	Use of solid waste as a fuel	All establishments										ER17		Governorates
	Solid waste storage	All establishments						ER6						Governorates
	Solid waste transportation	Vehicles		ER14				ER14 ER15				ER5		Governorates
	Solid waste disposal	Solid disposal facilities						ER17		ER17	ER17	ER17		Governorates
	Fencing of vacant land	Owners of vacant lands							ER22					Governorates
Law 140/1956 concerning roads and its decrees	Solid waste from Construction works and its transportation	All establishments							ER7 ER11					Governorates
Law 48/1982 and its executive regulations (decree 8/1983)	Storage or disposal of solid waste on the banks of waterways	All establishments		L2 ER2										Ministry of Irrigation

ANNEX 1.2: DEMONSTRATING EFFECTIVE ENVIRONMENTAL MANAGEMENT OF INDUSTRIAL ESTATE THROUGH INSTITUTIONAL FRAMEWORK.

The establishment of facilitating enterprises such as Environmental Management / Co-ordination / Promotion Units within the Industrial Estates has provided major boosts to their everyday running. Such enterprises offer much-needed hands-on support to multi-sectoral as well as multi-sized businesses (as is often the case) within the industrial estate in the form of awareness, training, B2B exchange information, by-product exchanges and thus, general eco-industrialization of the estate. Thus, these institutes have evolved to become a one-stop shop for all the environment management and business needs of the industries. Refer to Box 1.

Box 1 Institutional framework for environmental management of Industrial estate

Burnside Industrial Park of Nova Scotia, Canada[4], after establishment the Estate Management undertook a number of projects/activities aimed towards "eco-industrializing" the Park. The Estate Management has establishment of an environmental management unit. Teaming up with the Dalhousie University, School for Resource and Environmental Studies, Nova Scotia Power Inc. and the Nova Scotia Department of the Environment, the Halifax Regional Municipality (i.e. the Estate Management) created a "catalyst" institution called the Eco-efficiency Centre which has the following functions:

- The Eco-Efficiency Centre promotes networking, serves as an information resource, undertakes environmental reviews and supports educational and training programs among firms in the Park.
- It encourages companies to join an Eco-Business program adopting an environmental code or policy, setting objectives and targets and, competing for reduction or conservation awards.
- In 2001, the Centre began testing the Efficient Entrepreneur Calendar and Assistant[5] developed jointly by the Wuppertal Institute and UNEP-DTIE to encourage companies to track their performance in terms of eco-efficiency.
- The Centre also supports a province-wide waste materials exchange programme. Most notably, all of these projects/activities have helped the Park greatly in terms of solid waste management issues. Nearly 50%[6] of all materials that would otherwise be destined for a landfill are now diverted for other purposes.

The Environmental Enhancement Centre of the Industrial Estate Authority of Thailand (IEAT)[7] is a technology transfer and information centre. Its focus is on pollution control, clean technology, environmental management, industrial safety and environmental awareness among the industries. The Centre provides information to entrepreneurs, consultants and technocrats on environmental issues and concerns. The Centre also has an annual seminar programme providing opportunities for firms and consultants to present information on technologies to industrial operators, consultants, entrepreneurs, government agencies and academic groups. Finally, the Centre provides exhibition space for display and demonstration of environmental technologies.

[4]Unless otherwise mentioned, sourced from http://www.uneptie.org/pc/ind-estates/casestudies/Burnside.htm (Accessed March 27, 2004)

[5] Refer to www.efficient-entrepreneur.net/ for more information. (Accessed March 27, 2004)

Lessons learnt: Novel environmental institutional frameworks have formed the cornerstone to the successful operation of an industrial estate. Institutionalising has helped in bringing a varied experience to the table for managing the environmental issues and concerns of the industries effectively.

[6] Final Report: Experts Forum on Environmental Management Systems for Industrial Estates, 21-23 October 1998, Singapore. Available at: http://www.riet.org/forum/forum-files/final-report-web.doc (Accessed March 25, 2004)

[7] The Environmental Management of Industrial Estates by the United Nations Environment programme. Available at: www.uneptie.org/pc/ind-estates/pdf_documents/ TR39/TR39-Eng.pdf (Accessed March 27, 2004)

CHAPTER 2: PLANNING ACTIVITIES

2.1. ESTABLISHING THE INDUSTRIAL ESTATE

Industrial estates tend to modify social and natural environment in order to create or enhance the standard of living and economy of the region. Establishing an environmentally sound industrial estate would require sustainable planning and operation taking into consideration different environmental and social aspects in relation to the proposed development.

The key environmental issues associated with the industrial estate development should be addressed in the development plan and identified through an environmental assessment process.

Establishing new industrial estates includes three stages: planning, designing and operating. Figure 2.1 presents a flow diagram for the three stages.

- The planning stage considers selecting the most suitable site, defining potential industries, identifying potential environmental and socio-economic impacts and preparing strategic EIA.
- The designing stage considers planning the internal layout, establishing an effective zoning, planning of common infrastructure, and assessing possible cumulative impacts.
- The operating stage considers preparing facility level EIAs, maintaining and updating environmental quality data for the estate and assisting the facilities to achieve environmental compliance.

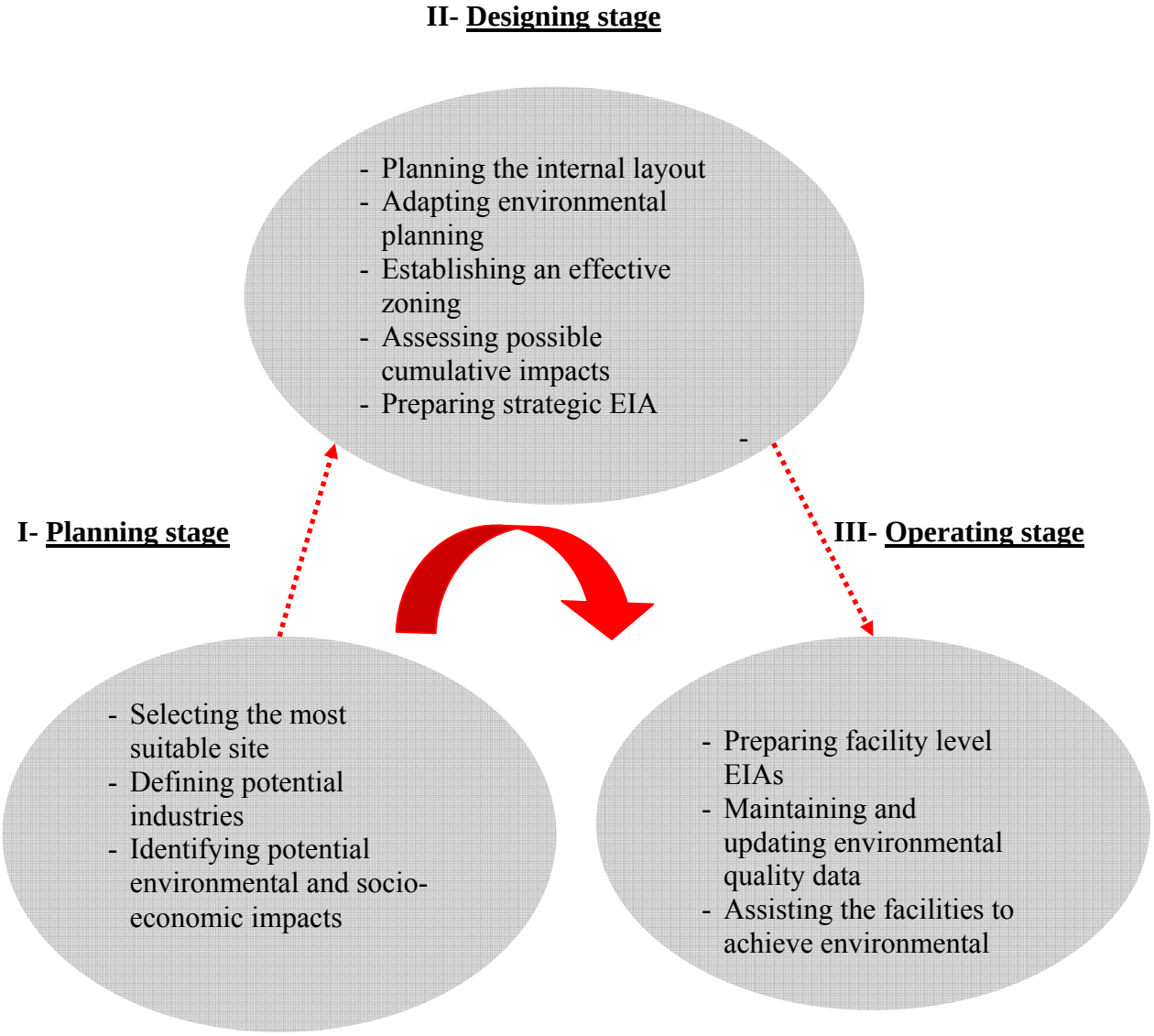


Figure 2.1: Industrial Estates Establishments

2.1.1. Planning Stage

The industrial estate development plan should cover issues such as:

- Details of the location (Topography, Hydrology , Metrology)
- Mix of industries on the site (to ensure their compatibility)
- Layout and design
- Fuel storage
- Availability of basic infrastructure (electricity, water, transport)
- Air quality management
- Water quality management including effluent treatment facilities
- Solid waste management
- Management of hazardous materials and hazardous wastes
- Noise control
- Occupational health and safety issues
- Emergency preparedness and response plan

2.1.1.1. Selecting the Most Appropriate Site

Inaccurate selection of the location of the industrial estates could lead to irreversible loss to certain habitat or change in the natural ecosystem. For example, reclamation of valuable ecosystems such as wetlands for the construction of an industrial estate destroys the habitat for many animal and plant species.

Selecting appropriate sites for industrial estates involves a comprehensive planning process, in which the management agency should examine relevant variables, identify locations that meet key criteria, consider environmental and socio economic impacts and finally acquire the site. Effective environmental decision about site selection would require:

- Avoiding environmentally-sensitive areas such as wetlands, forest etc
- Identifying sites where environmental impacts could be minimized by good site planning and management
- Choosing gently sloping land with poor soil and limited vegetation
- Avoiding areas prone to floods, mud slides and earthquakes (they are neither cost-effective nor environmentally appropriate)
- Re-using previously developed sites to help contain urban sprawl and avoiding exploitation of agriculture lands, wetlands, forest or other significant natural resources
- Investigating previously used lands to ensure the absence of toxic wastes, underground storage tanks, and other forms of air, water (surface and ground) or water pollution.

2.1.1.2. Defining Potential Industries

Inappropriate consideration of the size of the industrial estate or type of industries to be located within the estate could cause over consumption and depletion of existing resources.

Therefore, it is very important to identify and classify industries to be included in new industrial estates. This includes the scale of industries, large, medium or small, as well as the type of industries, heavy industries, light manufacturing or service industries. Depending on these factors, required infrastructure and services could be identified.

These factors would also influence the site selection process as well as other crucial issues such as expected water and energy consumption.

Annex 2.1 provides a case study related to sitting of industrial estates.

2.1.2. Design Stage

2.1.2.1. Designing the Internal Layout

Designing the internal layout of the industrial estate would require consideration of key planning principles that enables industries to co-exist with natural systems. These planning principles include:

- Assessing the carrying capacity of the site for air, water, land and safety for human health.
- Minimizing the disruption of natural areas and indigenous vegetation
- Retaining natural drainage systems
- Retaining the existing land use pattern
- Developing common environmental infrastructure for the industrial estate.

2.1.2.2. Adopting Environmental Planning

The conventional planning of industrial estates incorporates land use, transportation, and waste treatment as well as infrastructure demands. This master plan aims to provide a balanced approach to development while considering the long term implications of all major elements in the development process.

Environmental planning, on the other hand, recognizes that development and environmental preservation are not necessary conflicting goals. It provides the missing environmental perspective in conventional planning. Adopting environmental planning, therefore, aims at:

- Building the planning process on reliable information about the likely environmental impacts
- Optimizing the communities' use of energy and materials without exceeding a region's carrying capacity.
- Developing the aesthetically appealing landscape that is a functional combination of the natural and built environment.

2.1.2.3. Establishing Effective Zoning

Based on the identified potential industries to be located in the industrial estate, the most appropriate zoning scheme could be prepared. It would consider clustering and/or dispersing industries depending on their material and energy consumption, operations, waste generated, This would help in effective management of the infrastructure and utilities. e.g. Heavy industries consuming high energy can have a common dedicated energy supply rather then having individual captive power plants, hazardous waste management and disposal from a petrochemical zone would be easier as compared to dispersed petrochemical industries within the sector. This would provide an opportunity to establish an industrial ecosystem as well as minimize the possibilities of industrial accidents. Criteria for effective zoning include:

- Sitting of complementary industries in the same premises
- Providing sites with required infrastructure for a conglomeration of industrial units

- Supplying common system of effluent treatment thereby making them more affordable to smaller units which are unable to install such facilities on their own

2.1.3. Preparing Strategic EIA

The strategic EIA is an important tool in environmental planning. It is used to predict the potential cumulative impacts of a proposed development project, programme or policy (i.e. environmental and socio-economic impacts). By identifying potential problems, project planners and engineers can execute the project with maximum benefits without causing inadvertent problems.

The other purposes of the strategic EIA include:

- Identification and mitigation of environmental impacts due to common environmental infrastructure such as wastewater treatment plants, solid waste transfer stations etc.
- Evaluation of environmental effects due to regional policy changes , e.g. implementation of waste minimization standards, use of alternative fuel for fossil fueled power and heating plants
- Assessment of requirements for regional environmental review, implementation of mitigation measures and monitoring programs.

In the case where a strategic EIA is prepared for the industrial estate as a whole, the cumulative impacts of the facilities combined will be assessed. The estate may include several large facilities or a number of small projects or a combination. The estate EIA may, in some cases, substitute the project specific EIA by producing guidelines and criteria for the design and implementation of projects in the estate. More often, it will result in identification of the major environmental issues in the sector and development of a database, enabling project specific EIAs to proceed more expeditiously.

2.1.3.1 Identifying Potential Environmental and Socio-economic Impacts

Industrial estates could lead to adverse environmental and social impacts, if not planned, developed and operated properly.

- *Environmental Impacts*

  Environmental impacts could arise either as a change in Land use pattern due to construction and operation of the facilities.

- *Change in Land use pattern*

  Land Acquisition for the purpose of establishment of an industrial estate may result in partial or complete loss of:
  - Ecological habitats
  - Sites of historical or cultural importance
  - Valuable land, e.g. agricultural, residential
  - Aesthetics

- *Construction*

  The construction phase causes air emissions, liquid effluents, solid waste and noise. These could lead to environmental degradation. Environmental concerns of these activities could result from the generated:
  - Air emissions; smoke, fumes, exhaust gases and dust

- Liquid effluents; wastewater containing suspended and dissolved solids, oils and grease
- Solid waste; sand, cement, brick, aggregates, steel, aluminum, wood, paper, plastic bags, etc.
- Noise from operation of machinery and vehicles
- Accidents at work place
- Municipal solid and liquid waste from workers at site and offices.

- *Operation of Industrial Estates*

During the operational phase, the usual environmental impacts associated within individual industrial establishments exist. They arise from:

- Consumption of materials, water and energy in manufacturing operations (processes and utilities)
- Storage, handling and / or transport of hazardous material
- Release of residues to air, water, soils, sewerage system
- Release of light, heat, noise, vibration, or other radiation
- Generation and disposal of wastes (process wastes, surplus materials, hazardous wastes)
- Accidents- explosions, accidental releases, spills, fire, etc.
- Vehicle movements on and off site
- Housing (residential) facilities provided to the workers

However, these problems tend to be intensified due the cumulative impacts of different sources. The most common impacts include, air pollution water pollution and soil contamination.

Inefficient environmental management system during operational phase can lead to long term habitat and biodiversity loss, pollution of water catchment areas, natural resources depletion, change in Land use pattern and local nuisances such as noise, odour etc.

- *Social Impacts*

Social impacts could arise due to improper sitting of the industrial estate or other factors that were not accurately examined such as community displacement, competition for resources and interference of activities.

The improper sitting of the industrial estate could lead to socio-economic impacts to neighboring communities. Establishing industrial estates over flat agriculture lands located next to urban centers, for example, would certainly lead to a loss of high quality land suitable for agriculture. That would not only lead to an economic loss, but it would also lead to loss of livelihood by farmers. On the other hand, establishing the industrial estate in other area that does not have an economic or ecologic significance would increase the socio-economic benefits of existing communities (i.e. more income and more job opportunities).

Moreover, failing to estimate the industrial estate's water consumption could lead to a shortage in the water supply for the local community, and the depletion of available

water resources. Also, not considering the housing and the transportation of the industrial estate's work force would certainly put a tremendous strain on the existing infrastructure of neighboring communities.

Establishing a new industrial estate could also require resettlement of existing residential communities, which could be a reason for losing income sources from previous land uses. Furthermore, the neighboring communities will face the risk of industrial accidents (e.g. hazardous material spills and pollution).

2.1.3.2. Assessing Cumulative Impacts

In addition to facility specific impacts, estimation should be made of the total environmental load when the estate is fully developed and operational. The final impact depends greatly on the sensitivity of the local ecosystem to environmental pollution thus it is necessary to study the sensitivity of the local ecosystem to pollution. In some situations, this would require to model the environmental interactions that are likely to arise from hypothetical set of environmental pollutions. Such work would necessitate obtaining large amount of complex data and a trained assessment team to carry out these tasks.

2.1.4. Operating Stage: Preparing Individual Environmental Impact Assessment (EIA)

Along with strategic EIA for industrial estate each industrial facility should provide an individual EIA to assure compliance to the law requirements regarding emissions and effluents. However, the scope and the size of the required EIA would vary. More details about the EIA requirements and process are presented in section 2.4.

2.2. MONITORING AND CONTINUOUS UPDATING OF ENVIRONMENTAL BASELINE

It is necessary to provide a continuous monitoring and updating of the environmental conditions, on which environmental management objectives could be set.

Baseline data about the existing environment could be found in the strategic EIA of the industrial estate or the individual EIAs prepared by the industrial facilities. The baseline data should describe the following:

- Land characteristics and use
- Landscape character and existing views
- Ecosystems and Habitats with flora and fauna
- Water including hydrology, ground and surface water and water quality
- Air quality and Meteorology
- Noise levels
- Sites of historic and cultural significance
- The social and economic context such as availability of labor, types of economic activities undertaken by the community, composition of the community
- Traffic flows and transport infrastructure
- Utility services

Nevertheless, in case the strategic EIA is not available, the estate management should compile the above mentioned baseline information. Reliable sources of information include but are not limited to:

- Urban planning departments of the Governorate

- Environmental management unit of the Governorate
- Regional branch offices of the Egyptian Environmental Affairs Agency (EEAA).
- National Protectorates Department, Egyptian Environmental Affairs Agency (EEAA).
- Environmental monitoring projects of EEAA
- Scientific entities and universities of the Governorate.

2.3. ENVIRONMENTAL CONSIDERATION IN LOCATING FACILITIES

Locating facilities within the industrial estate is a process based on set criteria that is applied to the conditions of the estate. These conditions differ from one estate to another according to the nature of industries, location of estate, topography, wind direction and neighboring sensitive areas.

The environmental considerations are thus functions of the estate-specific nature. These considerations are indicated based on the knowledge of the industrial processes, raw material, generated pollutants, expected hazards of the new facility and its effect on the existing ones. Based on this knowledge, it will be possible to locate the new facility according to:

- Air emissions-specific conditions
  Avoid locating facilities in areas where:
  - The air emissions generated from the facility negatively affect the ambient environment whether individually or through the reaction with pollutants from other facilities
  - Air emissions from the facility negatively affect the processes and the product quality of existing facilities by making the air quality unsuitable for the manufacturing or imposes higher costs for production due to pre-treatment
  - Air emissions generated from neighboring facilities will negatively affect the processes of the new facility

- Wastewater-specific conditions
  Avoid locating facilities in areas where:
  - Wastewater from the new facility represents a load on the sewers in the area or incompatible with wastewater of other facilities

- Emergency-specific conditions
  Avoid locating facilities in areas where:
  - The facility's raw materials, processes or finished products might be endangered in cases of emergencies in neighboring facilities
  - The nature of the processes in the facility might magnify hazards for existing facilities in cases of emergencies
  - The type of processes and material in the facility require specific emergency conditions and arrangements that might not be possible to provide in the investigated area
  - The facility represents a hazard for existing facilities in cases of emergencies

- Noise-specific conditions
  Avoid locating facilities in areas where:

- The noise generated from the facility negatively affect the ambient noise in the area and exceeds it above the acceptable limit especially with the presence of sensitive recipients

- Water and Electricity-specific conditions
  Avoid locating facilities in areas where:
  - The facility requirements of water or electricity could not be supplied in this area due to insufficient network layout or will represent an additional load on the network
  - The facility requirements will make the consumption to its peak level which might imply future problems (water unavailability or excessive electrical demand)

2.4. DIRECTING THE FACILITY TO PREPARE AN EIA

2.4.1. Introduction to the EIA Process

The Environment Law No. 4 of 1994 and the Executive Regulations issued by Decree No. 338 of 1995 states that new establishments or projects as well as expansions of existing establishments must be subject to an "Environmental Impact Assessment" (EIA). The assessment includes the project phases, site preparation, construction, commissioning, operation, maintenance and decommissioning. The purpose of the assessment is to guarantee the protection of the natural resources and eliminate/reduce the pollution effects on human being, animals and plants.

In the first place, it aims at implementing the projects in a way that ensures reducing the resultant environmental impacts to the maximum degree possible and maintaining the economic and social returns. Taking the environmental dimension into consideration during the planning process, it will achieve economy and time-savings for all the parties, when the project is being implemented, including the project owner and the units responsible for preserving the environment.

For industrial development projects, EIA may be needed for:
- Development of land as industrial estates on which services and infrastructure are provided in advance to the occupying industries
- Specific industrial projects on existing serviced industrial land

2.4.2. Key Players in the EIA System

The two main players are:

a. Proponents

Proponents are responsible for the preparation of the EIA according to conditions and guidelines set by the regulator.

b. Regulators

Regulators include:

- Competent Administrative Authorities (CAAs), who are responsible for EIA receipt, checking EIA completeness, field investigations, and post-project monitoring to ensure that approved mitigation measures are adopted.

  - Egyptian Environmental Affairs Agency (EEAA) is responsible for managing the EIA system, reviewing EIAs, and providing its opinion on EIAs to the CAAs.
- The regulators are jointly responsible for protecting the environment, health of community (stakeholder), and achieving a balance between development and environmental protection.

Annex (2.2) explains the EIA regulatory framework.

2.4.3. Proposed Role of Estate Management

- The estate management allocates the location of the facility while taking into consideration the environmental factors to avoid future undesirable impacts.
- The estate management in the industrial estate could aid in directing the proponent to the correct EIA category to which the facility belongs using the EIA lists (annex 2.3). and provide the proponent with EIA forms A and B (annexes 2.4)
- In case where strategic EIA is available, the estate management should provide the facility with the conditions included in the strategic EIA to be reflected in the individual EIA.
- The estate management could also ensure implementation of the conditions included in the facility EIA and their inclusion in the facility's contract with estate management.

2.5. INCLUDING ENVIRONMENTAL CONDITIONS IN THE CONTRACT

The estate management has established a contractual agreement with the facility to allocate land for its premises. The contract does not currently include environmental considerations. However, it represents a good opportunity for ensuring the commitment of the facility to environmental management practices and preventive approach towards environmental protection.

Two types of environmental conditions that could be integrated in the contract are:

- General conditions
- Specific conditions

Specific conditions will differ according to the environmental management scheme adopted and the environmental setting of the site of the estate and might include different conditions for different facilities.

2.5.1. General Requirements

- Comply to all requirements of environmental laws and regulations
- Coordinate with the estate management aiming for enhancement of environmental management at the estate
- Abide by the conditions included in the estate EIA
- Prepare individual EIA as per the requirements of law 4/1994 taking into consideration the requirements of the estate EIA
- Provision of information and data regarding the environmental aspects of the facility. (The facility should be assured that the information will only be used to ensure sound environmental management within the estate and will not be shared with regulatory agencies)

- Other requirements according to the environmental management scheme of the estate

2.5.2. Specific Requirements

These requirements may differ from one facility to another according to the several factors including the raw material, process, finished goods, location, pollution generated and sensitivity of surrounding.

A liability of the facility regarding non-compliance with the above mentioned conditions should be indicated, within the enforcement actions in case of non-compliance with the contract clauses.

ANNEX 2.1: PLANNING FOR THE SITTING OF INDUSTRIAL ESTATES

The issue of sitting industrial estates is significant in terms of the carrying capacity of the region. A few countries already have certain rules to be followed while selecting sites for developing industrial estates, other countries are still in the process of establishing guidelines, methodologies or even long-term strategies for this purpose. Refer **Box 2** below.

Typically, regional plans that suggest suitable sites compatible to the surrounding land use and the carrying capacity of the region do not exist in many developing countries. Hence, the industrial growth doesn't align the land use and the resource base of the region. Thus proper sitting of newly planned industries and industrial estates cannot ensure the environmental soundness of the industrial development. Adversely in many developing countries the site selection is not based on environmental criteria, with the objective of minimizing adverse environmental impacts.

Box 2 Sitting of Industrial Estates in Singapore: Abiding by "Codes of Conduct"

Industries in Singapore are classified into one of the following four categories: "clean", "light", "general" and "special" industries based on the impact of residual emissions of fumes, dust and noise on surrounding land use. The National Environment Agency of Singapore imposes certain "Codes of Conduct"[8] pertinent to land use planning and sitting of industries. Among these, it is mandated that:

- Industrial premises located close to residential areas and within unprotected water catchments are allocated to clean or light industries only.
- To minimize risk from the handling of hazardous substances, special industries, which use large quantities of such chemicals, be sited on off-shore islands or industrial estates which are located away from residential estates.

Thus, there are attempts to exert some measure of control over the sitting of industrial estates, which in this case, assume the dual function of "pollution control."

Industrial Estate Sitting: The Zoning Atlas Programme of the Central Pollution Control Board of India

The Zoning Atlas classifies the environment in the district[9] and depicts the pollution-carrying potential of various sites/zones within it. It also recommends the possible alternate sites for industries through easy-to-read maps. Thus, objectives of preparing a Zoning Atlas for sitting of industries are:

- To classify the environment in the district.
- To identify locations for sitting of industries.
- To identify industries suitable to the identified sites.

[8] Code of Practice on Pollution Control. Available at: http://app.nea.gov.sg/cms/htdocs/article.asp?pid=138 (Accessed April 6, 2004)

[9] In India, States are further divided into districts for administrative purposes. For example, the State of Andhra Pradesh is divided into a number of districts such as Nellore, Prakasam, Guntur, Kurnool, Anantapur, Chittoor, etc. In Egypt, Governorates form the equivalent of States.

The Zoning Atlas studies are carried out in 1:250,000 scale (1 cm = 2.5 km). These zones are marked out using a combination of data gathered from satellite imagery and geographical information systems (GIS) tools. Some of the essential features captured in the Zoning Atlas include groundwater potential, quality, drainage system, agriculture/land use, air quality, surface water use/flow/quality, wind speeds/direction, etc.

Central Pollution Control Board (CPCB) of India has categorized industries depending on the extent of pollution caused by it. A "Sensitivity Assessment", which involves determining the vulnerability of area towards air, surface water and groundwater pollution, is determined for a given area. This vulnerability is measured in terms of three classes-high, medium and low. Based on the sensitivity, the site suitability to receive a particular type of pollution and hence the type of industry can be determined. This understanding leads to the creation of a "Sensitive Zone Map" showing all the zones where industries are prohibited due to legal/social reasons. This map is overlaid on each of the air, surface water and groundwater pollution sensitivity maps to calculate the ultimate Risk Map that shows the remaining areas available for sitting of industries along with their sensitivities. **Figure 2.2** shows a schematic on the generation of Risk Maps.

Zoning Atlas for 19 Districts in 14 States was completed in the pilot phase during 1995-96. In the second phase, i.e. during 1997-99, 42 Districts were completed. About 50 priority Districts have been covered by the end 2001[10].

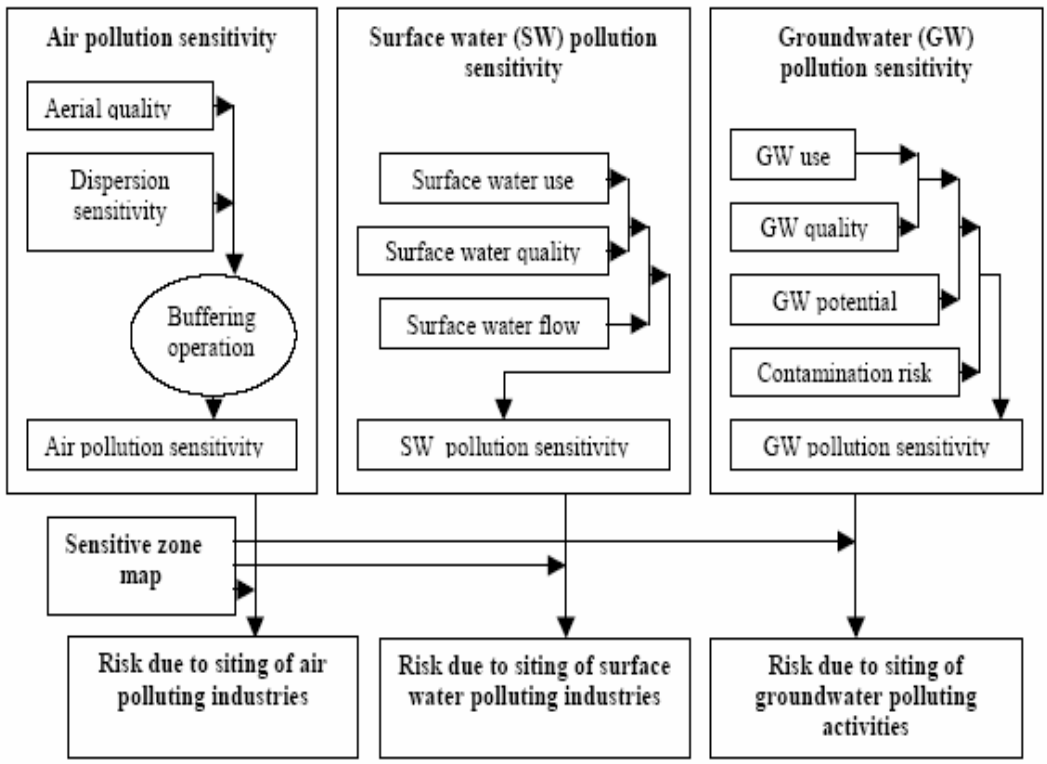
The Programme has been extremely useful to State and District level authorities particularly in the identification and promotion of industrial estates, as well as the planning of Special Economic Zones (SEZs)[11,12].

[10] *Zoning atlas: Programme Overview* by N. Raghu Babu and Anand Kumar of CPCB, Delhi, India. Available at: http://www.gisdevelopment.net/application/environment/pp/envp0003pf.htm (Accessed April 5, 2004)

[11] The Hindu Business Line: Zoning Atlas for setting up industries in Andhra Pradesh. Available at: http://www.thehindubusinessline.com/bline/2003/05/17/stories/2003051701911700.htm (Accessed April 5, 2004)

[12] A Special Economic Zone (SEZ) is a deemed foreign territory within a country with special rules for facilitating FDI for export-oriented production, and for purposes of trade and customs duties. The key implication of being deemed foreign territory is that individual units within the SEZ are allowed operational freedom in routine activities and not supervised by the customs authorities.

Figure 1: Generation of Risk Maps



Lessons learnt: Programmes such as the Zoning Atlas are laudable because they provide the required data and information for the effective protection of the environment as well as address the issue of sustainable development. Through this programme;

- It is possible for industries to identify environmentally and economically suitable sites, as well as estimate potential negative impacts and risks and thus plan for their required abatement and mitigation.
- Environmental administration at the Local and State administration level, is more calculable than was previously possible. Monitoring, preventing and controlling pollution generation also becomes easier and faster.
- Increases the competitive chances of local and even national governments in attracting greater volumes of business and at the same time, maintaining a healthy balance between industrial development and the environment.

ANNEX 2.2: REGULATORY FRAMEWORK FOR EIA

1. EIA Preparation

According to law 4/1994 (articles 19,20,21,23) and its executive regulations (articles 10,11,12,13,14,15,16), project proponents should prepare an environmental impact assessment (EIA) with the application for license of new projects and extension of existing facilities. According to the law, the EIA should be submitted to the Competent Administrative Authority (CAA), under which jurisdiction the project falls.

Categorization System in the Egyptian EIA System

The approach adopted in the Egyptian EIA system depends on the classification of projects into three categories reflecting increasing levels of environmental impact assessment according to the severity of potential impacts. According to the guidelines, projects are categorized into three categories/lists:

- **Category A**: white list with minor environmental impacts. It is required to fill in form A provided by EEAA
- **Category B:** gray list, which may have substantial impacts. It is required to fill in form B provided by EEAA. In some cases, a scoped EIA is required for specific components of the project, in accordance with Terms of Reference prepared by EEAA EIA Central Department.
- **Category C:** black list, which have high potential impacts. In this case, a full study is required.

The Egyptian EIA Guidelines indicates the CAA of each type of project. In case the governorate is the CAA, the EUs/EMU are involved in the receipt of the EIA and its processing. In case the CAA is another entity, the EMUs/EUs do not participate in any activity regarding the EIA review.

2. EIA Review

The CAA should assess the EIA and should send it to EEAA to issue its opinion within 60 days, beyond which the study would be considered implicitly approved. The proponent is informed of the decision and the conditions to abide with in both construction and operation phases. The proponent is granted a construction license coupled with these conditions.

EEAA/RBOs inform the CAA of its decision. The outputs of the EIA review activity falls under the following categories:

- **Recommendation of Conditional Approval of the Project**

The department approves the EIA and compiles a list of all conditions and criteria that the developer should abide with in the design, construction or operation phases. Some of these conditions reiterate what the study has committed to as mitigation and others are added according to the comments of the reviewer to ensure sound environmental management.

- **Recommendation of Granting the Project Temporary License**

In this case, the project is only granted a temporary license. This usually applies to industrial establishments in governorates where industrial estates outside the urban mass have yet to be established. According to the urban planning law 3/1982, the license could be renewed until such estate is adequately serviced and available for relocation.

- **Recommendation for Objection of the Project**

The EIAs are usually rejected when the project contains issues that contradict with principles stated in environmental regulations or guidelines. For example, according to law 4/1994, the location of the project should be appropriate to its activities. In case of the inappropriateness of the site to the project activities, EEAA rejects the EIA and recommends the rejection of the project.

In case of industrial establishments, the main principle is to reject polluting industries in population centers, especially in densely populated cities and towns.

Although not require by law, EEAA sometimes request public participation hearings for a number of category C EIAs. The CAA is expected to attend such hearings.

3. Appeal System

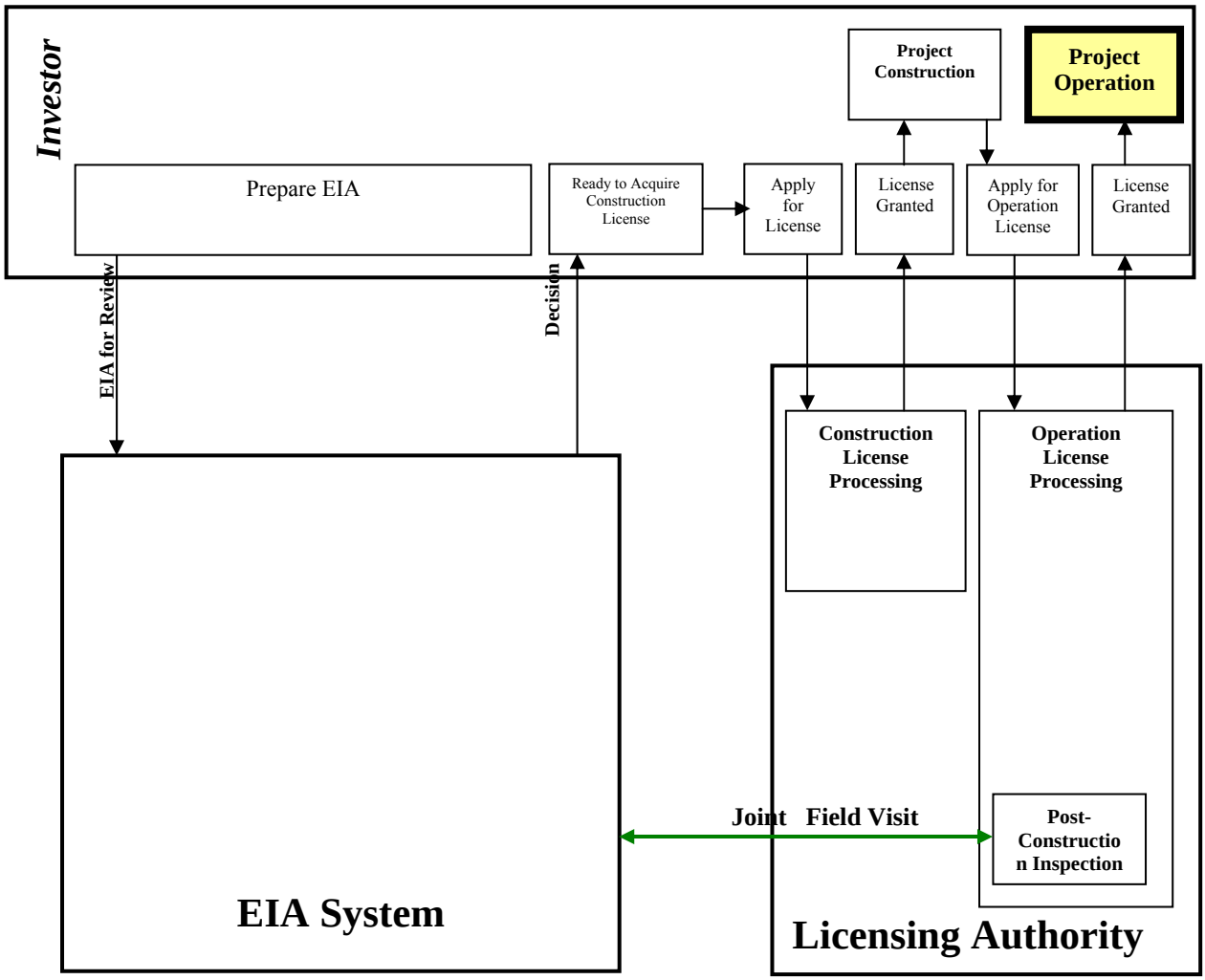
The CAA informs the applicant of the decision through a certified registered letter. The proponent has the right to issue an appeal within 30 days from his receipt of the decision. Within this period, proponents have the right to appeal the decision of EEAA EIA department, whether the decision is rejecting the EIA, request for modifications or conditions for approval.

The appeal is submitted to EEAA where the Permanent Review Committee investigates the appeal. The committee is formed of experts from inside and outside of EEAA. A technical sub-committee is sometimes formed to investigate the appeal, when needed. The investigation might require field visits to the project site.

4. Pre-operation Field Investigation

After construction works are finished, the proponent applies for the operation license. According to article 20 of law 4/1994, the CAAs have the responsibility of insuring the implementation of mitigation measures or conditions included in the EIA approval. According to law 4/1994 and its executive regulations, the environmental specifications or conditions issued with the EIA decisions should be included in the environmental register and/or the hazardous waste and material register, if applicable. The conditions in the EIA approval should be included in the license by the licensing authority.

The interaction between the EIA system and the licensing system is shown in the following figure.


Investor
Project Construction
Project Operation
Prepare EIA
Ready to Acquire Construction License
Apply for License
License Granted
Apply for Operation License
License Granted
EIA for Review
Decision
Construction License Processing
Operation License Processing
Joint Field Visit
Post-Constructio n Inspection
EIA System
Licensing Authority

ANNEX 2.3: EIA LISTS

مشروعات القائمة البيضاء

يشمل هذا التصنيف المنشآت/المشروعات ذات الآثار البيئية الضئيلة وفى هذه الحالة يجب على مقدم المشروع ملئ الاستمارة أ للفحص البيئي وتضم هذه القائمة المنشآت التى قد تتم الموافقة عليها دون إجراء دراسات تفصيلية

قائمة المشروعات

أولاً :المشروعات الصناعية :

١. الصناعات الغذائية:

١. المخابز البلدي والأفرنجي الآلي والنصف آلي/الأفران العمومية والمخابز العمومية
٢. محال تحميص وتسويه الحبوب والبقول/مقالي الحبوب ، محال تجهيز وطهى وتقشير الحبوب
٣. مخازن التبريد أو ثلاجات الحفظ لاقل من ١٠ طن
٤. محال تجهيز الفواكه والخضراوات للحفظ
٥. محال بيع وذبح وتجهيز وتعبئة الدواجن والطيور ومحال التفريخ
٦. محال عمل حلوي من عجين/تصنيع حلوى جافة
٧. مصانع الخميرة وتخمير الشعير (البيرة) والتي تقام بالمناطق الصناعية المعتمدة
٨. تخمير وبيع الألبان وتعبئتها في زجاجات أو صفائح أو أي أوعية أخرى/محال تجميع وتعبئه وبيع اللبن الخام للشرب/معمل منتجات الألبان (الجبن ، الزبدة ،٠٠٠)/ محال فرز الألبان/محال تصنيع اللبن الزبادي/معامل الالبان وبيعها وتصنيع الزبادي والجبن الابيض جميعها بطاقة أقل من ١ طن/ يوم
٩. المصانع التي تنتج الفواكه والخضراوات المعلبة بكميات تبلغ ١٠٠٠ طن سنويا او اقل والتي تقام بالمناطق الصناعية المعتمدة
١٠. المصانع التي تقوم بتصنيع منتجات الاسماك بكميات تبلغ ١٠٠٠ طن او اقل سنويا
١١. معامل تدخين المواد الغذائية التي تنتج ٥٠٠ كيلو من المواد الغذائية او اقل يوميا
١٢. مصانع الثلج
١٣. فرم وتعبئة العجوة
١٤. معامل تعبئة الخل
١٥. فراكة أرز ومطحن صغير (حجر واحد أو حجرين) ومجرشة الحبوب وطحن التوابل وخلافه
١٦. المطاعم ومحال تجهيز المأكولات والتى لا تقام على المجارى المائية أو البحار والمصارف
١٧. شونة الحبوب

٢. صناعة الغزل والنسيج والألياف الصناعية :

١٨. مصانع المنسوجات التي لا تتضمن وحدات صباغة والتي تقام بالمناطق الصناعية المعتمدة
١٩. محالج الأقطان/محال كبس وتنظيف القطن / مصانع القطن الطبى
٢٠. مصانع الدوبار والحبال (بشرط عدم احتوائها على أعمال تصنيع بلاستيكية)
٢١. تشغيل التريكو ويدخل فيها (رفي الجوارب ـ عمل شريط ـ عمل أستك ـ قيطان - عراوي)/ عمل الزراير والكبش/تصنيع الملابس (بدون تبيض أو صباغة)/ النسج اليدوي/محال تشغيل المنتجات النسيجية ومحال المنسوجات والسجاد ومحال التنجيد البلدي بماكينة الخياطة/مصانع شريط التنجيد

٣. الصناعات الكيماوية :

٢٢. مستودعات الأسمدة الكيماوية
٢٣. مصانع تشغيل الجلود والأحذية التي تقام بالمناطق الصناعية المعتمدة بدون القيام بأعمال دباغة
٢٤. مستودعات الجلود الغير مدبوغة (الخضراء والطرية والجافة) ولا تشتمل على التصنيع
٢٥. محال تشغيل المصنوعات الجلدية دون الدباغة

٤. الصناعات الخشبية :

٢٦. ورش نجارة ميكانيكية
٢٧. تصنيع الأدوات الموسيقية

٥. الصناعات الحرارية والتعدين ومواد البناء واللدائن :

٢٨. تقطيع ولحام البلاستيك/ تقطيع الرولات الجاهزة لعمل الأكياس البلاستيكية
٢٩. كسارة بلاستيك داخل المناطق الصناعية المعتمدة
٣٠. تقطيع وصقل وتشطيب الرخام والجرانيت بالمناطق الصناعية

٦. الصناعات المعدنية :

٣١. محال صهر وتشغيل المعادن الثمينة كالذهب والفضة والبلاتين (ورش الصياغة)/ طلى بالالكتروستاتيك للذهب والأكلاشيهات
٣٢. تصنيع اللوف المعدنى
٣٣. ورش تشغيل الحديد /ورش الحدادة /ورشة خراطة المعادن /المخارط /ورش تشكيل الألواح المعدنية بدون صهر او سبك /ورش تشكيل المعادن بالقطع على البارد والطرق /ورش لحام المعادن بالكهرباء والأكسيجين / ورش صيانة الماكينات والمحركات

٧. المشروعات الحرفية والخدمية :

٣٤. أعمال تشغيل الزجاج - وورش تقطيع وشطف الزجاج بالكمبيوتر ، محال شطف البلور وتفضيض المرايا
٣٥. تصنيع و تجميع المظلات والتند
٣٦. عمل مراتب أسفنج وسوست
٣٧. معامل الأفلام وتحميضها وطبعها
٣٨. محل بيع البذور والتقاوي والمبيدات الحشرية والأسمدة والمخصبات الزراعية (منزلية ـ زراعية) دون الخلط أو التعبئة وفي عبوات مغلقة
٣٩. حلقات ومحال بيع الأسماك الطازجة
٤٠. المطابع (محال طباعة الأوراق سيلك سكرين)
٤١. محال تصليح وشحن البطاريات
٤٢. ورش إصلاح السيارات/ ضبط ابواب السيارات / ورش السمكرية/محال إصلاح وصيانة المحركات الأجزاء الميكانيكية للسيارات والمقطورات والجرارات والموتوسيكلات وما يماثلها
٤٣. ورش الحفر والزنكوغراف
٤٤. المغسلة والتنظيف الجاف
٤٥. محلات الأسترجية اليدوى (دهان الموبيليات)
٤٦. محال بيع بالتجزئة للبويات زيوت ـ ورنيش ولاكيه ـ أحبار الطباعة
٤٧. مستودعات ومحال بيع الفحم والكسب ومواد الوقود الجاف
٤٨. محال تبييض المعادن دون القيام باى اعمال طلاء معدنى
٤٩. الجراجات العمومية التى لا تقوم بأعمال صيانة

ثانياً : المشروعات الزراعية:

٥٠. مزارع الدواجن والأغنام والنعام
٥١. زرائب المواشي والأغنام والجمال والخيول والدواجن آي كان عددها / زرائب المواشي غير الحلوب وتربية الحيوانات/الإسطبلات العمومية والخصوصية / زرائب الخنازير
٥٢. المجازر اليدوية

ثالثاً : المشروعات البترولية:

٥٣. محال بيع المواد البترولية ٥٠ لتر /٢٠٠لتر /١٠٠٠لتر-/محال بيع البنزين بكمية لا تزيد عن ١٨٠ لترا/يوم-/محال بيع الكحول والمواد البترولية إذا احتوت على نوعين أو اكثر من هذه الأنواع مهما كانت الكمية
٥٤. محطة تموين السيارات (سائل وغاز طبيعى) وطلمبات الرصيف فى المناطق غير الحساسة بيئياً
٥٥. تعبئة أسطوانات الغاز بالمناطق الصناعية المعتمدة
٥٦. مستودعات أنابيب الغاز

رابعاً : مشروعات الطاقة والبنية الأساسية:

٥٧. محطات معالجة مياه الصرف بطاقة تبلغ ١٠٠٠ شخص مكافئ PE أو أقل
٥٨. توسيع او تعديل طريق قائم بحيث يتم امتداده أو توسيع عرضه بنسبة ١٥ % أو أقل
٥٩. التوسع فى خطوط القوى الكهربائية قائمة بحيث لا يتم زيادة طول الخطوط بأكثر من ١٠ %

٦٠. إنشاء أو التوسع فى محطة التشغيل المصاحب لجهد لا يتجاوز ١٣٠ كيلو وات

خامساً : أخرى:

٦١. المحطات الأساسية للتليفون المحمول

مشروعات القائمة الرمادية

تشمل هذه القائمة المنشآت التى سوف تخضع للفحص بالنسبة للأثار البيئية الهامة. ويتم تحديد هذه المنشآت بناء على الأنشطة وكمية الإنتاج وحجم المشروع، وفى الحالات التى لم يضع التصنيف حدوداً لها، تؤخذ كافة الأحجام ويجب على مقدم المشروع ملئ الاستمارة) ب) الخاصة بالفحص البيئى فى هذا الصدد. ويشمل الإجراء فى هذه الحالة خطوتين هما: رقم (١) ملء الاستمارة ب الخاصة بالفحص البيئى ومن المحتمل أن يتبعها بعد ذلك الخطوة رقم (٢) وهى ملاحظات تقييم الأثار البيئية بالنسبة لأثار/معالجات معينة تحدد طبقا لتقييم جهاز شئون البيئة

قائمة المشروعات

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١. مصانع تجفيف البصل
٢. مصانع المكرونة
٣. مصانع الحلوى والشربات والعصائر والمرطبات والمياه الغازية
٤. تصنيع اللبان
٥. تصنيع الحلاوة الطحينية
٦. مصانع البسكويت والعجائن
٧. مصانع استخراج الزيوت النباتية التي لاتحتوي علي تكرير أو معالجة
٨. مصانع العسل الأسود
٩. عصارة السمسم والزيوت النباتية وسرجة الطحينة
١٠. مصانع ملح الطعام
١١. المصانع التي تنتج الفواكه والخضراوات المعلبة بكميات تزيد عن ١٠٠٠ طن/سنة
١٢. مصانع تدخين المواد الغذائية والتي تزيد طاقتها عن ٥٠٠ كجم/يوم من المواد الغذائية المدخنة
١٣. منشآت تصنيع وانتاج أعلاف الحيوانات و الأسماك
١٤. مصانع الخميرة وتخمير الشعير(البيرة)و مصانع المياه المعدنية أو تعبئة مياه طبيعية التى تقام خارج المناطق الصناعية المعتمدة
١٥. مصانع النشا
١٦. مصانع الألبان ومنتجاتها "اللبن المبستر ـ المعقم ـ الزبدة ـ الجبنة " بطاقة إنتاجية أكثر من ١ طن / يوم
١٧. مصانع فرم الدخان وتعبئته وصناعة السجاير ومحال صنع الدخان المعسل والنشوق
١٨. مصانع تكرير السكر
١٩. المصانع التي تقوم بتصنيع منتجات الأسماك بكميات تتجاوز ١٠٠٠ طن/سنة، ومصانع الفسيخ والأسماك المملحة ومخازنها
٢٠. مضارب الأرز/مطاحن الغلال
٢١. تصنيع الأيس كريم

٢- صناعة الغزل والنسيج والألياف الصناعية

٢٢. معاطن النباتات التى تنتج الالياف كالكتان والتيل ومصانع نفضها وندفها خارج الكتلة السكنية
٢٣. مصانع الألياف الصناعية كالحرير الصناعي والنايلون والتي لاتحتوي علي وحدات صباغة
٢٤. أعمال صباغة المنسوجات بطاقة تبلغ ١٠ طن يوميا او اقل
٢٥. منشآت تشغيل السليلوز ومصانع الغزل والنسيج التي تقع خارج المنطقة الصناعية المعتمدة

٣- الصناعات الكيماوية (الجلود ، الورق ، المطاط ، الزجاج ، الأدوية)

٢٦. تشغيل الورق والمنتجات الكرتونية وعمل ورق الحائط
٢٧. صنع الكلونيا والروائح العطريه ومستحضرات التجميل
٢٨. تصنيع الأقنعة الواقية من الغازات السامة
٢٩. المطابع (الأوفست ,العمومية ,ومطابع المجلات والصحف) وطباعة الصفيح

٣٠. محال تصنيع الفلين
٣١. مصانع إنتاج وتعبئة الغازات الصناعية
٣٢. مصانع الصابون والجليسرين
٣٣. مصانع الكبريت
٣٤. مصانع تصنيع اسطوانات الغازات البترولية المسالة وملحقاتها
٣٥. إنتاج الإسفنج الصناعي
٣٦. تشكيل البلاستيك /حقن البلاستيك/ مصانع المواسير البلاستيك/تخريز البلاستيك/تغليف سلك البلاستيك/مصانع / كسارات البلاستيك / ومصانع الأستك
٣٧. تعبئة وتغليف الكيماويات السائلة والصلبة والمنتجات في مواقع خارج المناطق الصناعية المعتمدة
٣٨. مصانع الصمغ الصناعي والغراء
٣٩. منشآت تصنيع الجلود والأحذية خارج المناطق الصناعية المعتمدة
٤٠. مصانع البويات الزيتية والورنيش/احبار طباعة
٤١. تصنيع منتجات المطاط والكاوتشوك
٤٢. تصنيع معجون الأسنان وبودرة الأسنان والشامبو و زيت الشعر
٤٣. تصنيع الفيبرجلاس
٤٤. المدابغ التي لا يزيد إنتاجها عن مليون قدم مربع سنويا أو تستخدم ٧٥٠أقل من قطعة كاملة من جلود الحيوان/يوم
٤٥. تصنيع كيماويات معالجة المياه
٤٦. مصانع خلط وتعبئة الأسمدة الورقية أو العضوية
٤٧. تصنيع الأقلام الرصاص والجاف
٤٨. مصانع إنتاج لب الورق بطاقة إنتاجية تقل عن ١٠٠ طن /يوم من قش الأرز و ٥٠٠ طن /يوم من تفل (مصاصة) قصب السكر
٤٩. تعبئة الأدوية والكريمات فقط بدون تصنيع للمواد الخام أو المواد الفعالة

٤- الصناعات الخشبية

٥٠. مصانع نقع الأخشاب (المعالجة الكيميائية للأخشاب)/ مصانع الأخشاب الصناعية
٥١. مصانع تصنيع الأبواب والنوافذ والتجهيزات والأثاث والمكاتب الخشبية

٥- الصناعات الحرارية والتعدين ومواد البناء

٥٢. صناعة الزجاج
٥٣. مصانع وورش تصنيع البلاط الآلي
٥٤. مصانع الطوب والقرميد والفخار والمواسير المصنوعة منها والصيني/ مصانع الطوب الطفلي
٥٥. تصنيع المنتجات الأسمنتية (خزانات أسمنتية ، أغطية البلاعات ، ...)
٥٦. قمائن الطوب والجير والجبس / الفاخورات
٥٧. ورش طحن الجبس والجير والحمرة والزجاج
٥٨. المصانع التي تقوم بخلط الإسفلت وإنتاج مواد إنشاء ورصف الطرق وخلاطات الخرسانة المسلحة
٥٩. مصانع الأسمنت التي تستخدم العملية الصناعية الجافة و أعمال الجير التي لا تزيد طاقتها عن ١٠٠ طن / ساعة ، ومصانع التي تستخدم عمليات أخرى (رطبة ـ شبة رطبة ـ شبة جافة) وتبلغ طاقتها ٥٠ طن / ساعة أو اقل
٦٠. تصنيع وتنظيف ومعالجة الفحم النباتي / مكامير الفحم
٦١. معالجة طفلة محاجر
٦٢. محاجر وكسرات الرخام والرمال والطفلة وخلافه
٦٣. استخراج المعادن في مناطق جديدة تشغل مساحة اجمالية تبلغ ١٥٠٠ فدان او اقل
٦٤. المشروعات الخاصة بصناعة البورسلين والخزف ويزيد انتاجها عن ٢٠٠ كجم / يوم اذا كانت تقع خارج المناطق الصناعية المعتمدة
٦٥. استخراج الفحم الحيواني من عظام الحيوانات

٦- الصناعات المعدنية

٦٦. تصنيع علب المعلبات المعدنية
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٧١. تصنيع ورق تغليف الأطعمة (الفويل)
٧٢. مصانع وورش صهر وصب المعادن فيما عدا الثمينة والرصاص
٧٣. مصانع المواسير الصلب
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٧٥. مصانع الأسلاك والكابلات الكهربائية
٧٦. مسابك الحديد ومسابك الصلب ومسابك المعادن غير الحديدية
٧٧. مصانع المعالجة السطحية لأعمال الحديد والصلب او المعادن غير الحديدية / مصانع الطلاء الكهربائي التي تنتج ٢٥ طنا او اقل من المشغولات يوميا
٧٨. مصانع الغلايات والمراجل البخارية
٧٩. مصانع الصلب والحديد والزهر اذا كانت الطاقة الإنتاجية لا تزيد عن ١٥٠ طن/يوم

٧- الصناعات الكهربائية والإليكترونية

٨٠. تصنيع أجزاء مكيفات الهواء
٨١. تصنيع وتجميع الآلات الكهربائية/الثلاجات
٨٢. تصنيع المعدات العلمية والحسابية والمعدات الإلكترونية
٨٣. تصنيع المنتجات الكهربائية (المفاتيح ، الفيش ، ...)
٨٤. مصانع مصابيح وأنابيب الإضاءة
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٨٦. تصنيع خلايا شمسية
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٨- المشروعات الحرفية والخدمية

٨٨. ورش الدهان بالدوكو/أفران الدهان بالدوكو
٨٩. استوديوهات التصوير وأخذ المناظر والصور بالآلات

٩- صناعة الماكينات ووسائل النقل

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٩٢. المكابس الحرارية

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٩٣. المنشات والمواقع الخاصة بأعمال التدوير واعادة استخدام المخلفات

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٩٤. الاستصلاح الزراعي للأراضى فى مساحة ٤٠٠ فدان او اقل
٩٥. إقامة مزارع سمكية بمناطق غير حساسة بيئياً
٩٦. مجزر نصف الي / مجزر الي

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٩٨. (محارق المستشفيات/ ووحدات المعالجة) داخل المستشفى

رابعاً : المشروعات البترولية

٩٩. إنشاء خطوط أنابيب بحرية أو برية طولها ٥٠ كليو مترا أو اقل في المناطق غير الحساسة بيئيا
١٠٠. إنشاء مستودعات لتخزين الوقود البنزين أو الغاز أو الديزل(بخلاف محطات الخدمة)و التى تبلغ سعة تخزينها الإجمالية ١٥،٠٠٠ متر مكعب أو اقل
١٠١. محطات الخدمة وتموين السيارات (غاز - سائل) /محال تشحيم السيارات
١٠٢. مصانع الكيماويات البترولية (البتروكيماويات) الأساسية بطاقة إنتاجية ٥٠ طن / يوم أو اقل

١٠٣. المسح الاستكشافى (الجيولوجى / الجيوفيزيقى) فقط على البر أو في البحر للبحث عن البترول والغاز
١٠٤. الحفر الاستكشافي فقط دون تنمية على البر او في البحر للبحث عن البترول والغاز
١٠٥. الحفر الإنتاجي في مناطق بها تسهيلات إنتاج والتي لها القدرة على استيعابها مع ربط الآبار الجديدة مع هذه التسهيلات دون إضافة أية توسعات جديدة

خامساً : مشروعات الطاقة والبنية الأساسية

١٠٦. تعديل رصيف ميناء قائم بحيث لا يتضمن التعديل التخلص المحتمل من أي مواد ملوثة في الماء ، إصلاح بوغاز
١٠٧. إنشاء ممر هبوط للطائرات طوله ١٥٠٠ متر او اقل (توسع فى مطار قائم)
١٠٨. إنشاء خط سكة حديد بامتداد ٥٠ كليومترا او اقل
١٠٩. محطات معالجة مياة الصرف بطاقة تبدأ من ١٠٠٠ شخص مكافئPE حتى مليون شخص مكافئ PE، ووحدات معالجة المخلفات الحضرية
١١٠. الطرق الداخلية والطرق السريعة فى المدن(تبلغ حركة السيارات بها ١٠،٠٠٠ سيارة او اقل يوميا فى المتوسط السنوى)
١١١. تعبئة وتنقية مياه الشرب / محطات مياه الشرب ونظم التوزيع - منشآت إمداد المياه
١١٢. نظم النقل الضخمة و الطرق السريعة بامتداد٥٠ كيلومترا اواقل شاملة مترو الأنفاق والكبارى والأنفاق
١١٣. التوسعات او التعديلات المقترحة فى هياكل الرى والصرف القائمة بحيث تؤدى هذة التوسعات او التعديلات إلى زيادة المنشاة
١١٤. تعديل او توسيع طريق قائم بحيث يتم امتداده او توسيع عرضه بنسبة اكثر من ١٥ %
١١٥. توسعات في أحواض بناء السفن والأحواض الجافة والعائمة لاصلاح وصيانة السفن / توسع فى ترسانة قائمة)
١١٦. الاستادات الرياضية
١١٧. محطة القوى الحرارية بطاقة ٣٠ ميجاوات او اقل
١١٨. خطوط نقل القوى الكهربائية و محطات التحويل التى لم تذكر فى القائمة (أ)
١١٩. أعمال التطهيرات للمجارى المائية الرئيسية

سادساً : المشروعات السياحية

١٢٠. انشاء فنادق او منتجعات داخل مركز سياحي تم عمل دراسة متكاملة له / أو فى مناطق خلفية (خلف الطريق ـ داخل كردون المدن المعتمد) .
١٢١. تسير ورسو خط ملاحي / إنشاء ممشي أو سقالة على خوازيق بدون تراكى أو مبيت / قزق بحري أو نيلى
١٢٢. الكافتيريا التى تقع مبانيها على البحار والأنهار والترع والمصارف

مشروعات القائمة السوداء

تتضمن هذه القائمة المنشآت التى سيتطلب لها إجراء تقييم كامل للأثار البيئية. ويتم تحديد هذه المنشآت تبعا لأنشطتها وكمية إنتاجها وحجم المشروع. وفى الحالات التى لم يضع التصنيف حدود لها، تؤخذ كافة الأحجام

قائمة المشروعات

أولاً :المشروعات الصناعية :

١. الصناعات الغذائية:

١. تكرير واستخراج الزيوت النباتية
٢. تكرير الزيوت النباتية ومعالجات اخري لها والزيوت المهدرجة /ومصانع المارجرين والزيوت والدهون النباتية والحيوانية المهدرجة المعدة للطعام/مصنع المسلى الطبيعي

٢. صناعة الغزل والنسيج والألياف الصناعية :

٣. مصانع الألياف الصناعية كالحرير الصناعي والنايلون والتي تحتوي علي وحدات صباغة
٤. أعمال صباغة المنسوجات والسجاد وغيرها بطاقة إنتاجية تزيد عن ١٠ طن / يوم

٣. الصناعات الكيماوية (الجلود ، الورق ، المطاط ، الزجاج ، الأدوية):

٥. مصانع انتاج الأحماض والقلويات ومشتقاتها
٦. إنتاج البوليمرات بطاقة إنتاجية أكثر من ٥٠ طن / يوم
٧. مصانع إنتاج واستنباط المبيدات الحشرية/مصانع التعبئة والخلط لكيماويات المبيدات

٨. مصانع تقطير الفحم وإنتاج مشتقاته
٩. مصانع إنتاج لب الورق بطاقة إنتاجية تزيد عن ١٠٠ طن /يوم من قش الأرز و ٥٠٠ طن /يوم من تفل (مصاصة) قصب السكر
١٠. المدابغ التي يزيد إنتاجها عن مليون قدم مربع سنويا أو تستخدم أكثر من ٧٥٠ قطعة كاملة من جلود الحيوان /يوم
١١. إنتاج اللقاحات بأنواعها
١٢. انتاج زيوت المحركات
١٣. الصناعات الكيماوية المتكاملة مثل مصانع الأسمدة (ما عدا الأسمدة الورقية والعضوية) ومصانع الزيوت والشحومات وانتاج الأدوية

٤. الصناعات الحرارية والتعدين ومواد البناء :

١٤. مصانع الأسمنت التي تستخدم العملية الصناعية الجافة و أعمال الجير التي تبلغ طاقتها ١٠٠ طن /ساعة أو اكثر ومصانع الأسمنت التي تستخدم عمليات صناعية أخرى (رطبة- شبه رطبة -شبه جافة)وتكون طاقتها ٥٠ طن /ساعة أو اكثر
١٥. استخراج المعادن في المناطق الجديدة والتي تزيد المساحة الكلية لمنطقة الاستخراج بها عن ١٥٠٠ فدان
١٦. المرافق الخاصة بإنتاج الألياف المعدنية الطبيعية المسامية

٥. الصناعات المعدنية :

١٧. مسابك ومصانع وصهر تشغيل الرصاص
١٨. المصانع التي تقوم باعمال الطلاء الكهربائي والتي تزيد الطاقة الإنتاجية لها عن ٢٥ طن من المشغولات يومياً
١٩. مصانع استخلاص المعادن غير الحديدية من الخام
٢٠. مصانع الصلب والحديد الزهر بطاقة إنتاجيه أكثر من ١٥٠ طن / يوم
٢١. إنتاج و تصنيع فحم الكوك

٦. مشروعات معالجة أو التخلص من المخلفات الخطرة او السامة:

٢٢. منشآت معالجة أو التخلص من المخلفات السامة والخطرة

ثانياً : المشروعات الزراعية:

٢٣. الاستصلاح الزراعي للأراضى في مساحة تزيد عن ٤٠٠ فدان
٢٤. إقامة مزارع سمكية بمناطق حساسة بيئياً

ثالثاً : المنشآت الصحية:

٢٥. (المحارق /وحدات المعالجة) المركزية الخاصة بالمخلفات الخطرة والطبية

رابعاً : المشروعات البترولية:

٢٦. إنشاء خطوط أنابيب بالبحر أو علي البر إذا زاد طولها عن ٥٠ كيلو مترا
٢٧. الحفر الاستكشافى والتنمية على البر أو فى البحر للبحث عن البترول والغاز
٢٨. تنمية حقول البترول والغاز على البر أو فى البحر
٢٩. إنتاج البترول / الغاز على البر أو فى البحر
٣٠. إنشاء خطوط أنابيب على البر أو البحر بطول أقل من ٥٠ كم فى المناطق الحساسة بيئياً
٣١. مستودعات تخزين الوقود (البنزين أو الغاز أو الديزل) بسعة تخزينية إجمالية أكبر من ١٥٠٠٠ م٣ بخلاف محطات الخدمة
٣٢. محطات تكرير البترول والبتروكيماويات
٣٣. شبكات توزيع الغاز الطبيعى للمدن
٣٤. وحدات فصل ومعالجة وتداول وتخزين البترول والغاز
٣٥. مصانع البتروكيماويات التى تزيد طاقتها الإنتاجية عن ٥٠ طن / يوم

خامساً : مشروعات الطاقة والبنية الأساسية:

٣٦. أنظمة النقل الضخمة والطرق السريعة(بامتداد اكثر من ٥٠ كيلو مترا) شاملة مترو الأنفاق،الكباري والأنفاق
٣٧. إنشاء المطارات أو توسع فى هبوط للطائرات والذى يزيد طوله عن ١٥٠٠ مترا
٣٨. خطوط سكك حديدية جديدة والتى يزيد طولها عن ٥٠ كيلو مترا
٣٩. مشروعات الري والصرف الكبرى الجديدة شاملة السدود والقناطر

٤٠. محطات معالجة مياه الصرف بطاقة تزيد عن مليون شخص مكافئ PEشاملة شبكات الصرف الصحى
٤١. مشروعات إنشاء مناطق صناعية
٤٢. مشروعات التنمية العمرانية الجديدة أو التوسع فيها
٤٣. طرق داخلية وطرق سريعة في المدن (التي يزيد المتوسط السنوي لحركة السيارات بها عن ١٠٠٠٠ سيارة يوميا
٤٤. انشاء مجاري مائية
٤٥. محطات تحلية المياه شاملة شبكات التوزيع
٤٦. إنشاء أو إجراء توسعات فى الموانى التجارية أو موانى البترول أو موانى التعدين أو الموانى الحرة سواء داخل ميناء بحرى أو بشكل منفصل أو مستقل
٤٧. محطات القوي الحرارية التي تزيد طاقتها عن ٣٠ ميجاوات
٤٨. محطات القوي التي تستخدم وقود نووي في التشغيل
٤٩. خطوط ربط القوي الكهربائية عبر القارات
٥٠. محطات توليد الكهرباء باستخدام الطاقة المائية
٥١. محطات توليد القوي الكهربائية شاملة الشبكات الخاصة بها
٥٢. أماكن ومواقع معالجة الحمأة
٥٣. مواقع الدفن الصحي
٥٤. إقامة أحواض جديدة لبناء السفن والأحواض الجافة والعائمة لاصلاح وصيانة السفن

سادساً : المشروعات السياحية :

٥٥. إنشاء فنادق أو منتجعات في مناطق بيئية حساسة مثل النيل وفرعيه وترعه الرئيسية ،وفي المناطق السياحية والاثرية والمناطق المزدحمة بالسكان وعلي شواطئ البحر او البحيرات أو داخل المحميات الطبيعية
٥٦. إنشاء الملاهي الكهربائية الترفيهية (مدينة ملاهي)
٥٧. المارينات المجمعة
٥٨. أية إنشاءات داخل منطقة حرم الشاطئ أو فى البحر بخلاف ما ورد بالقائمة (ب)

ANNEX 2.4: EIA FORMS

Arab Republic of Egypt
The Cabinet of Ministers
Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency

The information required in this form should be filled in an accurate and legible way. The administrative authority should review and stamp the form, then send it to EEAA for review and give opinion. Site visit report or any additional attachment might be submitted

Environmental Screening FORM (A)

1. General Information

1.1. Project title:----------

1.2. Type and number of project (refer to the attached list) ----------
---

1.3. Name of the owner (individual, company, etc) ----------

1.4. Name of the person in charge (the responsible person): ----------Address:------
---

Telephone: ----------

1.5. Competent Administrative Authority:----------

2. Project data

2.1 Location of the project (please attach a map that clearly shows the location of the project in relation to residential areas and neighboring activities. The map should have a suitable and clear scale and should be approved by the competent administrative authority).

Address of the project: ----------

A. City ☐, village ☐, accredited industrial zone ☐, others ☐ (please specify)-------

B. In a residential area ☐, Outside a residential area ☐

C. Individual building ☐ A multiple story building with a residence above ☐

Total area of the project (Square meter): ----------

2.2. Type of project:

New ☐ Extension ☐

Type of extension: ----------

- *If the type of project is an extension, has an EIA study been submitted for the original project?*

  Yes ☐ No ☐

- Date of obtaining the previous approval from the EEAA: ----------

2.3 Production capacity: ☐ and/or storage capacity: ☐

Please mention units used: ----------

2.4. Final product: ----------

2.5. By-product: ----------

Stages of the project and expected starting dates:

Construction: ----------, Operation: ----------

2.7. Brief description of the project:

2.7.1 Project components such as machinery, equipment and complementary services

---

2.7.2 Industrial processes (demonstrated as possible by catalogues and *figures*)

2.7.3 Power supply used: ---------- source: ----------

2.7.4 Type of fuel: ---------- rate of consumption:----------

2.7.5 Raw materials:

Main:----------
Auxiliary:----------

2.7.6. Source of water (public, groundwater, surface water, others):----------
---

Water usage (cooling, industrial uses, *human use*):----------
Rate of consumption: ----------

3. Wastes resulting from the activity during the operation stage and treatment methods:

3.1.Liquid wastes:----------
Type of liquid wastes:----------
Volume:----------
Methods of disposal: ----------
3.2 Solid wastes: ----------
Type:----------
Amount: ----------
Methods of disposal: ----------
3.3 Gaseous emissions , dust, Temperature condition and methods of control (stacks, filters, others):---------
---

3.4. Methods of protection and control of noise: ----------

3.5. Description of any other mitigation measures: ----------
---

DECLARATION

Hereby I, the signer, declare that the information submitted above is accurate and true and that in case there is any modification of the information stated above, the EEAA shall be informed through the Competent Administrative Authority. Hereby I declare:

Name: ----------
Identity Card number and address: ----------
Position (in the capacity of): ----------
Date: ----------

Form filled in with the knowledge of the competent administrative authority

Name: ----------
Professional title:----------
Signature: ----------

Official Stamp

Arab Republic of Egypt
The Cabinet of Ministers
Ministry of State for Environmental Affairs
Egyptian Environmental Affairs Agency

The information required in this form should be filled in an accurate and legible way. The administrative authority should review and stamp the form, then send it to EEAA for review and give opinion. Site visit report or any additional attachment might be submitted

Environmental Screening FORM B

3. General Information

3.1. Project title:----------

3.2. Type of project (infrastructure, petroleum and mining, tourism, industrial, other) --------

---

3.3. Name of the owner (individual, company, etc) ----------

3.4. Name of the person in charge (the responsible person): ----------

Address:----------

Telephone No: ----------Fax No----------

3.5. Competent Administrative Authority:----------

4. Project data

2.1 Location of the project (please attach a map that clearly shows the location of the project in relation to residential areas and neighboring activities. The map should have a suitable and clear scale and should be approved by the competent administrative authority).

Address of the project: ----------

A. City ☐, village ☐, accredited industrial zone ☐, others ☐ (please specify)-------

B. In a residential area ☐, Outside a residential area ☐

C. Individual building ☐ A multiple story building with a residence above ☐

Total area of the project (Square meter): ----------

2.2. Type of project:

New ☐ Extension ☐

Type of extension: ----------

- *If the type of project is an extension, has an EIA study been submitted for the original project?*

  Yes ☐ No ☐

  - Date of obtaining a previous approval from the EEAA: ----------

2.3 Production capacity: ☐ and/or storage capacity: ☐

Please mention units used: ----------

2.4. Main products: ----------

2.5 By-product: ----------

2.6. *A general description of the area surrounding the project including a description of the different activities, historical areas, protected areas, tourist and recreational areas, etc…*

----------Infrastructure available:

- *Water supply (network)*: Available ☐ Not available ☐
- Electricity supply (network): Available ☐ Not available ☐
- Sewers: Available ☐ Not available ☐
- Roads/railways: Available ☐ Not available ☐
- natural gas: Available ☐ Not available ☐

2.7. Reasons for choosing the site and the degree of its safety against natural hazards and its compatibility with the neighboring communities:

---

3. Project phases and their expected starting dates:

Construction: ---------- Actual operation: ----------

4. A brief description of the construction stages

4.1. Sources of water: ----------

Water use: ----------

Rate of consumption: ----------

4.2. Type of fuel: ----------

Source of fuel: ----------

Rate of consumption: ----------

4.3. Expected number of workers: ----------

5. Wastes resulting from construction, control and disposal methods:

5.1. Solid wastes: ----------

type ----------

amount: ----------

methods of disposal:----------

5.2. Liquid wastes: ----------

type ----------

amount: ----------

methods of disposal:----------

5.3. gaseous emissions (smoke, dust, particulate matter)----------

---

methods of control: ----------

5.4 Noise: ---------- methods of control: ----------

6.Detailed description of the operation stage (*diagrams should be attached if possible*)

6.1. Main components of the project: ----------

6.2 Description of Industrial processes (demonstrated as possible by catalogues and diagrams)

6.3 Electrical supply used: ---------- source: ----------

6.4 Type of fuel (natural gas, *sular*, fuel oil): ----------rate of consumption:----------

6.5 Raw materials:

Main:----------

Auxiliary:----------

6.6. *Alternatives taken into consideration of raw materials* ----------

---

6.7 Reasons for choosing the technology used----------

6.8 Expected number of workers:----------

6.9 Source of water (public, groundwater, surface water, others):----------

---

Rate of consumption: ----------

7. Wastes, treatment methods and ways of disposal

(Expected standards of atmospheric emissions and waste water after treatment)

7.1.Liquid wastes:

Waste water:----------

Discharge rate: ( ) cubic meter/day

Methods of discharge (public sewer, boreholes, etc) ----------

---

Industrial waste water: ----------

Discharge rate: ( ) cubic meter/day

Expected analysis of industrial waste water: ----------

Methods of discharge (please choose one of the following options):

- Directly into the municipal public sewer ( )
- *The project has a unit for treatment of industrial wastewater which is discharged into the public sewer after treatment ( ) (please attach a catalogue or diagram for the waste water unit used and the standards of treated waste water)*

- *It is discharged in a bore hole and then collected ( )*
- *It is discharged into surface water (please state the standards of wastewater, the discharge rate and the name of the surface water body)* ----------
  ----------( )
- *Any other methods of discharge (please specify)*----------
  ----------( )

7.2. Atmospheric emissions:

(the type of atmospheric emissions, and the concentrations of SOx, COx, particulate matter, etc)---

---

7.3 Solid wastes: ----------

Type:----------

Amount: ----------

Methods of transport, handling and storage:----------

Methods of disposal: ----------

7.4 Hazardous wastes: ----------

Type:----------

Amount: ----------

Methods of treatment::----------

Methods of disposal: ----------

8. Preliminary analysis of environmental impacts during operation and methods of mitigation:

8.1 Impact of the project on the air quality: ----------

8.2. Impact of the project on quality and availability of water:----------

---

8.3. Impact of the project on soil quality and fertility:----------

---

8.4. Visual impacts:----------

8.5. Noise: ----------

8.6. Other predicted and significant impacts of the project:----------

---

9. Description of any other measures not mentioned earlier to mitigate the negative impacts of the project : ----------

---

---

10. Measures undertaken to protect the health and safety of workers and fire prevention facilities:----------

---

DECLARATION

Hereby I, the signer, declare that the information submitted above is accurate and true and that in case there is any modification of the information stated above, the EEAA shall be informed through the Competent Administrative Authority. Hereby I declare:

Name : ----------

Identity Card number and address: ----------

Position (in the capacity of): ----------

Date: ----------

Form filled in with the knowledge of the competent administrative authority

Name: ----------

Professional title:----------

Signature: ----------

Official Stamp

CHAPTER 3: MANAGEMENT OF EXISTING INDUSTRIAL ESTATES

3.1. ENVIRONMENTAL MANAGEMENT ACTIVITIES OF THE ESTATE MANAGEMENT

The estate management is responsible for the management of environmental aspects at the estate level. In order to fulfil its responsibilities, the estate management will follow a unified approach regarding all environmental issues, namely:

- Management of water supply
- Management of electricity supply
- Management of ambient air quality
- Management of wastewater
- Management of solid waste
- Management of hazardous waste
- Management of ambient noise
- Management of emergency situations

The environmental management approach is based on the analysis of the environmental status to analyze gaps and identify needs. Accordingly, actions are taken to address the needs while routine precautionary activities are undertaken to account for future needs and ensure the achievement of set objectives.

It should be noted that the indicated activities could be undertaken by the estate management or by other parties. Professional input might be required for some of the actions especially activities related to monitoring.

Other environmental management schemes like ISO14001 could also be applied.

Annex 3.1 includes a case study related to Environmental Management Systems for Industrial Estates.

3.1.1. Monitoring and Updating of the Environmental Status in the Estate

This activity involves the collection of data related to the environmental aspect. The collected data provides an overview on the status of specific environmental aspect and the current means of its management.

Collected data might include:

- Quantification of the environmental aspect such as concentration of pollutants in air quality or amount of generated solid waste
- Types of pollutants and their potential sources based on the knowledge of major environmental aspects of the different types of industry
- Mechanisms for the management of the environmental aspects such as the current collection and transportation practices for hazardous waste
- Water and wastewater generation and management

Mechanism for Data Collection:

- Measurements such as noise or ambient air quality
- Visual observations such as solid waste or mobile sources of pollution
- Retrieving data from documents such as information acquired from the facility EIA including baseline conditions
- Communication with the facilities leading to data specific to the facility

Monitoring should be made according to a set plan. It should be noted that the equipment used are simple and provide fairly accurate results. The plan should also take into consideration the associated costs and should include actions needed to assist the estate management in allocating the impact to the source.

3.1.2. Data Analysis and Identification of Needs

The main objective of the analysis is to evaluate the status and identify needs for action. This analysis could include:

- Comparison with laws requirements and identification of gaps
- Identification of major contributors to the problem
- Indicate reasons for deviation
- Indicate needed resources or capabilities

Based on the analysis, needs for action are identified. These needs should be addressed through specific actions.

3.1.3. Identification of Actions

The actions identified by the estate management differs according to:

- Location of the estate
- Types of industries
- Contractual agreement between the estate and the facilities
- Available resources
- Responsiveness of external parties
- Accordingly, it is not possible to recommend in these guidelines actions that could be adopted by all estates. For each of the environmental aspects, a number of alternatives are recommended. The list of alternative is not exhaustive yet it provides guidance for managing the aspect. The estate management will generate the required alternatives that are compatible with the status and circumstances of the estate.

Actions are divided into two types:

- Routine/Preventive actions
- Need-based actions

Routine/Preventive actions are those that are implemented on a routine-basis to ensure sound environmental management in the estate and prevent future problems.

Need-based actions are those that are implemented in response to specific needs or problems.

Each of these two types involves actions that could be implemented on three levels:

- Actions at the facility-level, in which the facility is the implementer or receptor of the action. The estate management is responsible for promoting the action through appropriate tools.
- Actions at the estate-level, in which the estate is responsible for the management and implementation of the action
- Actions involving external entities, in which the estate management coordinates with external concerned parties. In this case, the role of the estate management is to support, recommend to and communicate with the responsible party.

3.1.4. Documentation Requirements and Information Management System

In order to undertake the responsibilities and monitor the performance of the estate, the estate management should maintain a well organized information management system, the data can be of following nature:

- General data and documents related to the estate and its surroundings
- Data related to the facilities
- Specific environmental information related to different environmental aspects

General data and documents:

- Estate EIA, if any
- Plans for industrial development
- Surrounding developments
- Environmental policies
- Legal requirements
- Institutional context of the environmental management system
- Role of other entities with respect to the environmental management of industrial estates

Data related to the facilities

- Sectors, raw materials, byproducts, processes, expected pollutants, utilities
- Conditions for the EIA approval for individual facilities

Specific information

Specific information will be included in the specific chapters of Chapter 3 and 4.

The information system could be manual or electronic according to the resources of the estate management. However, a number of principles should be applied to ensure the effectiveness of the system:

- Assigning of responsibilities of monitoring, data collection, data entry and analysis
- Determining the sources of information and mechanism for data collection
- Validity and confidentiality of the data
- Data analysis and decisions based on the findings

Data should be collected as stipulated in the monitoring plan and continually updated in the database for assessing the environmental status of the estate.

It is suggested that:

- Facility-level information should be compiled separately such that each facility has its own database
- Estate-level environmental information should be compiled according to the environmental issues (air quality, solid waste, etc.)
- A general compilation for the environmental regulations, policies and conditions should be maintained

The estate management should make decisions based on the interpreted results of the monitored data to manage the environmental issues based on their priority and significance.

3.2. MANAGEMENT OF WATER SUPPLY

3.2.1. Objective

The overall objective of the water management is to ensure that the water demands of the facilities are fulfilled within the supply constraints.

In that respect, specific objectives include:
- Secure water supply
- Rationalize the consumption of water

Annex (3.2) is a technical background for water supply.

3.2.2. Roles and Responsibilities

3.2.2.1. Estate Management
- Collect data and estimate water demands of the estate
- Facilitate contracts and contacts between facilities and water suppliers
- Solve problems and find solutions for raised issues.
- Inform the responsible entity when maintenance or rehabilitation of water network is needed within the estate.
- Develop and propose water conservation measures within the estate to be implemented by the water entity or specialized consultant.
- Propose awareness activities to be implemented by the water entity within the estate.

3.2.2.2. Facility
- Define its water needs, types/quantities
- Water conservation
- Timely payments of water bills to the water entity

3.2.2.3. Water Supplier/Entity
- Ensure water quality, quantity, pressure and continuity.
- Maintain, repair and rehabilitate water networks and meters.
- Water sampling, analysis and record keeping.
- Respond to new facility needs and growing water demand.
- Cooperate and coordinate with the estate management unit to fulfill water requirements of the estate.

3.2.2.4. Water Network Manager
- Supervises maintenance and repair of network and water meters
- Implement leak detection and loss reduction programs, if necessary.
- Network record keeping, mapping and updating.
- Monitoring water uses and consumption to avoid abnormal peaks.
- Respond to new facility applications for water connections.

3.2.3. Activities Undertaken by the Estate Management to Fulfill its Responsibilities

3.2.3.1. Investigating and Updating of Status

Data to be Collected
- Water supply to the estate
- Water demands of the facilities
- Time peak load of the estate on a 24 hour basis

- Foreseen water demands of new facilities
- Status of the water network
- Pattern of water supply failure

Data Collection Mechanism
- Water supply to the estate could be acquired from the water supplier
- Water demands are acquired from the facilities
- Time peak load for the estate is acquired through measurements on 24 hours using meters installed on the main input to the estate. The measurements are then drawn against time
- Foreseen demands are requested from new facilities. They could also be acquired from the facility's individual EIA
- Water networks could be inspected for leakages and for maintenance
- Water supply failure should be recorded (duration and date)

Monitoring Frequency
The monitoring should have a time history of water consumption on a 24 hours or 1 shift basis.

Data Documentation
Documentation forms include:
- Documentation of water -related information (Annex 3.3)
- Documentation for water supply failure (Annex 3.4)
- Incident report in case of the occurrence of any incident such as the need for maintenance (Annex 3.5)
- Tables and graphs for time peak loads in which the consumption of water will be plotted against time

3.2.3.2. Data Analysis and Identification of Needs

Data Analysis
- The water supply is compared to the demand. Foreseen consumption for new facilities should be accounted for to investigate the needs of the future
- The time peak load diagram is investigated to detect the peaks on consumption in the estate and in each facility.
- Investigation of water network will detect possible leakages.

Needs
According to the analysis, a number of findings require specific actions to address them.

- Water supply failure, especially if occurs frequently
- Water supply is not adequate to the needs of the industries or will not be in the near future
- Needs for maintenance

3.2.3.3. Actions

a. Routine Actions

a1. Interventions at the Level of the Facility

Promotion of Water Conservation through Awareness
The estate management could organize awareness sessions for the facilities on water conservation. In that respect, it could seek the expertise of research and technical institutions.

The awareness should include:

- Mechanism for water use
- Methods and equipment that can be used to help control and reduce water losses
- Benefits of water conservation

Annex 3.6 includes tips for water conservation.

a2. Interventions at the Level of the Estate

- **Preventive Maintenance for the Water Network**

In coordination with the responsible entities, the estate management could set a plan for periodic preventive maintenance for the water network to minimize leakages and other malfunctions.

b. Need-based Actions

b1. Interventions at the Estate-level

- **Central Water Tank**

The estate management could consider installation of a central water tank to be used in water supply failure or during peak consumption. The tank could be filled in the periods when no facilities are operating.
The tank could be owned by the estate or collectively by the facilities.

- **Adjusting Peak Loads**

If possible, the estate management could coordinate with the facilities to reduce the maximum peak load within the estate. This is done by considering moving some operations that occur during the typical peak period to the off-peak period.

b2. Interventions at the Facility-level

- **Individual Water Tank**

Facilities with high water consumption should be encouraged to install their own central water tank to be used in water supply failure or at the peak consumption.

b3. Interventions Involving External Entities

- **Communicate with the Water Supplier for the Provision of Addition Water**

As a last resort, the estate management could communicate with the water supplier for additional water. This will be especially needed if the gap between the supply and the demand is not easily controlled by other interventions.

This action should be taken according to the analysis of data and should not be postponed until actual shortage is encountered.

- **Communicate with the Water Supplier when Maintenance is Needed**

The estate management will inform the water supplier when maintenance is needed.

3.3. MANAGEMENT OF ELECTRICITY SUPPLY

3.3.1. Objective

The objective is to ensure that the electricity demands of the facilities are fulfilled within the supply constraints.

In that respect, specific objectives include:
- Securing electricity supply
- Rationalizing the consumption of the electric energy
- Minimizing energy cost relative to production cost
- Protecting the ambient air quality

Annex (3.7) is a technical background for electricity supply.

3.3.2. Roles and Responsibilities

- **Estate Management**
  - Collection and updating of information regarding electricity supply and demands
  - Secure supplying electric power to facilities with the required voltage.
  - Promote the application of energy conservation measures in facilities
  - Take the required actions to satisfy the identified needs

- **Facility**
  - Rationalize power consumption by adopting energy conservation programs and elaborate an energy management system
  - Provide correct information related to electricity demands
  - Cooperate with the estate to address electricity-related constraints and needs

- **Electricity Supplier**
  - Secure electric power supply to the different industrial facilities. This should be done continuously, with fairly competitive price to avoid the use of other alternatives that have higher environmental impacts.
  - Provide technical support to both estate management and facilities. The actual implementation of energy conservation obviously involves technical details: types of equipment, efficiency measurements, instrumentation, operation, maintenance.

3.3.3. Activities Undertaken by the Estate Management to Fulfill its Responsibilities

3.3.3.1. Monitoring and Updating of Status

- **Data to be Collected**
  - Electricity supply to the estate
  - Electricity demands of the facilities
  - Time peak loads of the facility on a 24 hour basis (or shift basis)
  - Time peak load of the estate on a 24 hour basis
  - Foreseen electricity demands of new facilities
  - Status of cables and their condition especially regarding corrosion
  - Pattern of electricity blackout

Annex (3.8) shows the typical energy consumption and power factor for industries.

- **Data Collection Mechanism**
  - Electricity supply to the estate could be acquired from the electricity supplier
  - Electricity demands are acquired from the facilities
  - Time peak load for the estate is acquired through measurements on 24 hours using power meters installed on the main cable to the estate. The measurements are then drawn against time
  - Time of peak load for the facility is acquired from the facility. Each facility has a meter for power measurements. The facility will be required to provide the readings along 24hrs or on per shift basis.
  - Future demands are requested from new facilities. They could also be acquired from the facility's individual EIA
  - Complete checking of electrical control boxes, cables (checking of proper insulation, earthing) of individual facility can be done from electricity supplier or from facility..
  - Electricity shut down could be recorded (duration and date of the blackout)

- **Monitoring Frequency**
  - A time history of power consumption should be prepared on a 24 hours or per shift basis.
  - Walkthroughs will be periodically undertaken (once each month). in case of complaints from the facilities

- **Data Documentation**

  Estate management should keep energy records to follow-up on the energy demands within the facility. Documentation forms include:
  - Documentation of energy-related information (Annex 3.9)
  - Documentation for electricity blackout (Annex 3.10)
  - Incident report in case of the occurrence of any incident such as the need for maintenance (Annex 3.11)
  - Tables and graphs for peak load versus time in which the consumption of electricity will be plotted against time

3.3.3.2. Data Analysis and Identification of Needs

- **Data Analysis**
  - The electricity supply is compared to the demand. Foreseen consumption for new facilities should be accounted in investigating the needs of the future
  - The peak load versus time graph is investigated to detect the peaks on consumption in the estate and in each facility.
  - Investigation of underground cables will detect possible heat loss to the surrounding soils. The investigation of the aerial transmission lines will detect corrosion and heat loss to the ambient air, especially in windy areas.

- **Needs**

  According to the analysis, a number of findings require specific actions to address them.

  - Electricity blackout especially if at high frequency

- Electricity supply is not adequate to the needs of the industries or will not be in the near future
- Corrosion of cables

3.3.3.3. Actions

a. Routine Actions

a1. Interventions at the Level of the Facility

- **Promotion of Energy Conservation through Awareness**

  The estate management could organize awareness sessions for the facility on energy conservation. In that respect, it could seek the expertise of research and technical institutions or private consultants.

  The awareness should include:
  - Energy Audits
  - Actual costs of energy
  - Methods and equipment that can be used to control and reduce energy wastage
  - Benefits of energy conservation
  - Benefits of power factor adjustment
  - Power factor adjustment and how to interpret the energy bill to see if there is any penalty (if any) due to power factor
  - Importance of peak load management

  Energy costs can be a significant portion of total production costs. Depending on the industry, the processes employed, and the raw materials used and final product manufactured, energy costs can be as high as 70 percent of total production costs. Annex 3.8 shows the cost of energy as related to the production costs and the typical power factors for different industries.

  Annex 3.12 provides tips for energy conservation in industries.

- **Power factor Correction**

  Encourage facilities to correct the power factor. The estate management could seek the expertise of professional institutes or consultants to provide demonstration for the facilities.

- **Encourage Facilities to Adopt Cogeneration Principles**

  Cogeneration is the combined generation of heat and power; therefore, cogeneration is sometimes referred to as CHP (combined heat and power). Examples for cogeneration include:
  - For a facility that has the capability of generating steam at high pressure and uses it at low pressure, it is advisable to employ a back-pressure steam turbine-generator unit to generate electric energy; the generated electric power is based on no-running-cost principles.
  - When electric power is generated through diesel-generator units, the hot cooling water can be used as a heating body in other applications. Also the elevated temperature exhaust gases from the engine can be used to produce steam in a waste heat recovery boiler.

- Exhaust gases from steam boilers (and other similar equipment) can be employed in a heat exchanger as a heat source to warm up air in an air conditioning winter system.
- Heat resulted from exothermic chemical reactions, in some chemical industries, can be employed in heating loads or steam generation, depending on the availability and economy.

Communication with the electricity supplier to investigate the possibility of connecting the co- generated electricity by the facilities which can produce surplus electricity to the main electricity feeding line of the estate.

Annex 3.13 provides background on the Combined Heat and Power (CHP) Generation.

b. Need-based Actions

b1. Interventions at the Estate-level

- **Stand-by Generator to Account for Frequent Blackout of Electricity**

If the blackout of the electric power frequently occurs, the estate management might consider installing its own local diesel power plant to provide electric energy to the facilities. In comparison to individual generators, this will yield:

- the generation efficiency will be higher,
- the cost per generated kW will be less,
- the emission levels will be less; the emissions from large low-speed diesel units are less compared to small high-speed diesel units, and
- The source of emission will be localized.

The generator could be owned by the estate or collectively by the facilities or by a contractor group.

- **Staggering Peak Loads**

If possible, the estate management could coordinate with the facilities to reduce the maximum peak load within the estate. Considering the impact that the time of day has on the peak. In many facilities the peak demand is set during one of the following periods:

- In the morning when some of the equipment is first turned on
- Just before or after tea breaks or lunch
- During summer afternoons due to cooling requirement
- Just before or after shift changeovers.

If the peak occurs during these periods, it is required to observe the equipment and operations in order to identify opportunities to reduce unnecessary equipment loading.

- **Staggering Employees Breaks**
  Employees returning from a break period will use process-related equipment that has been idle or turned off. Initial use of idle equipment often increases demand usage for a short period.
- **Alleviate the Facility Peak Load**

Considering shifting some operations that occur during the typical peak period to the off-peak period. For example, if an operation can be shifted after office hours, when the office lights are typically off, then the load during the peak demand period will be reduced. Some process equipment may also be moved to a swing shift in order to reduce peak demand.

- **Staggering Start-up of Equipment**
  Motors typically experience an in-rush current, which is much higher than their rated current, when they are first energized. This inrush current varies depending on the starting torque of the motor, but is at least 5 times as great as the rated current. This higher in-rush current does not last long (perhaps 20 seconds), but averaged over 15 minutes with a lot of equipment, this additional load could be significant. For example, a 100 hp motor (74.6 kW) with a 500% inrush current over a 20 second period would result in a demand of 81.2 kW (when averaged over 15 minutes). This power requirement is about 9% higher than the normal load of 74.6 kW, which is expected for this motor.

b2. Interventions Involving External Entities

- **Communicate with the Electricity Supplier for the Provision of Addition Electricity**
  As a last resort, the estate management could communicate with the electricity supplier for additional electricity. This will be especially needed if the gap between the supply and the demand is not easily controlled by other interventions.

  This action should be taken according to the analysis of data and should not be postponed until actual shortage is encountered.

- **Communicate with the Electricity Supplier when Maintenance is Needed**
  The estate management will inform the energy supplier when corrosion in cables is detected

3.4. MANAGEMENT OF AMBIENT AIR QUALITY

3.4.1. Objective

The main objective is to ensure the environmental compliance of the estate ambient air quality with the limits set by Environment Law 4/1994, in order to reduce the negative impacts of air pollution from the estate on the surrounding areas and the nearby residents, and to protect the estate from internal and external sources.

Annex (3.14) includes a technical background related to air quality.

3.4.2. Roles and Responsibility

- **Estate Management**

The estate management role is to:

- Maintain the level of pollutants, at the industrial estate, emitted by internal and external sources, including mobile sources and fugitive emission sources, at the limits required by the law

- Monitoring and follow-up of ambient concentrations of air quality
- Ensuring that air emissions from the facilities do not negatively affect the ambient air
- Take the required actions to address identified needs

The estate role will not be extended to the facility as long as the facility emissions do not negatively affect the ambient air quality, regardless of its compliance status

- **Facility**

The facility's responsibility is to:

- Maintaining gaseous emissions' levels at the source within the limits required by the Law through selecting and implementing required measures
- Performing periodic monitoring of air emissions from the facility as required by law 4/1994
- Providing correct information regarding air emissions concentrations

3.4.3. Activities Undertaken by the Estate Management to Fulfill its Responsibilities

3.4.3.1. Monitoring and Updating of Status

- **Data to be Collected**

The estate management should collect the following information:

- Ambient concentration of the critical pollutants. The concentration of these pollutants in the ambient air should be monitored to track pollution trends, and to provide a baseline level to which emissions should be compared. Other pollutants could also be evaluated based on the types of industries in the estate. Annex (3.15) provides emissions expected from different industries.
- Information specific to facilities include types of emissions generated from each facility according to the type of industrial processes undertaken in it as well as measures taken to control the emissions. It should be noted that information regarding the emissions from facilities are only acquired when needed.
- Information regarding new facilities that would be established in the estate. The information include type of processes, and expected emissions.
- Information regarding adjacent developments that may affect the ambient condition throughout the state.

- **Data Collection Mechanism**

- The estate management should monitor the ambient concentrations of the critical pollutants in selected points/stations in the estate based on the monitoring plan. These activities will need professional input.
  - Monitoring stations should be located within the industrial clusters in areas that may receive maximum impact through releases from the industrial facilities. However, these stations should not be too close to source of pollutant.
  - The distance between the source and the sampler depends on the nature of pollutants and the condition at which it is dispersed (pollutant dispersion rate, flowing speed, etc.). Each pollutant has different requirements. For more details, please refer to the "Methods of Air Sampling and Analysis, 1999" produced by EEAA. The document includes standard procedures for sampling and analyzing the ambient air for each criteria pollutant as well as means of

establishing benchmarks to ensure that all performed sampling processes produce comparable results.
  - Each cluster will be examined individually to determine the number of monitoring stations needed to adequately characterize the air quality within that area.
  - Meteorological data should be collected to supplement the pollutant sampling. The data includes ambient temperature, wind speed, wind direction, and precipitation amounts.
  - Measurement spots should be located in down wind direction where strong pollutant streams are always obtainable.
  - Monitoring equipment should be placed at the edge of the area being evaluated to detect the pollutant concentrations entering and leaving the area, provided that no major obstacles exist around the equipment such as high buildings and trees.

- Facility-specific information could be acquired from individual EIAs as well as from the facility based on contractual agreements. Visual observation of unusual incidents of smoke or colored emissions from facilities is an indication that should be further investigated.
- Baseline conditions are either acquired from the strategic EIA, if there is one or the estate management could undertake baseline measurements at minimum pollution load (when most of the industrial facilities are not in operation on holidays for example). In such case, all criteria pollutant concentrations should be monitored inside the estate at the previously defined stations and in the neighborhood. Baseline readings are used as reference for comparison and evaluation of status. Deviation from the baseline will confirm the occurrence of pollution. Further analysis will be needed to identify polluting sources either from the estate or outside it.
- Information and plans regarding adjacent developments could be acquired from the governorate or other concerned parties.

- **Monitoring Frequency**

  The monitoring is to be periodically carried out at selected locations in the estate to define the typical pollutant concentration according to the nature of industries existing in the estate. Frequency of measurements is recommended to be every 3 month. Monitoring is also undertaken in case of accidental releases.

  The estate management should keep under surveillance any new facility being built in the estate to perceive any negative impact especially during the construction and commissioning phases.

- **Data Documentation**
  - Air quality monitoring report for each monitoring location (Annex 3.16) including the results of the periodic measurements of ambient air quality as compared to allowable limits. Comparing the measurements and drawing the pattern for measurements development will facilitate status identification and actions to be taken towards mitigation procedures. The reports are accompanies by a map of the estate indicating the points of measurements.
  - Incident report in case of accidental releases (Annex 3.17)

3.4.3.2. Analysis of Information and Identification of Needs

- **Analysis of Information**
  - The results for monitoring of the ambient air quality are obtained for different monitoring stations.
  - The results are compared to the limits set by Environment Law 4/1994 in a tabulated form. The results will also be compared to the baseline measurements to identify the deviation.
  - Trends will be analyzed through the comparison of measurements at the same locations.
  - Based on the knowledge of emission from each industry and from stations where the ambient monitoring exceed the allowable limits, identifies the industries that contribute most to the negative impact,
  - Determine the locations of polluting sources that release the high pollutant concentration indicated in the measurements. Potential sources include:
    - Facilities: due to emissions released from:
      - processes, which are not managed by air pollution control devices
      - air pollution control devices which are under repairs, replacement, failure, malfunctioning.
      - accidental release
      - loading and loading of material
      - Storage of raw materials, which allows a release of fugitive pollutants
    - Construction of new facilities
    - Start-up of new production facility resulting in increasing the air pollution load.
    - Vehicle emissions from transports and material handling equipment inside the estate.
    - Unpaved roads and areas
    - Sources outside the estate including:
      - Garbage burning in a nearby dumping site.
      - Vehicle emissions in adjacent traffic.
      - Open storage areas in the vicinity.
      - Construction activities

- **Identification of Needs**
  - Persistent high concentration of pollutants exceeding or approaching allowable limits
  - Accidental releases that could be detected through visual observation.

3.4.3.3. Actions

a. Routine Actions

- **Intervention on the Facility Level**
  - All industrial facilities under construction should have adequate facility for controlling adverse effect on the ambient air during construction phase. This entails that the estate management impose some obligations in the contractual phase of the facility, such as:
    - Siting proper material storage areas to prevent fugitive dust.

- Limiting usage of open vessels containing chemicals or volatile compounds to avoid evaporation.
- Eliminating fumes or fuel burning in open areas.
- Limiting any emissions from vehicles used on site.

- Operating facility should ensure that stack and vent emissions comply with the law requirements.

- Promotion of emission control measures where the estate management could appoint consultants to provide awareness sessions including:
  - Implementation of air quality management programs
  - Implementation of cleaner production measures.
  - Implementation of good housekeeping.
  - Implementation of preventive maintenance programs for pollution control equipment.
  -

- **Interventions on the Estate Level**
  - Keeping all roads paved and regularly maintained.
  - Wetting dusty roads to reduce dust from wind and vehicle movement.
  - Covering of fugitive emission sources such as rarely used piles of material.
  - Setting speed limits inside the estate.
  - Regulating material handling activities such as conveying systems or trucking of materials.
  - Regulating small dumping operation such as loading and unloading of materials that produce fugitive dust; a vent hood can be installed in place to capture any fugitive dust.
  - Regulating fuel unloading inside the estate to eliminate oil spills to avoid fumes.
  - Adequate enclosure of storage areas to minimize fugitive dust caused by loading/unloading of materials.
  - Creation of buffer zones

Annex 3.18 includes a background related to the creation of "Green Belts" or "Buffer Plantation Zones" at industrial estates.

b. Need-based Actions

- **Interventions on the facility level**
  - Addressing accidental release detected during visual inspection:

The estate management should have a emergency plan to address any accidental release of dust, fumes or odor. The plan should include:

- Records of accidental release events throughout the estate should be kept as reference for the estate personal.
- Identification of the source of the release
- Measurement of the particular accidentally released pollutant should be carried out, and results should be recorded.
- In case of release from facilities, the estate personal should contact the facility to take the necessary action to stop the emissions within a specified time.
- The estate management could assist the facility to address such case by contacting maintenance contractors and experts to solve the problem

  - The release case should be well reported and registered in the accidental release records.
- In case of persistent high concentration or certain trend within a specific area, the estate management should take the decision to stop locating new facilities in this area especially those generating the same pollutant or sensitive to it.

- **Intervention addressing external sources**
  Alternatives requiring intervention of external entities to address external pollution sources. Each source, mainly fugitive emission area sources, must be addressed in a specific manner due to the variation in treatment processes:
  - Garbage burning in nearby dumpsites: The estate management, in collaboration with the urban planning authority, should review the neighboring site plan, and suggest environmental requirements. This requisite should be supported by the Estate Board of Directors.
  - Vehicle emissions in adjacent traffic: The estate management should approach the transport department to control traffic around the estate and to make sure that all roads are paved.
  - Open ponds, ditches and settling basins of wastewater: The estate management should approach municipal authority to reduce turbulence and temperature of these sources in order to minimize the volatilization of VOCs.
  - Open storage areas: Any storage area, which can be reasonably enclosed, should be covered to avoid emissions.

3.5. MANAGEMENT OF LIQUID WASTES

3.5.1. Objective

The overall objective of the management of liquid wastes is to ensure minimum impact on the receiving water bodies and on the network.

The specific objectives of wastewater management are:
- Ensure that the wastewater generated from the estate is within the allowable limits of environmental laws and regulations
- Ensure that the raw water supply network is well maintained and is not affected with the effluent discharged from the facilities
- Annex 3.19 represents some technical background related to wastewater.

3.5.2. Roles and Responsibilities

3.5.2.1. Estate Management
- Collect, keep, and update data related to the wastewater discharged from different facilities.
- Prepare a tabulated format computing the impact by waste water from industry.
- Coordinate with the wastewater authority and newly operated facilities for connecting to the wastewater system.
- Follow up and ensure the routine maintenance programs and emergency maintenance or repair of the wastewater system components.
- Promote in-house measures for facilities requiring pre-treatment of their wastewater before discharging to the public system.
- Awareness of facilities to minimize the wastewater loads by making similar case studies and experiences available.

3.5.2.2. Facility

- Comply with the environmental laws and regulations regarding discharged wastewater
- Provide true and correct information, when needed, regarding amount and quality of wastewater generated by the facility as well as frequency and pattern of discharging to the wastewater system. This should indicate the pattern of discharge if it is continuous or intermittent.
- Undertaking periodic monitoring of discharged wastewater according to the requirements of environmental laws and regulations
- Notify the estate management in case of accidental discharges or perceived need for maintenance.

3.5.2.3. Network Manager

- Planning and design of the wastewater system components within the context of the regional and national plans.
- Follow up and monitor the facility discharges to ensure compliance with the regulatory limits.
- Apply routine maintenance programs.
- Overcome any operational problems including emergency maintenance and repair.
- Upgrading of the wastewater system based on the actual need of the estate.

3.5.3. Central Wastewater Treatment Facilities in Industrial Estates

In some cases, the industrial estate has a central wastewater treatment plant. If the plant is managed and maintained by the estate management, in this case, the estate management will have the following responsibilities:

- Allocating a plot of land within the industrial estate to serve as the wastewater treatment plant
- Establishing a contractual agreement with the facilities concerning the quality of wastewater that is acceptable by the plant
- Follow-up on the quality of wastewater discharges by the facilities

3.5.4. Activities Undertaken by the Estate Management

3.5.4.1. Monitoring and Updating of Status

- **Data to be Collected**
  - Facilities related information including characteristics and quantities of wastewater discharged by facilities to the estate network (Annex 3.20 includes the characteristics of wastewater from different types of industry) as well as implemented pre-treatment equipment
  - Status of the wastewater network
  - Information related to the wastewater collection system including type, diameter, length, and flow direction of the pipes, layout of the network, manholes type and location identifying the connected facilities, system management and routine

maintenance program as well as main equipment list and related specification, in case the system has pumping stations.

- **Data Collection Mechanism**
  - The estate management could acquire the analysis of the facility generated wastewater from the regulatory agency.
  - Facilities related information is acquired from the facility based on an agreement
  - The status of the network is investigated through visual observation following a specific plan
  - Information related to the network is acquired from the network manager

- **Monitoring Frequency and Mechanism**

The estate management should have a monitoring program to follow-up on the network conditions and the characteristics of wastewater discharged. The measurements will be undertaken periodically every three months. Measurements are also undertaken after specific incidents such as complaints, flooding of wastewater or problems in the pipelines.

- **Data Documentation**

  Documentation include:
  - Facility specific information on wastewater characteristics and quantum
  - Incidents and actions taken in their response (Annex 3.21)
  - Information related to the network
  - Map of the sewer network with facilities and manholes indicated

3.5.4.2. Data Analysis and Identification of Needs

- **Data Analysis**
  - The analysis of the wastewater measurements results provided by the regulatory agency will indicate violating facilities
  - Investigation of the sewer network status will indicate problems and maintenance needs
  - Investigation of the sources of pollutants
  - Investigation of the pollutants and the sewer network will indicate locations where mixing of wastewater from different sources may cause problems such as release of gases or toxic chemicals.
  - Potential sources for the problems in the network are indicated based on the knowledge of the type of pollutants discharged by each facility and the network layout

- **Identification of Needs**

  Needs that could be identified are based on incidents that might include:
  - Problems with the wastewater network including flooding or leakage due to continual peak discharges
  - Blockage or corrosion of pipelines due to violating discharge
  - Accidental spills or discharges

3.5.4.3. Actions

a. Routine Actions

a1. Interventions on the Facility Level

- **Conditions for New Facilities**
  The estate management should set conditions for the new facilities with the compliance with the laws and regulations regarding wastewater and the provision of required information.

- **Awareness of Facilities**
  The estate management could organize awareness sessions for the facilities regarding the wastewater reduction at sources, recycling and other mitigation measures.

  The awareness activity could be undertaken in coordination with the service provider. Cooperation with the network manager is essential in this respect.

a2. Interventions on the Estate Level

- **Preventive Maintenance of the Wastewater Network**
  Preventive maintenance programs should be agreed upon with the network manger to avoid any leakages or over-flooding or sudden failure of the system.

b. Need-based Actions

b1. Interventions at the Estate Level

- **Adjusting periods for peak discharge**
  The investigation of wastewater measurements and the network condition might indicate a peak period of discharge that could not be handled by the network. In this case, the facilities are directed to adjust their discharge periods so as to avoid the peak period.

b2. Interventions Involving External Entities

- **Notify the responsible authority of any indication of the system failure**
  In case incidents of network problems such as flooding, leakage or blockage occurs, the network manager is notified to take the required action. This might include extension of collection system, replacement of existing pipelines, rehabilitation of pumping stations.

  The need for the modification of parts of the network may arise if it is found that the mixture of specific effluents form corrosive compounds that negatively affect the pipelines.

b3. Interventions at the Facility Level

- **Promote Common Treatment**
  The estate management could promote the implementation of common treatment facility among the facilities.

Annex 3.22 provides background on common effluent treatment plants for wastewater management.

- **Contain Accidental Spills**
  In case of accidental spills or discharges, facilities should inform the estate management of the incident. Actions to contain the spill and alleviate the impact of the spill are taken according to the type of the discharge and its potential impact on the network and the environment.

3.6. MANAGEMENT OF SOLID WASTE

3.6.1. Objective

The overall objective of management of solid waste within the industrial estate is to minimize risks to public health and environment due to improper handling of solid waste.

Within this context, specific objectives encompass:
- Prevention of industrial solid waste accumulation
- Safe and cost effective transportation of solid waste
- Cleanliness of the streets within the industrial estate.
- Minimization of generated solid waste

Annex (3.23) provides a technical background related to solid waste.

3.6.2. Roles and Responsibilities

- **Estate Management**
  - Collection and disposal of solid waste generated by facilities.
  - Reviewing and registering potential solid waste transportation contractors to operate within the estate.
  - Ensuring that all collection and transportation activities of solid waste are carried out within proper environmental standards.
  - Ensuring that solid waste is segregated from hazardous waste.
  - Ensuring that the streets within the industrial estates are appropriately cleaned.

- **Industrial Facility**
  - Providing correct information regarding solid waste generation, transportation and disposal.
  - Segregating hazardous waste from solid waste prior to disposal.
  - Off-site storing and/or disposing its solid waste only in areas designated by the estate management for receiving such waste.
  - Transporting its solid waste only through transportation contractors who are registered with the estate management, in case facilities do not have their own transportation operations.
  - Meeting the recommendations of the estate management for collection and transportation operations, in case the facility manages its solid waste on its own.
  - Meeting all agreed financial requirements for solid waste management services as rendered by the estate management or private registered contractors.

- **Contractor(s)**
  - Ensuring that no hazardous waste is collected and disposed with the solid waste.
  - Preventing and clean up of leaks/spills during waste handling.
  - Meeting set conditions for safe transportation of solid waste.

3.6.3. Central Facilities for Solid Waste Management in Industrial Estates

The solid waste resulting from the facilities could either be collected by individual contractors to be transported and disposed by them or collected and transported to a central transfer station in the estate. The transfer station minimizes the costs of transportation per unit waste, which is particularly true for small quantity generators, especially if the waste disposal site is located far from the industrial estate. Other factors to decide whether a transfer station would be needed or not, include:

- Availability of land within the estate for establishing the facility
- Proximity of the industrial estate to disposal sites.
- Number of small generators within the estate.
- Fees currently paid by facilities to contractors for collection of waste, against fees to be paid to the transfer station operators.

If the estate management establishes a transfer station, it will be operated by a private contractor. The private contractor would either be given a plot of land for free or it would be leased from the industrial estate. The private contractor will be selected based on a number of technical and financial criteria. Crucial technical criteria include:

- A permit from the governorate
- Vehicles in good shape and periodically maintained and abide by the specifications of law 38/1967
- Qualified employees trained on handling solid waste
- Necessary equipment is available
- Minimal violation records (both contractual as well as environmental violations)
- Previous experience in managing transfer stations would be an advantage

In this case, the estate management would be responsible for:

- Allocating a plot of land within the industrial estate to serve as a Transfer Station.
- Selecting a private contractor for the operation of the Station based on the above mentioned criteria
- Establishing a contractual agreement with the contractor. One important stipulation in this agreement is the responsibility of the Transfer Station operator not to accept hazardous waste.

3.6.4. Activities Undertaken by the Estate Management to Fulfill its Responsibilities

3.6.4.1. Monitoring and Updating of Status

a. Identification of generated solid waste and its collection and transportation practices

In order to establish a solid waste management system within the estate, there is a need to estimate the amount of solid waste generated and indicate the practices for its collection and transportation.

- **Data to be Collected**

  The compiled data on solid waste would include:

- Types of solid waste generated (Annex 3.24 provides the types of solid waste expected to be generated from common industrial sectors)
- Actual solid waste generated from operating facilities
- Estimated solid waste expected from facilities that are not operational yet, that are under construction or for which land has been allocated, but the construction has not been started.
- Current (or intended) collection and transportation practices
- Solid waste contractors managing the waste (applicable for existing facilities)

- **Mechanism for Data Collection**
  - Data will be collected and updated from the industrial facilities using a form where actual types and amounts of solid waste generated (or expected for new facilities, under establishment), as well as current (or intended) methods of transportation and disposal, are specified.
  - Industrial facilities would be required to provide this information, to their best knowledge, according to the contractual agreement between them and the estate management. New facilities will be also required to fill in this form. A suggested form is included in (Annex 3.25).
  - The estate management is also required to undertake routine walkthroughs in the estate to observe any accumulated solid waste

b. Compiling Information on Solid Waste Contractors and their Performance

- **Data to be Collected**

  The estate management has to compile information on solid waste contractors working within the governorate in which the estate is located. In this regard the estate management has to develop a database[13] for waste contractors with the following information:
  - Status of activity permit from the governorate
  - Facilities within the estate specific contractors are servicing
  - The violation record (if any) of each of the contractors from the concerned regulatory body[14].

  This database needs to be continuously updated.

  The contractors also include the contractor responsible for the operation of the transfer station.

- **Data Collection Mechanism**

  The data will be collected from different sources including:
  - Responsible entities in the governorate for permits issuing and inspection on the solid waste contractors
  - Feedback and complaints from facilities within the estate regarding services rendered by the contractors.
  - Visual observation for transportation contractors

[13] It is recommended that this database be computerized. However, a non-computerized database would also be effective.

[14] The concerned regulatory body would be the entity inspecting the solid waste management practices.

c. Monitoring Frequency

Periodic monitoring and evaluation will be needed. Complaints or other incidents will require further non-routine investigation.

d. Data Documentation

There are three different documentation records that the estate management should keep; documentation for waste generation, documentation of violations as well as a database of the contractors.

- The estate management should develop a database of the waste generated based on the form, filled by the facilities, attached in (Annex 3.25).
- The estate management should develop database of solid waste management violations and incidents occurring within the estate based on the incident reports (Annex 3.26)
- The estate management should develop a database of solid waste contractors, including information on the waste contractors working within the governorate

3.6.4.2. Data Analysis and Identification of Needs for Action

The analysis of the compiled data will serve to identify needs for action with respect to the contractors and the solid waste management system within the estate. The analysis of the collected data will indicate gaps in the solid waste management practices in the estate. Actions will be taken to address the identified needs as well as to address specific incidents. These needs include:

- *Accumulation of Waste Inside and/or Outside the Industrial Facilities*
  In cases where solid waste is found to be accumulating in industrial facilities and causing problems to the neighboring facilities, or when solid waste are found to be accumulating outside the facilities in areas within the industrial estate, actions should be taken by the estate management to track the cause and responsible entities for such accumulation.

- *Mixing of Hazardous Waste with Solid Waste*
  In cases where hazardous waste is mixed with solid waste by the facilities and detected either by the:

  - Transporter: The transporter in this case should refuse to accept the waste.
  - Transfer station contractor: In case mixed waste is delivered to the transfer station, the contractor could discover this situation before accepting the waste and accordingly might refuse to accept it.

  It is important to note any problems in segregation of non-hazardous and hazardous waste originates at the generator.

3.6.4.3. Actions

a. Routine Actions

a1. Interventions on the Estate Level

- **Assessment and registering potential solid waste contractors**
  - A registering system for solid waste transportation contractors is to be established at the estate to ensure that only contractors up to the set environmental standards are operating within the estate.
  - The estate management should develop and update criteria for the assessment of the waste contractors. Only contractors meeting such criteria should be "registered" by the estate for solid waste collection and transportation operations. Recommended criteria for assessment includes:
    - A permit from the governorate
    - Vehicles abide by the specifications indicated in law 38/1967 (could be verified through visual inspection as well as documentation for maintenance)
    - Qualified employees trained on handling solid waste (could be verified through working or training records)
    - Previous experience in solid waste collection and transportation, with industrial facilities
    - Minimal violation records (both contractual as well as environmental violations)
  - This registration is to be carried out through a contractual agreement between the estate management and the contractor, renewed annually and stipulating that the contractor would operate following the general conditions for solid waste collection and transportation, as set by the estate management based on law 38/1967.
  - Registered contractor should be given a registration number, and stickers to be placed on the vehicles, for easier identification.
  - The performance of the contractors is to be continually monitored through visual observations or from the feedback of facilities. The performance monitoring together with the continuously updated information of the contractor database, should be used for as a basis for the annual assessment for the renewal of registration. If violations of any of the set conditions are detected, the contractor could be removed from the list of registered contractors.
  - For contractors registrations which are cancelled or not renewed, the estate management is to inform all industrial facilities within the estate, and the ones using such contractors would have a time notice (previously agreed upon with the estate management and the contractor) to change the contractor(s).
  - If new contractors get registered, the estate management is to inform the industrial facilities within the estate.

- **Ensuring the proper collection and transportation of solid waste**
  - Solid waste is to be collected and transported either by registered contractors, the transfer station contractor or by the generators. These operations must be properly and safely carried out. Suggested conditions for the safe and proper collection and transportation of solid waste include:
    - Vehicles or containers used for the collection and transportation of solid waste should comply with the technical specifications indicated by law 38/1967

- The vehicles should be cleaned on regular basis and should be maintained in good working conditions.
- Loading and unloading of solid waste should be carried out in such a manner that the contents will not fall, leak, or spill. In case of spills, the material shall be contained by the collector/ transporter and returned to the vehicle or container and the area properly cleaned.
- Every truck or other vehicle used for collecting and transporting solid waste should have plainly visible and easily legible details of lettering showing the name, address and/or telephone number of the owner, and the estate management registration number.
- The collector/ transporter should ensure that no hazardous waste is collected with the solid waste.

- In the unlikely event of a generator (industrial facility) getting involved in the collection and transportation of waste generated by other establishments within the estate, these activities should be subject to the conditions, and agreements of collection and transportation contractors.
- The estate management should control the performance of the transportation contractors through the registration process and the stipulations of the contractual agreements with the industrial establishments regarding limiting their resort to registered contractors only. In this respect, collection and transportation contractors not abiding to such conditions, or whose performance is not up to the set standards, should have their registration cancelled, or not renewed
- The estate management should control the performance of the Transfer Station operator, as well as the waste generating industrial establishments, for collection and transportation, through the existing contractual agreements it has with them. Cases of non compliance to set regulations and standards should be dealt with according to the conditions set by these contractual agreements.

- **Capacity Building and Awareness to the Solid Waste Contractors**
  - Training of solid waste contractors on the other hand must be tailored to develop their knowledge of possible types of hazardous waste generated from different industries, as well as their ability to differentiate between non-hazardous and hazardous waste. Accordingly, the estate management needs to organize training and capacity building sessions for the solid waste contractors, addressing the following issues:
    - Hazardous Waste Characteristics and Types
    - Expected hazardous and non-hazardous waste from different industries (industries within the estate should be selected)
    - Responsibilities and actions falling within the scope of the contractor.

    In case the facility has a hazardous waste contractor, the contractor might contribute to the awareness sessions.

- **Providing Street Cleaning Activities within the Estate**
  - One of the services which the estate management is responsible for is the street cleaning inside the estate. In this regard, the estate management is to select a contractor to carry out such service subject to a contractual agreement.
  - The street cleaning contractor will assist in detecting facilities illegally dumping their waste.

- Collected solid waste should either be delivered to the Transfer Station, if one is established in the estate, or sent to the waste disposal area.
- The same contractor could be responsible for the operation of the transfer station and for street cleaning.

a2. Interventions on the Facility Level

- **Awareness to the Facilities Regarding Hazardous Waste**
  The industrial facility should be able to distinguish between solid non-hazardous waste and hazardous waste. In this regard, capacity building and training programs are needed. Industrial establishments should receive training on hazardous waste management, as described in section (3.7).

- **Promotion of Waste Minimization Concepts**
  Awareness of facilities regarding waste minimization concepts such as source reduction, reuse, recycling, recovery, etc.

b. Need-Based Actions

These actions are carried out based on the needs for actions identified above in section 3.6.4.2.

These are interventions undertaken on the estate-level.

b1. Acting to the Solid Waste Accumulation

The accumulation of solid waste could occur either within the industrial facilities, outside the industrial facilities in the roads of estate or in empty areas, or in the transfer station. In all three cases the estate management should track the deficiency in the solid waste management system that led to the occurrence of accumulation. This is carried out through:

- Investigating the situation through questioning the concerned entities, identifying the source of the accumulated waste according to the type of the waste and the entity responsible for the accumulation.
- Taking actions for remedying the situation including the removal of the waste at the expense of the entities responsible.

b2. Acting to Mixing Hazardous Waste from Solid Waste

Mixing hazardous waste with non-hazardous solid waste originates from the generator. Accordingly, in such cases, the estate management should:

- Trace back such case to the responsible generator.
- Take action according to the generator's responsibilities in the contractual agreement between the generator and the industrial estate management.

3.7. MANAGEMENT OF HAZARDOUS WASTE

3.7.1. Objective

The overall objective of the management of hazardous waste within the industrial estate is to minimize public health and environmental risks associated with this type of waste.

Within this context, specific objectives encompass:

- Segregation of hazardous waste from non-hazardous waste
- Handling of hazardous waste according to the requirements set by Egyptian environmental legislation and guidelines particularly with regard to transportation and storage.

Annex 3.27 provide a technical background on Hazardous Waste Management.
While Annex 3.28 represents Hazardous Waste Compatibility chart.

3.7.2. Roles and Responsibilities

- **Estate Management**
  - Collection and updating of hazardous waste (HW) types and quantity generated.
  - Reviewing potential hazardous waste transportation contractors to operate within the estate.
  - Ensuring that HW is segregated from non-hazardous waste for collection, transportation and off-site storage, if any.
  - Ensuring that all collection, transportation and off-site storage activities of hazardous waste are carried out as per requirements of the concerned legislation and technical guidelines.
  - Obligating environmental insurance against HW accidents off site.

- **Industrial Facility**
  - Continuously providing correct and true information regarding hazardous waste generation and transportation schedule and routes.
  - Proper management of generated hazardous waste within the facility.
  - Disposing of hazardous waste segregated from solid waste.
  - Refrain from storing or disposing of hazardous waste generated by the facility activities on public roads and/or public areas in the estate except those identified by the estate management for receiving such waste.
  - Only use waste transportation contractors those are permitted, if facility by itself is not carrying out the transportation operations.
  - Meeting the collection schedules agreed upon, when transportation is carried out through contractors as specified above.
  - Taking environmental insurance against hazardous waste accidents off-site and central storage area (if any).
  - Meeting all financial requirements agreed upon for hazardous waste management services as rendered by the estate management or private registered contractors.

- **Contractor (s)**
  - Ensuring that HW is properly handled, transported and that all legal safety requirements are maintained during collection, transportation and off-site storage.

3.7.3. Activities Undertaken by the Estate Management to Fulfill its Responsibilities

3.7.3.1. Monitoring and Updating of Status

a. Collection and updating of HW types and quantities

In order to ensure a proper HW management system within the industrial estate, the estate management should have adequate information about the types of HW generated (or expected to be generated) by the different establishments, estimated quantities, as well as HW management practices, in particular regarding transportation.

- **Required Data**

  The compiled data would include:
  - Generated HW types from the existing facilities. The Ministry of Industry developed such a HW list for wastes generated from different activities in the industrial sector (Included in Annex 3.29). Annex 3.30 presents industrial sectors most commonly generating hazardous waste and the likely generated types of waste.
  - Actual HW quantities generated from already existing and operating establishments.
  - Estimated HW types and quantities expected from facilities that are not operational yet that are under construction or for which land has been allocated, but the construction has not been started.
  - Current (or intended) disposal practices

- **Sources of Data**
  - The required information could be provided through the HW register available at each generator according to the requirements of Law 4/1994. The register must include data regarding types and quantities of HW and its handling methods. The facility could agree with estate management to provide copies of the information regularly to them.
  - New facilities will be also required to provide the necessary information as part of the requirements of the contractual agreement with the estate management.
  - The estate management is also required to undertake routine walkthroughs in the estate to observe any accumulated solid waste.
  - All such information is to be kept in a HW database and be periodically reviewed and updated.

b. Compiling information on hazardous waste contractors and their performance

The estate management must ensure that the HW transportation operations within the estate are carried out properly in order to avoid potential accidents and to minimize risks. In this respect the estate management has to compile information on licensed HW transporters in the governorate in which it is located.

- **Required Data**

  The compiled data would include:
  - Status of activity permit from the governorate
  - Facilities within the estate where contractors are servicing
  - The violation record (if any) of each of the contractors.

- Feedback from facilities within the estate regarding services rendered by the contractors.

In this regard, the estate management is recommended to develop a database[15] of waste contractors. This database needs to be continuously updated.

Only permitted transporters should be allowed to operate within the estate. The estate management is responsible for notifying the industrial facility in case transporters' licenses are revoked. According to Law 4/1994, generators can only use licensed HW contractors[16].

It is therefore not necessary for the estate management to carry out its own registration of HW transporters. HW transporters must obtain their transportation permit from the concerned administrative authority, according to stipulations of Law 4/1994 and its ER and the HW licensing and transportation.

c. Monitoring Frequency

- If violations of legal requirements by the transporter are detected, the transporter's details could be reported to the concerned regulatory body.
-
- If performance violations by the operator of the central storage facility are detected, including violations to legal requirements or contractual agreements, actions will be taken according to the contract conditions. In case the contract between the estate management and the operator is terminated, the industrial facilities should be notified particularly for cases where this operator is also providing HW transportation services to industrial establishments.

Periodic monitoring and evaluation will be needed. Complaints or other incidents will require further non-routine investigation.

d. Data Documentation

- **Documentation of Waste Generation**
  The estate management should develop a database of the waste generated. The database could either be computerized or non-computerized. If a computerized database is developed a number of search keys could be used including:
  - Facility
  - Waste type
  - Transportation contractor

If a non-computerized database is developed, the records could be organized by facility based on data documentation forms (Annex 3.31). Other reports are produced as needed.

[15] It is recommended that this database is computerized. However, a non-computerized database would also be effective.

[16] The transportation process is subject to stipulations of law 4/1994 and its ER and the HW transportation guidelines issued by EEAA.

- **Documentation of Violations**
  The estate management should develop database of HW management violations occurring within the estate. If a computerized database is developed the search keys would include:
  - Unit responsible for the violation
  - Violation type
  - Action taken

  If a non-computerized database is developed, two filing systems would be prepared one organized by unit responsible, while the other by the type of violation based on the violation report (Annex 3.32)

- **Documentation of Transport Contractors**
  The estate management should develop a database of HW transport contractors. If a computerized database is developed, the search key would be by the contractor name. Similarly if non-computerized database is developed, it would be filed by contractor's name and location.

3.7.3.2. Data Analysis and Identification of Needs for Actions

The analysis of the compiled data will serve to identify needs for action with respect to the contractors and the HW management system within the estate. This analysis together with the occurrence of certain incidents would indicate that there is a gap in the HW management system within the estate and accordingly the estate management would be responsible for taking actions. The needs include:

- **Accumulation, spills or leaks of HW**
  In cases where HW is accumulated outside the industrial facilities on the roadsides of estate or in empty areas, or spilled or leaked from HW transporting vehicle and cause problems to neighboring facilities or to the surrounding environment, the estate management should take actions to determine the facility/transporter responsible for such incident.

- **Mixing of HW with solid waste**
  In cases where HW is mixed with the non-hazardous solid waste. The mixing could be detected either by the solid waste transporter or by the transfer station contractor.

- **HW Accidents within the Estate**
  In case HW accidents occur during transportation from the industrial facilities within the estate, the estate management needs to take actions to manage the accidents and minimize potential risks.

3.7.3.3. Actions

a. Routine Actions

a1. Interventions on the Estate Level

- **Providing a central location for temporary HW storage**
  - In Egypt the necessary infrastructure (disposal and treatment facilities) for proper HW management are not yet available. Therefore, HW generators are responsible for carrying out proper long term storage of their waste until the infrastructure is complete and operational. Providing proper long term storage and compliance to

the legal and technical conditions requires significant investments that would present a financial burden for the facilities within the estate, especially for SMEs.

- Within this context, it is recommended to provide storage services to the generating facilities to help them meet their legal obligations and most importantly encourage proper HW segregation and avoid unintended or intended mixing of such waste with non-hazardous solid waste, and its delivery to the solid waste transfer station.
- In this regard, the estate management could designate an area to be used as a central HW storage facility. According to law 4/1994 and Environmental Impact Assessment (EIA) to determine potential impacts of such facility on the surrounding environment and measure for mitigation of such impacts.
- This area would be subdivided into smaller locations, whose price is to be incorporated within the land allocated for the HW generating facilities. The area to be used for temporary storage of their HW. The facilities will bear the operating costs of the storage area.
- In order to reduce potential risks, only packaged waste is to be allowed (i.e. identified waste in labeled barrels/containers). The sizes of the storage locations provided to the generating facilities are determined based on the expected HW quantities generated.

Siting and design conditions for the central HW storage facility

- The central storage area must meet significantly the requirements of law 4/1994 and its ER as well as the HW storage guidelines issued by EEAA.
- The area should be away from public places and any nearby watercourses.
- It should be of adequate size to accommodate all HW generating facilities in the industrial estate.
- It should have suitable access roads
- It should be provided with the necessary utilities (water/electricity), and safety equipment.
- It must be surrounded by a wall, and roofed.
- The floor must be tiled and covered with a material that would withstand spills, and smooth enough so as to allow proper and easy cleaning.

Detailed requirements are available in the EEAA On-site HW Storage Guidelines.

- Whether the infrastructure of this area is to be installed and prepared by the estate management or by a private operator is subject to a contractual agreement, as discussed below.
- Industrial facilities using this service would be responsible for their own HW within the allocated location, as per the HW Storage guidelines of EEAA.

- **Operating the central storage area through a private contractor**

- In case estate management has a central storage area, it will be operated by a private contractor, according to a contractual agreement. One alternative is for the estate management to install the necessary infrastructure and prepare this area as per the stipulations of Law 4/1994 and EEAA HW Storage Guidelines. In such a case, the operator is to lease this location from the estate management, and provide storage services to the industrial establishment for a certain fee. Alternatively, the operator could be the one to install the necessary infrastructure and prepare the

location, and offer storage services for the industrial establishments for a certain fee.

- Regardless of the option implemented, the contractor is responsible for the overall management of the storage site as per the stipulations of Law 4/1994 and the EEAA Storage Guidelines. Amongst the responsibilities, following are most significant:
- Zoning within this location is necessary, based on the types of waste to undergo storage, in order to ensure compatibilities of waste stored in adjacent locations.
- Installing lighting and fire fighting systems for all storage locations.
- Providing equipment for waste handling at the site, such as loader, forklift, etc
- Providing materials for spill control such as absorbents, etc
- Ensuring site safety and security.
- Developing an emergency plan for the site.
- Maintaining a HW register according to requirements of Law 4/1994. In this regard, information about every waste shipment coming into the central storage facility should be registered.
- Services associated with this overall management are what the industrial estates pay for. Moreover, upon agreement with HW generators, the operator of the site could also provide transportation services from the generator to the storage site subject to a fee payable to the operator of the storage site[17].
- HW generators must provide sufficient information to the operator of the storage area about the types of HW stored. So that the operator will be able to take necessary actions in cases of emergency. The information should be included on the label of the HW container.

- **Providing capacity building and technical support for HW identification and management**

  The estate management can play a role in building the capacity of all concerned units for proper HW management. These units would include transporters, and the operators of the Central Storage Facility.

a2. Interventions on the Facility Level

- **Providing capacity building and awareness to industrial facilities**

- Awareness campaigns, primarily targeting the generating industrial facilities in the estate, with the aim of highlighting the importance of proper HW management and potential adverse impacts if improperly handled, as well as how HW management on-site relates to HW management within the estate. These campaigns would include: printed material (brochures, leaflets, posters, etc.) to be distributed among industrial facilities during site visits, and made readily available at the estate management, as well as conducting meetings, and workshops.
- Establishing HW information database where industrial facilities can obtain necessary information regarding HW lists, procedures for HW permitting, and potential sources, for support both at the governorate and at the national levels. The estate management should be in continuous contact with relevant units

[17] The transportation process is subject to stipulations of law 4/1994 and its ER and the HW transportation guidelines issued by EEAA.

concerned with HW management, such as the concerned department within EEAA and the concerned ministries, the RBO and EMU, as well as HW service providers nationwide.

- **Necessitating Environmental Insurance against HW accidents off-site**
  It is recommended that the responsibilities of the estate management include necessitating an environmental insurance from industrial establishments generating HW, as well as transportation contractors, and the storage area operator against HW accidents[18].

b. Need-Based Actions

Actions are carried out based on the needs for actions identified above in section 7.4.2. These actions are interventions undertaken on the estate-level.

b1. Actions to HW Accumulation, Spills or Leaks within the Estate

In cases it was found that HW is accumulated outside the industrial facilities on the roadside of estate or in empty areas, spilled or leaked during HW transportation, the estate management should take actions as follows:

- Determine the unit responsible for the incident through questioning potentially involved units.
- Taking actions for remedying the situation including the removal of the waste at the expense of the entities responsible.

b2. Mixing of HW with solid waste

In cases where HW is mixed with the non-hazardous solid waste, the mixing could be detected either by the solid waste transporter or the transfer station contractor. The mixing is traced back to the responsible unit. Actions will be taken according to the contract between the generator and the estate management.

b3. HW Accidents within the Estate

- Provide support to manage the accidents (e.g. provide fire fighting, absorbent materials, etc.) according to procedures of the overall estate emergency plan.
- Inform the civil defense authority about the accident.

3.8. MANAGEMENT OF AMBIENT NOISE POLLUTION

3.8.1. Objective

The overall objective of noise management is to protect the human health and environment from noise exposures. This should be in compliance with the limits set by Environmental Law 4/1994.

The specific objectives of ambient noise management are:

- Taking actions needed to minimize noise impacts
- Facilitate actions relating to the prevention, minimization and control of noise from premises causing excessive noise.

Annex 3.33 is a technical background related to ambient noise.

[18] For HW transporters, this is recommended as part of the licensing procedures.

3.8.2. Roles and Responsibilities

- **Estate Management**
  The estate management will have the following responsibilities:
  - Maintaining the level of ambient noise within the permissible limits required by the law
  - Monitoring and follow-up of ambient noise levels.
  - Identify the locations having high noise levels
  - Take the required actions to reduce noise levels at identified locations.
  - Estimating the noise levels produced by the respective facility, by taking into consideration the meteorological effects (such as wind, temperature inversions…etc).

- **Industrial Facility**
  The role of the facility is restricted to controlling noise levels within the premises such that it abides by environmental laws and regulations. This can be achieved by:
  - Undertaking periodic monitoring for noise levels within characteristic phases of production profile
  - Identifying noise sources and considering mitigation strategies for excessive noise sources

3.8.3. Activities Undertaken by the Estate Management to Fulfill its Responsibilities

3.8.3.1. Monitoring and updating of Status

- **Data to be Collected**
  Data required includes:
  - Noise levels at different locations in the estate
  - Noise levels at adjacent areas to the estate
  - Atmospheric conditions at which the noise levels are indicated
  - Background noise levels
- **Data Collection Mechanism**
  - Noise levels in the estate are estimated through monitoring.
    - The estate is divided into grids. Monitoring locations should be in grid cross points in additions to noise sensitive locations.
    - Grid spacing is defined according to noise impact expected as well as type of industry involved. Smaller grid spacing, normally around 100m, is required for those areas having high obstacles and barriers. Estates involving nearly uniform patterns of relatively short buildings and little obstacles and barriers, the noise may be measured using a larger spacing grid, normally in the order of 350m.
    - Noise levels at grid points are then interpolated to obtain noise contour maps for the area. Contour lines are plotted which characterizes points of equal noise level. A number is shown with each contour indicates the noise level exceeded within that contour.
  - Background noise is indicated from the estate strategic EIA, if it exists. However, in case there is no estate-level EIA, measurements for background noise are undertaken on holidays where no operations / activities are carried out at facility's premises.

- Noise expected at adjacent areas to the estate could either be measured by the estate management or could be acquired from the concerned inspection entities in the governorate.
- Atmospheric conditions could be acquired from the responsible entity in the governorate

- **Monitoring Frequency**

The recommended frequency of noise measurements is within 8 to 12 times per year depending on the activity level of the area of interest. Non-routine measurements might be needed in cases of:

- Major change in activities (e.g. facility remodeling or change of production schedule, opening a new highway etc).
- Noise complaints
- Commencement of temporarily events (e.g. exhibits, construction works etc)

- **Data Documentation**
  - Air quality measurements report for each monitoring location (Annex 3.34) including the results of the periodic measurements of ambient air quality as compared to allowable limits. Comparing the measurements and drawing the pattern for measurements development will facilitate status identification and actions to be taken towards mitigation procedures. The reports is accompanied by a map of the estate indicating the points of measurements.

3.8.3.2. Data Analysis and Identification of Needs

- **Data Analysis**

  The measurements will be analyzed to determine the noise contribution from a particular industrial source among multiple industrial noise sources:
  - The contour lines are imposed on a map and compared to allowable ambient noise limits
  - Areas with high noise levels, exceeding/approaching the allowable noise levels, are indicated along with the areas that are on the threshold.
  - Further investigation is needed to determine the contribution of different sources to the noise in each area:
    - Based on the type of industry, it might be possible to indicate the potential major contributors to noise in the area (Annex 3.35)
    - Measuring noise levels with and without the operation of a suspect source will indicate whether it has a high contribution to the ambient noise (this could be done in coordination with the source)
    - Measuring noise from each of the facilities at reference locations (boundaries for example) and then calculating the noise- levels back to the receiver. Commonly this step requires a noise prediction model; however acceptable results may be achieved narrowing down the search for the high noise contributor by reducing the measuring grid spacing close to the facility of interest.
    - In the case where mobile sources exist, the noise contribution from a development may be determined by isolating the transportation noise level. This could be done by measuring the noise levels in periods of low transportation

- To assess the performance of the facility adequately, noise monitoring should cover the full cycle of operational activity at each of the identified stages. Noise could be monitored over a full day (day, evening and night), a week, or longer depending on the development.
- It should be noted that in some cases, the facilities might be complying with law limits for noise level; yet, the cumulative of noise from different facilities may lead to violating ambient noise.
- The comparison of the measurements at the same location and drawing a pattern is essential to analyze progress or deterioration in the noise level and take required actions accordingly.

- **Identification of Needs**

Specific incidents will indicate the need for actions.

- Ambient Noise Exceeds Allowable Limits

  Violations of the acceptable limits or even abrupt changes in noise levels are required to be ascertained thorough investigations and proper determination of mitigation methods. In some instances it may not be possible to achieve even the recommended permissible noise level, even after all feasible and reasonable noise mitigation has been applied. Such cases are expected to have a larger adverse noise impact.

  Depending on the source identified as the major contributor for noise, actions will be taken.

3.8.3.3. Actions

a. Routine Actions

- **Interventions addressing external noise sources**

These interventions addressed noise sources from outside the estate. In this case, the main role is played by external entities. The estate management coordinates with the entity involved to implement actions for higher noise level mitigation. Explaining of the specific environmental situation and needs, demonstrating of environmental impacts, proposition of proper mitigation methods is within the role of the estate.

Recommended measures include:

- Lowering speed limits and setting isolation barriers in nearby highways
- Adjust working shifts in adjacent construction sites
- Regulating tuning of engines
- Banning horn honking in the area
- Traffic control plans and studying alternative routes at nearby busy traffic junctions

- **Interventions on the estate level**

- Setting speed limits inside the estate.
- Paving all roads and providing scheduled maintenance.
- Use of speed bumps in busy intersections.
- Industrial facilities under construction are required to adopt noise mitigation schemes with the aim to lower both emitted and transported noise.

- Conditions and restrictions imposed on new facilities so as to maintain a reasonable ambient noise level

- **Interventions on the facility level**
  Awareness of facilities regarding noise regulations and potential actions to achieve compliance with these laws and regulations. Through the awareness, facility will be encouraged to:
  - Compliance with manufacturer's operating speeds for rotating equipment
  - Selecting vehicles with minimum noise output including tire noise, exhaust and compressor/fan noise
  - Using rolling stock with quiet couplings and brakes
  - Using trenches, cuttings, tunnels and barriers for transport routes
  - Ensuring proper tuning of machinery and exclusion of high noise emission machinery if possible.
  - Avoiding use of old machinery having high noise
  - Ensuring proper moving parts lubrication since it highly contributes to overall noise emitted.
  - Using conveyor systems with low noise output
  - Ensuring proper operation and loading the machines involved

b. Need-based Actions
In the following, a number of alternate interventions are recommended to address the identified needs. The level of interventions to be adopted is case specific.

- **Interventions on the estate level**
  - Noise barriers, more effective if near source or receiver; effectiveness is also controlled by the height of the barrier and the material used (reflective or absorptive)
  - Studying the possibility of adding sound barriers and tree walls to isolate the noisy source
  - Restricting times for truck operations

- **Alternatives requiring the interventions on the facility level**
  To reduce impact of noise pollution, industrial facilities are to be encouraged to adopt the following measures:
  - Organization of machine's operation time schedule (if possible) with the aim of reducing the total noise emitted.
  - Enclosing the source; the design of the enclosure / canopy and the material used will highly affect attenuation level
  - Adopting silencing exhausts if applicable
  - Using noise suppressant bases
  - Enclosing conveyors wherever possible and necessary

ANNEX 3.1: ENVIRONMENTAL MANAGEMENT SYSTEMS FOR INDUSTRIAL ESTATES

Efforts have been made to incorporate continual environmental improvement through out the life cycle of the project/activity. Environmental Management Systems (EMS) ensures commitment to environment for continual improvement. This concept has been effectively use for an industrial estate. Refer Box 3 illustrates, ISO 14001 EMS is being used as a tool by the Chinese Economic and Technological Development Zones (ETDZ) to improve their environmental performance.

Box 3 Dalian Economic and Technological Development Zone, China[19]

Overview of the Dalian ETDZ: ETDZs are examples of Integrated Industrial Zones, where a new industrial estate or park is developed according to an approved plan with integrated residential, commercial and public areas. The scale of the Dalian ETDZ (DETDZ), a surface area of 28 km² of which 15 km² is designated for industrial use, means that it is really a reasonable size town of 200,000 inhabitants.

The DETDZ Administration Commission (DETDZAC) is the official agency of Dalian Municipality in charge of the daily administration of zone functions[20]. The Planning and Construction Bureau (PCB) of DETDZAC is in charge of environmental protection in the zone. The bureau has established an environmental protection office, environmental supervision department and some environmental monitoring stations to implement this function. Moreover, in order to enhance their performance, they also hired an environmental management agent in each part or community of the zone to help them enforce environmental protection laws and regulations. This organizational framework has ensured quite an efficient and effective level of environmental protection.

Triggers for the DETDZAC to consider the adoption of EMS as per ISO 14001: However, this framework did not solve all environmental issues. With the rapid economic development and a low level of environmental awareness in the general public, environmental issues still confounded the local government and even affected the attraction of further foreign investment. *Therefore, adopting a more comprehensive environmental management approach was crucial.* Owing to generic feasibility in October 1998, the DETDZAC decided to establish an EMS according to the ISO 14001 standard.

Concurrently, the Dalian Municipality initiated a new programme named "Blue Sky, Green Sea Project", the objective of which was to "protect (the) local natural environment, promote the local residents' living conditions and increase the city's competitiveness". It was recognized that implementing the ISO 14001 EMS would have assisted greatly in achieving the objectives of the "Blue Sky, Green Sea Project". Other drivers for adoption of the EMS included the opportunity for cost savings, enhanced employee safety and environmental stewardship.

Setting Up the EMS Guidance Group: Implementing an EMS in such a large geographical area required the DETDZAC to adopt new different approaches from those employed for companies. What was required in particular was a robust and efficient organizational framework. *To address this need, the DETDZAC set up a specialized EMS Guidance Group by deploying the existing environmental management framework, as well as*

[19] EMS as an Opportunity for Engaging China's Economic Development Zones: The Case of Dalian. Available at: http://www.uneptie.org/pc/ind-estates/casestudies/Dalian.htm (Accessed March 27, 2004)

[20] Hence, the DETDZAC could be looked on as the management of the Dalian ETDZ.

inviting environmental experts from local universities and institutions. Environmental aspects for the region were identified, then by considering the local economic and social reality and analyzing the related environmental regulations and laws, the integrated and comprehensive approach fostered by the EMS was stipulated. This resulted in an enhanced identification of aspects and opportunities and the development of plans to address them.

The measures adopted by the group led to reduced air emissions, wastewater generation, recycling of treated wastewater, rain water harvesting, improved solid waste management

The local EPB initiated Awareness and Preparedness for Emergencies at the Local Level (APELL) programme in 1995, the objective of this programme was to prevent technological accidents and to reduce their impacts by assisting decision makers and technical personnel to increase community awareness of hazardous installations, and to prepare response plans in case unexpected events at these installations should endanger life, property or the environment.

Environmental Education: DETDZAC hosted activities to increase the local people's environmental awareness, including making TV advertisements, publishing newsletters, hosting environmental knowledge competitions, installing signposts with environmental knowledge in the urban areas, "training trainers" for capacity building, hosting conferences and workshops on environmental protection, setting up an environmental column in the local daily newspaper.

The end result: By implementing these measures, the zone was certified ISO 14001 on December 16, 1999 as assessed by the Huaxia EMS Examination Centre, a unit of China's State Environmental Protection Agency. This has improved the foreign investment in the region, improved the environmental quality of the region and provided the local government and the Industrial Estate Management a much-valued green image.

DETDZ actively promoted EMS ISO 14001 by funding, policy and an information service to those planning to establish their EMS. These measures have inspired local entrepreneurs and thirteen enterprises have been certified ISO 14001 in the year. Now more enterprises are actively preparing to establish their EMS in this zone.

Lessons learnt: The adoption of a more decentralized mode of governance, necessitated by economic reform, has allowed the local environmental agencies to display a larger degree of flexibility in adopting and implementing their own policies and in shaping public opinion about such matters as pollution. The DETDZ experience has shown that a *more favorable context* can be created by implementing an EMS. The key is to establish an appropriate system based on local realities. ISO 14001 therefore is a primary tool to achieve the goals of eco-industrial estate planning and development but also the local government's mandate.

Lastly, implementation of an EMS should not be thought of as the ultimate objective for an ETDZ's environmental management. The next steps must be to encourage further public participation and to take an integrated approach leading to an industrial ecosystem, which can realize better environmental performance at the zone-level.

ANNEX 3.2: TECHNICAL BACKGROUND ON MANAGEMENT OF WATER SUPPLY

Definitions

- **Water Demand**
  The amount, type (drinking, cleaning, cooling, brackish), quality, pressure and rate of consumption of the water supply required for a particular facility.

- **Water Supplier**
  The external entity responsible for water treatment for potable use and distribution in the governorate, city or village where the industrial estate exists. Water supplier can be a public authority, public or private company, housing department or city/village local administrative unit.

- **Water Consumption**
  The facility or per capita daily rate of water consumption measured at the connection to the facility or house.

- **Water Source**
  The source from which the raw water is drawn to the water treatment plant. The source may be surface water (river) or groundwater (wells).

- **Water Treatment Plant**
  The facility in which the raw surface or groundwater is treated to meet the applicable drinking water standards or specific process standards.

- **Water Intake**
  The point on the river or canal at which the raw surface water is drawn by a raw water pumping station or a pipe or a open channel.

- **Unaccounted for Water**
  The amount of water treated that has no revenue. This includes unpaid consumed water, losses due to leakages from pipe network and the water used for filters backwash in the water treatment plant.

Potential Impact

Improving water supply in terms of both quality and quantity within the industrial estate will have the following positive impacts:

- Availability of water supply for domestic uses of the workers in the estate will improve the personal hygiene.
- Availability of irrigation water for tree-planting and increasing green areas will improve the overall environmental conditions within the estate.
- Availability of water supply for the industrial processes will minimize the side environmental effects due to the usage of contaminated water supplies. On the other hand, using of water supplies having quality problem will definitely affect the product quality.

ANNEX 3.3: DOCUMENTATION OF WATER-RELATED INFORMATION

Water supply: ----------

Water Demand by Facility

Facility	Monthly Water Demand
Total	

ANNEX 3.4: DOCUMENTATION OF WATER SUPPLY FAILURE

Date of Failure	Duration	Scope	Potential Causes

ANNEX 3.5: INCIDENT REPORT RELATED TO WATER SUPPLY

Date	
Incident	
Location	
Entity Responsible	
Action Taken	
Monitoring/follow-up Schedule	

ANNEX 3.6: GENERIC WATER CONSERVATION TIPS FOR INDUSTRIES

Water conservation measures consist of a sequence of steps, such as eliminating water use where possible, reusing non-contact cooling water in other plant operations where practical, and reducing water consumption to a large extent by installing cooling towers, changing manufacturing practices, and numerous other means.

In conserving water, the balance between flow reduction by recycling water and the resulting concentration of constituents should be checked to the point that they become contaminants, which is regulated in plant discharge.

1. Efficient process control and process information systems.
2. High degree of preventive maintenance, eliminating upset conditions.
3. Eliminate leaks and other inefficiencies.
4. Modern management systems, training, and education of staff and operators.

ANNEX 3.7: TECHNICAL BACKGROUND ON ELECTRICITY SUPPLY

Definitions

- **Inductive Loads**
  Inductive loads are electric loads which operate by virtue of the magnetic field induced by an alternating current power source. They include equipment such as induction motors, rectifiers, electric furnaces, fluorescent lamps, and transformers. The current which powers an inductive load may be disaggregated into two components: active and reactive currents.

- **Active Current**
  It is power-producing current, which is converted by the equipment into work, usually in the form of heat, light, or mechanical power.

- **Reactive Current**
  It is magnetizing current, which is required to produce the necessary flux for the operation of the equipment. Without magnetizing current, energy cannot flow through the core of a transformer or across the air gap of an induction motor.

- **Apparent power (S)**
  It is the total power required to operate the equipment, and includes both active and reactive components.

- **Power factor (PF)**
  It is the ratio of active power to apparent power (S). Power factor ranges from 0 to 1.0, with a higher value representing a better power factor. Since active power is the true measure of the electric power converted to other useful forms of energy, improvement in power factor reduces the apparent power drawn in order to accomplish a particular task.

Concepts

- **Power Factor Improvement**
  With active power held constant, as power factor decreases, the required apparent power increases. As a result, the electrical system resistance losses are increased. Low power factor cuts down distribution system capacity. For example, at a power factor of 0.8, a transformer rated at 500 kVA can only provide 400 kW. Correcting the power factor to 0.9 will allow the same transformer to provide 450 kW of useful power. Similar capacity improvements are possible with cables, circuit breakers, and other electrical equipment. Increasing power factor will result in increased capacity in existing electrical distribution systems. This can help to offset or reduce expenses for additional system capacity.

  The degree to which these power factors should be corrected depends on the economics of each particular installation. The cost of capacitor installation must be compared to the savings associated with higher power factor. Correction devices should be added until the cost of an additional kVAR begins to exceed the benefits. As a rough estimate, that level is reached in Egypt at power factors of between 0.90 and 0.95.

- **Opportunities for Power Factor Improvement**
  The benefits of power factor correction are maximized when devices for power factor improvement are located as close as possible to low power factor loads. Industrial end-users account for most of the improvement potential.

- **Incentives for Power Factor Improvement**
  In Egypt, the electric power is provided to each facility on the basis of the area regardless the industrial activity or the actual needs. For any facility which needs a higher capacity has to pay certain tariff per each additional kilowatt.

  Typically, both suppliers and consumers have incentives for power factor improvement. For a utility, power factor improvement reduces system losses and increases the portion of generation capacity available for productive uses. In addition, it can help maintain voltage at desired levels. Consequently, utilities often encourage consumers to maintain a high power factor by applying tariff clauses which penalize consumers for low power factor.

  In Egypt, suppliers impose a penalty in the form of higher charges for customers with contracted loads greater than 500 kW whose power factors are less than 0.9. From the customer's point of view, this penalty should be sufficient to motivate the installation of power factor correction (improvement) equipment. Aside from decreasing the electric bill (or actually resulting in a bonus), other advantages of power factor correction include increasing internal electrical distribution system capacity and reducing distribution system losses.

- **Power Factor Penalty**
  The power factor penalty is a multiplier applied to the normal total kilowatt-hour consumption charges. The penalty is based on an annual average power factor. If the consumer does not correct the power factor, the penalty is doubled after 3 months. The supplier also has the right to discontinue service if the consumer does not correct the power factor within another six months.

Potential Environmental Impact of Energy Conservation

Electricity is the cleanest source of power, though it is the most expensive in Egypt. In case of shortage or troubles with the local cable network, step down transformers, etc, the facilities have to install standby generators. Then the environmental impact on the ambient air and workplace is demonstrated through the following points of illustrations.

- **Combustion-generated Air Pollution**
  Light oil (solar) is mostly used as a fuel in case of local electric power generation using standby generators. Using electricity in the estate will decrease on-site pollution. Moreover, utility power plants use natural gas as a dominant fuel in electric power generation which emits lower levels of emissions and supplies more heat energy than oil fuels.

- **Noise Level Pollution**
  The noise levels from diesel-generator units are high (may reach values as high as 105 – 110 dBA) and may cause a compliance problems to the facilities.

- **Soil Pollution**
  Upon using diesel-generator units, the soil in the vicinity is polluted due to the possible spills of fuel and lubricating oils.

- **Particulate Matter**
  Fine particulates harmful to the respiratory system are usually emitted from diesel-generator units.

ANNEX 3.8: TYPICAL ENERGY CONSUMPTION AND POWER FACTOR FOR INDUSTRIES

Typical Unimproved Power Factors for Different Industrial Sectors

Industry	Power Factor
Textile	0.65 – 0.75
Chemical	0.75 – 0.85
Machine Shops	0.40 – 0.65
Arc Welding	0.35 – 0.40
Coreless Induction Furnaces	0.15 – 0.40
Cement Works	0.75 – 0.80
Clothing Factories	0.35 – 0.60
Steel Works	0.60 – 0.80
Brick Works	0.60 – 0.75
Foundries	0.50 – 0.70
Plastic Molding	0.60 – 0.75
Rolling Mills	0.30 – 0.75

Energy Cost Relative to Production Cost in Different Industrial Sectors

Industrial Sector	Energy Cost Relative to Production Cost
Aluminum	30 %
Ammonia	50 %
Cement	55 %
Ceramics	20 %
Fertilizers	25 %
Food products	10 %
Glass	30 %
Ice	70 %
Metallurgical	15 %
Oil refining	7.5 %
Paper	25 %
Steel	30 %
Textile finishing	12.5 %

ANNEX 3.9: DOCUMENTATION OF ELECTRICITY-RELATED INFORMATION

Electricity supply: ----------

Electricity Demand by Facility

Facility	Monthly Electricity Demand											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

ANNEX 3.10: DOCUMENTATION OF ELECTRICITY BLACKOUT

Date of Blackout	Duration	Scope	Potential Causes

ANNEX 3.11: INCIDENT REPORT RELATED TO ELECTRICITY SUPPLY

Date	
Incident	
Location	
Entity Responsible	
Action Taken	
Monitoring/follow-up Schedule	

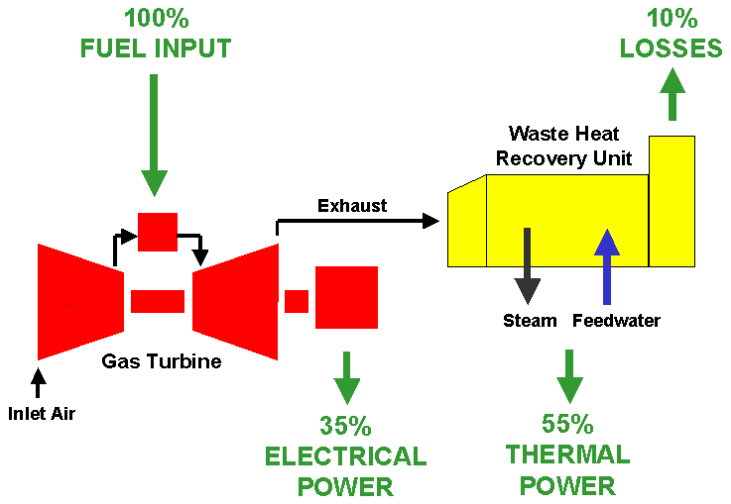
ANNEX 3.12: GENERIC ENERGY CONSERVATION TIPS FOR INDUSTRIES[21];

1. Cooling towers should be utilized wherever possible to decrease energy consumption and reuse as much cooling water as possible.
2. Plug all oil leakage. Leakage of one drop of oil per second amounts to a loss of over 2000 litres/year.
3. Filter oil in stages. Impurities in oil affect combustion.
4. Pre-heat the Oil. For proper combustion, oil should be at right viscosity at the burner tip. Provide heat capacity.
5. Incomplete combustion leads to wastage of fuel. Observe the colour of smoke emitted from chimney. Black smoke indicates improper combustion and fuel wastage. White smoke indicates excess air & hence loss of heat. Hazy brown smoke indicates proper combustion.
6. Use of low air pressure "film burners" helps save oil upto 15% in furnaces.

[21] Source: http://www.geda.org.in/e_conserv/ec_ov_tis.htm

ANNEX 3.13: COMBINED HEAT AND POWER (CHP) GENERATION

The heat and power applications in an industrial unit accounts for a substantial cost of the products in an energy intensive sector e.g. steel, cement, and hence substantially affect the production economics. The existing power and heat utilities (grid and captive power plants) operate in the range of 50-60% efficiency thus heat and power for an industrial unit forms the major cost head and environmental concern.



Source: http://www.nationsenergy.com/images/basics_of_cogeneration.gif

The CHP concept: CHP or cogeneration system as it produces both electricity and useable heat converts as much as 90% of the fuel into usable energy. A CHP plant utilizes the heat resulting from electricity generation, thereby raising the net efficiency of generating electricity. Due to the superior efficiencies, CHP produces energy with reduced emissions of carbon dioxide, nitrogen oxides, and sulphur oxides, thus providing a significant environmental benefit in comparison with traditional power plants. To make them most economical and practical, CHP systems need to have thermal loads somewhat well-matched with the heat supplied through the generation process. CHP cuts energy costs by 40 percent, reduce pollution and greenhouse gas emissions by 50 percent, increase energy efficiency by 20 percent, with a payback of less then five years[22].

CHP are more efficient then the conventional power plants[23] refer the figures below, the energy input for conventional plants in nearly 39% more then CHP plants to produce the same amount of electricity and heat.

[22] T. Kaarsberg, Northeast-Midwest Institute R. N. Elliott, American Council for Energy Efficient Economy. Combined Heat and Power: Saving Energy and the Environment. Source: http://www.nemw.org/ERheatpower.htm
[23] Source : adapted from http://www.est.org.uk/images/chp/chp_pic2.gif & http://www.est.org.uk/images/chp/chp_pic3.gif

ANNEX 3.14: TECHNICAL BACKGROUND ON AMBIENT AIR QUALITY

Definitions

- **Main Air Pollutants**

  Many types of pollutants are discharged to the air due to industrial operations, six main classes of air pollutants referred to as *criteria pollutants*. Law 4/1994 gives the maximum permissible limits for 5 of these pollutants. These criteria pollutants are defined hereinafter:

  - **Total Particulate Matter (PM):** Any finely divided solid or liquid material other than uncombined water as measured by the standard reference methods, where filter is used to determine the concentration of particulate in a gas at 248°F (120 °C). Accordingly, any droplets that will evaporate at 248°F (120 °C) not referred as particulate matter.
  - **Inhalable Particulates (PM_{10}):** PM10 are inhalable particles of 10 micrometers diameter and less that stay suspended in the air and accumulate in the respiratory system.
  - **Carbon Monoxide (CO)**: A colorless, odorless, poisonous gas, lighter than air, formed due to incomplete combustion of fuels.
  - **Sulfur Dioxides (SOx**) (especially SO_2): A colorless, acrid, corrosive, and poisonous gases generated during the burning of sulfur-containing fuels such as coal and oil in industrial processes.
  - **Nitrogen Oxides (NOx):** They are seven oxides of nitrogen that are produced when fuel is burned at very high temperatures. They are deposited in dry form (gas, particles) or wet form (rain, fog), and dispersed by wind.
  - **Hydrocarbons**[24]
    - Hydrocarbons Volatile Organic Compounds (VOCs): Any compound of carbon that is volatile by nature, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides, and carbonates, etc.
    - Non VOCs Hydrocarbons: all compounds of carbon and hydrogen, in liquid or gaseous form exempted as VOCs . Most are listed as Hazardous Air Pollutants HAPs.
  - **Lead (Pb):** a heavy metal that exists in the form of fine particles (PM_{10}).

Concepts

- **Types of Emission Sources**

Emission sources can be divided into stationary and mobile sources:

- Point Source is discharge of pollutants into the atmosphere through single source, e.g. such as stacks and vents.
- Fugitive Emission Sources (exist inside and outside the production facilities and the industrial estate) are defined as emissions, which can not pass through stack, chimney, vent, or other functionally equivalent opening. These emissions can include non-captured process emissions, such as equipment leaks or dust from

[24] Hydrocarbons are not considered as a major pollutant in the ambient air by law 4/1994. However, it will be considered in the guidelines due to its adverse effects on the environment. The allowable limits for VOCs in the ambient air are indicated by 50 mg/m^3 according to international standards.

conveying systems, area sources, such as wastewater ponds or storage piles, and accidental releases.
- Mobile Sources are mainly vehicles, trucks, and mobile material handling equipment, etc.

- **Air Pollution Control Equipment**

Air pollution control varies from emissions reduction at source, to end of pipe by using pollutant removal systems.
- At source reduction management methods have the advantage of allowing greater control and understanding of parameters, which contribute to emissions and often lead to increased process efficiency and product quality. Pollution management at source differs in every plant and for each process in the plant. The basic steps for pollution management at source includes:
  - Audit of raw material use
  - Identification of pollution-causing activities
  - Characterization of air emissions
  - Quantification of emissions
  - Audit of accident potential
  - Procedure to prevent and control air emissions.

- End-of-pipe control is based on the idea of collection, transportation, and then treatment of contaminants from the work environment before being discharged to the atmosphere. Air contaminants may be particulate matter, gases, or vapors. The air contaminants transportation system consists of a series of hoods (air collection devices), ductwork (containment devices), fans (transportation devices), and exhaust stack to conduct the air to atmosphere. The air pollution control devices or systems differ according to the nature of pollutant to be treated and the type of source as detailed in the following:

- **Control Equipment for Particulates**

Common control devices of particulate matters are:
- Settling Chambers are simple control devices; their function is based on the gravitational force on a particle and its downward velocity. They are efficient for large particles, and may be used as pre-cleaners for more efficient devices.
- Cyclones are most common inertial separators; they are also used for large particle size separation.
- Fabric filters are the most common collection devices used to control solid particulate. The collection efficiency of a properly operating fabric filter is often well above 99%.
- Control devices of Gases and vapors are based on flue gas scrubbing. Sulfur dioxide SO2 can be removed with a simple scrubber using water as a medium. In many cases, an alkaline agent is usually added to the water to increase the scrubbing efficiency. The resulting acidic liquid is always treated before discharge. (No significant removal of particulate matters is achieved by the wet scrubbers.)
- Thermal oxidation of waste gas streams (thermal incineration) is a widely used method for controlling VOCs emissions from industrial sources. The normal operating temperature for combustion of VOCs is 1000 to 1500oF (538oC to 815oC). CO emissions could also be incinerated to produce CO2.

- NOx are the most difficult pollutants to control. However, dry adsorption can generally be used to control NOx through activated carbon filters or ammonia injection systems.

Potential Environmental Impact

All criteria pollutants have adverse environmental impacts on the ambient condition. The effect of air pollutant on the ambient depends on:

- The nature of industries located in the estate. Industrial facilities grouped in certain zone could emit common types of pollutants that create cumulative negative impacts on the ambient condition; this in turn aggravates the degradation of the ambient air quality if not properly addressed.

Metrology plays a significant role in how pollutants affect the ambient air quality.

ANNEX 3.15: MOST COMMON POLLUTANTS EXPECTED FROM DIFFERENT INDUSTRIES

Pollutant name	Source	Examples	Impacts
Particulate matter PM &PM_{10}	Furnaces, boilers, incinerators, crushers, conveyors, grinders textile finishing, mixers and hoppers, spray booths, chemical processing equipment, and wood manufacturing processes, incomplete combustion, and unpaved roads.	Dust, smoke, fumes, oil droplets, and asbestos.	Chronic diseases of respiratory tract, poisoning, destruction of plant life, and effect on climate.
Sulfur dioxides SOx (especially SO_2)	Industrial boilers, electric utilities, smelters, mobile sources, and commercial heating	SO_2 in gaseous form or sulfurous acid, H_2SO_3 Sulfuric acid H_2SO_4 in liquid form a component of acid rain.	Causes breathing difficulty when dissolved in the respiratory system, forms acid rain, affects soil pH, destroys plants and contributes to lowered visibility due to the sulfate portion of suspended particulates.
Carbon monoxide	Stationary fuel burning sources, and mobile fuel burring sources (internal combustion engines).	Smokes and fumes	Reacts with the Hemoglobin in blood to prevents oxygen transfer.
Nitrogen oxides NOx mainly NO & NO_2	Burning fuel at very high temperatures from nitrogen in the air, produced from organic nitrogen in heavy oil and coal: mainly from large electric power generators, large industrial boilers internal combustion engines and nitric acid plants.	Smokes, smog and offensive odor	Reduces visibility, causes eyes irritation, affects pulmonary organs, reacts with VOCs under the influence of sun light to form Ozone, PAN and smog. Ozone and PAN are powerful oxidant that cause cracking of rubber, paint, textiles, etc. and damage plant life.
Hydrocarbons - VOCs	Produced from incomplete burning, but	photochemical smog and	Primary pollutants in forming ozone.

Pollutant name	Source	Examples	Impacts
	are primarily emitted from evaporative sources such as surface coating, printing, solvent cleaning operation, gasoline storage and transfer, petroleum tanks, vegetable oil manufacturing, plastic manufacturing, wood finishing and coating processes and tire manufacturing	stringent odor	
Hydrocarbons – Non VOCs	Freon, carbon tetrachloride, methylene chloride and methyl chloroform.	Air conditioning systems, degreasing processes and foam product manufacturing.	Ozone depletion
Lead Pb	Secondary smelters, lead base paints, battery manufacturing and storage.		Attacks the nervous central system, Subsequently leads to neurological damage. Cannot be easily removed from the body.

ANNEX 3.16: AIR QUALITY MEASUREMENTS REPORT

Location: ----------

Series No.	Date	Meteorological Data	Parameters	Measurements	Allowable limits	Compliance Status	Potential Sources

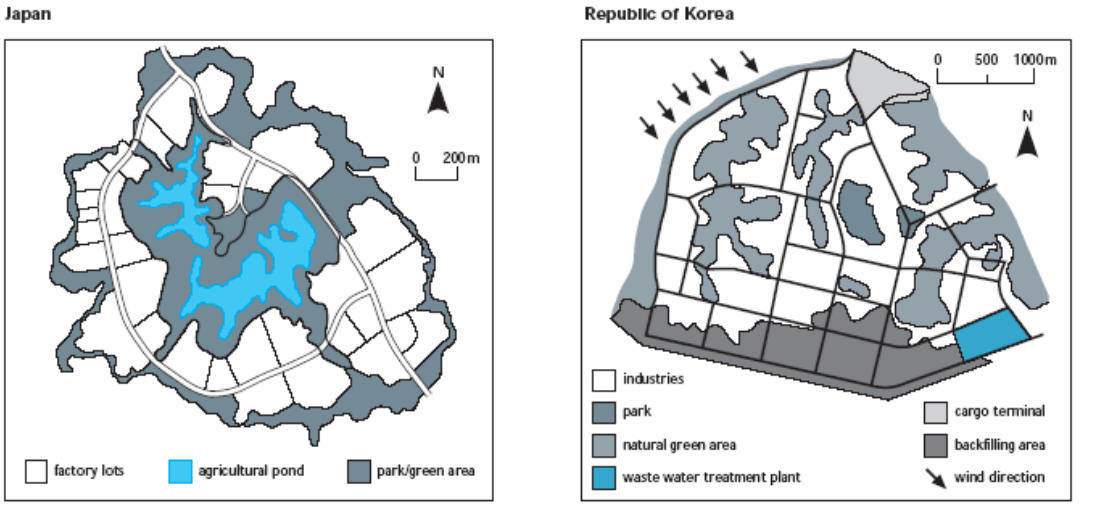
ANNEX 3.17: INCIDENT REPORT RELATED TO AIR QUALITY

Date	
Incident	
Location	
Entity Responsible	
Action Taken	
Monitoring/follow-up Schedule	

ANNEX 3.18: THE CREATION AND UPKEEP OF "GREEN BELTS" OR "BUFFER PLANTATION ZONES" AT INDUSTRIAL ESTATES

The creation of green belts is one of the more overlooked infrastructural measures for environmental pollution control at industrial estates. As the name suggests, the "green belt" is merely a strip of land designated for tree plantation activities in the industrial estate. These green belts absorb harmful CO2 emissions from the industrial activities on the estate, "regenerate the air in the area" to a certain extent and limit soil erosion. Thus, green belts act as valuable "buffer" zones. Hence, the creation of green belts becomes an aspect for every industrial estate manager to look into. Indeed, the layout of every well-planned industrial estate shows the consideration given to area allocations for the green belt (see Figure 3.1). Typically, the green belt is located around the entire periphery of the industrial estate as well the areas surrounding active industrial activity.

Figure 3.1: Planning for Green Belt Development in Industrial Estates – The Example of Industrial Estates in Japan and the Republic of Korea[25]



Box 4 provides the policy initiatives made by The Central Pollution Control Board, India and the Knowsley Industrial Park for green belt development in the industrial estates.

Box 4 Green belts: Down to a Science!

There is more to the planning of green belts for an industrial estate. Regulatory authorities may decide to provide stringent specifications and lay down criteria concerning green belt development on industrial estates. For instance, the Central Pollution Control Board of India deems the development and maintenance of green belts for pollution abatement so important that it mandates a "Green Belt Development Plan" for every industrial estate, be it proposed, existing or under expansion[26]. The Board lays down rules concerning the nature of plants which should be planted in the green belt (see **Table 3.1.a**) as well as principles to "optimize the design of the green

[25] *The Environmental Management of Industrial Estates* by the United Nations Environment Programme. Available at: www.uneptie.org/pc/ind-estates/pdf_documents/ TR39/TR39-Eng.pdf (Accessed March 27, 2004)

belt" (see **Table 3.1b**).

Table 3.1a: Nature of plants to be planted in the green belt	Table 3.1b: Principles to be considered while designing the green belt
▪ Fast growing ▪ Providing high and thick canopy cover ▪ Preferably perennial and evergreen ▪ Trees having a large area index ▪ Of indigenous variety ▪ Resistant to specific air pollutants ▪ Ability to maintain the ecological and hydrological balance of the region	▪ The height and canopy area of trees ▪ Mean wind velocity ▪ Distance from the source(s) of pollution ▪ Pollutant concentration

Lastly, the Board also specifies a mathematical formula or an indicator to assess the effectiveness of a green belt in attenuating the pollution. This value is called the "attenuation factor" and is calculated as the ratio of the mass flux of pollutants reaching a distance in the absence of green belt to the mass flux reaching the same distance in the presence of green belt.

More than "Just" a Green Belt: The "Rehabilitation" of Knowsley Industrial Park, United Kingdom[27]

Before the economic recessions of the 1970s and 1980s, Knowsley Industrial Park of the United Kingdom was the most important industrial area in the region, employing more than 35,000 people in 1975. Knowsley Industrial Park was a premier site for businesses, warehouses and industry. During the recessions however, the Park was hard hit by the economic decline due to the closure of factories and loss of jobs. This economic decline had a major impact on the environment, leaving degraded sites abandoned, and virgin sites unsaleable.

However, the creation of a new scheme with a green belt as its focus actually helped revive the fortunes of this industrial estate. The Knowsley Industrial Park was rehabilitated as part of the New Use for Vacant Industrial Land (NUVIL) scheme. *By planting harvestable trees on vacant land, the NUVIL scheme intended to generate income while improving the environment and making the area more attractive to businesses.* The desire underlying this approach was to develop employment in the long term through the harvesting of certain plantations on the estate, while protecting the environment through the development of a green belt in the short term.

[26] Infrastructural Measures for Environmental Pollution Control. Available at: http://www.cleantechindia.com/eicimage/210602_22/4.htm (Accessed March 19, 2004)

[27] Facts Sheets of Some European Business/Industrial Parks. Available at: http://www.uneptie.org/pc/ind-estates/casestudies/Knowsley.htm (Accessed March 20, 2004)

To implement the scheme, the free areas designated for economic development were cleaned up and planted with trees and wildflowers. These abandoned areas belonged either to the local authorities or to businesses.

The scheme was quite simple. When a business moved into an area, a perimeter of trees was left around it. This provided a pleasant environment for the employees and a crucial protective buffer between the businesses and the community. The trees which were harvested were sold to parties such as craftspeople for making baskets, florists or sculptors and other artists.

To date, under this scheme, 73 hectares have been treated and 270,000 trees planted. The success of this innovative scheme is testified by the fact that several businesses which had vacated the land are moving back into the Park. The NUVIL scheme provided Knowsley Industrial Park with good publicity, so much so that this operation has already received two awards from the Association of Metropolitan Authorities.

Lessons learnt: Thus green belts are as crucial to an industrial estate as are facilities such as water supply, wastewater treatment, solid waste disposal and so on. They also add a aesthetic value to the industrial estate.

ANNEX 3.19: TECHNICAL BACKGROUND RELATED TO LIQUID WASTE

Definitions

- **Effluent**
  Sewage, water, or other liquid, partially or completely treated or in its natural state, flowing out of a septic tank, subsurface wastewater infiltration system, aerobic treatment unit, or other treatment system or system component.

- **Activated sludge process**
  A biological wastewater treatment process in which biologically active sludge is agitated with incoming wastewater. The activated sludge is subsequently separated from the treated wastewater (mixed liquor) by sedimentation, and most of it is returned to the process. The rest is wasted as needed.

- **Biochemical oxygen demand (BOD)**
  A commonly used gross measurement of the concentration of bio-degradable organic impurities in wastewater. The amount of oxygen, expressed in milligrams per liter (mg/L), required by bacteria while stabilizing, digesting, or treating organic matter under aerobic conditions is determined by the availability of material in the wastewater to be used as biological food and the amount of oxygen used by the micro-organisms during oxidation.

- **Centralized wastewater treatment system**
  A wastewater collection and treatment system that consists of collection sewers and a centralized treatment facility. Centralized systems are used to collect and treat wastewater from entire communities.

- **Chemical oxygen demand (COD)**
  A measure of oxygen use equivalent to the portion of organic matter that is susceptible to oxidation by a strong chemical oxidizing agent.

- **Digestion**
  The biological decomposition of organic matter in sludge, resulting in partial gasification, liquefaction, and mineralization.

- **Disinfection**
  The process of destroying pathogenic and other microorganisms in wastewater, typically through application of chlorine compounds, ultra-violet light, iodine, ozone, and the like.

- **Pretreatment System**
  Any technology or combination of technologies that precedes discharge to a subsurface wastewater infiltration system or other final treatment unit or process before final dissemination into the receiving environment.

- **Residuals**
  The solids generated and retained during the treatment of domestic sewage in treatment system components, including sludge, scum, and pumping from grease

traps, septic tanks, aerobic treatment units, and other components of an onsite or cluster system.

Concepts

- **Characteristics of Industrial Wastewater**

  - **Physical characteristics:** The most important physical characteristic of wastewater is its total solids content, which is composed of floating matter, settleable matter, colloidal matter, and matter in solution. Other important physical characteristics include odor, temperature, color, and turbidity.

  - **Chemical Characteristics** which includes:

    - **Organic Matter:** Organic compounds are normally composed of a combination of carbon, hydrogen, and oxygen, together with nitrogen in some cases. Other important elements, such as sulfur, phosphorus, and iron, may also be present. Industrial wastewater may contain small quantities of a large number of different synthetic organic molecules ranging from simple to extremely complex in structure. Organic compounds include oils and grease, surfactants, volatile organic compounds. The organic content is measured by the Biochemical Oxygen Demand (BOD) which accounts for microorganisms and Chemical Oxygen Demand (COD) for organic matter containing chemical compounds.

    - **Inorganic Matter:** Several inorganic components of wastewater are important in establishing and controlling wastewater quality. Industrial wastewater has to be treated for removal of the inorganic constituents.

  - **Biological Characteristics:** Biological characteristics of waste water is needed to assess the degree of treatment of the wastewater before its discharge to the environment. Biological characteristics include pathogenic organisms, coli forms, etc.

- **Pollution Abatement for Industrial Wastewater**

  - **In-plant modifications** are changes that are performed in the plant to reduce pollutant concentrations in streams through recovery of materials, segregation and/or integration of streams or reducing the flow rate of the wastewater streams.

  - **In-Process modifications**, which are changes performed on the process such as the introduction of newer technology, substitution of a hazardous raw material, performing process optimization and control.

  - **End-of-pipe (EoP) measures**, which involve treatment of the pollutant or its separation for further disposal. Whereas in-plant and in-process modifications usually have an economic return on investment, end-of-pipe measures will be performed for the sole purpose of compliance with the laws without economic advantage.

Potential Environmental Impact

The impact of discharging untreated wastewater or non-complying discharges will have at least one of the following negative impacts to the environment:

- Deterioration of ground water resources in case of disposal by groundwater injection or land application.
- Deterioration of water quality of receiving water streams in case of disposal to agricultural drains or canals or rivers.
- Affect the operation of the community wastewater treatment plant by increasing the potential pollution loads or the hydraulic loads, in case of discharging to the community wastewaters system.
- (if present) in wastewater discharges may harm the wastewater collection system (in case of discharging to the public sewers) and the receiving water body.

Accordingly, having a proper planned, designed, operated, maintained and monitored wastewater system will definitely protect the environment in terms of water supply resources, and the public health. This would have positive social and economic impacts.

Annex 3.20: Wastewater Characteristics of Common Industries

Industries	Major characteristics
Textiles	Highly alkaline, colored, COD & temperature, high suspended solids
Dairy products	High in dissolved organic matter, mainly protein, fat and lactose
Brewed and distilled beverages	High in dissolved organic solids, containing nitrogen and fermented starches or their products
Meat and poultry products	High in dissolved and suspended organic matter, blood, other proteins, and fats
Pharmaceutical products	High in suspended and dissolved organic matter, COD
Sugar cane	Variable pH, should organic matter with relatively high BOD_5 of carbonaceous nature.
Palm oil	High BOD_5, COD, solids and total fats and low pH
Pulp & paper	High or low pH, color, high suspended, colloidal, and dissolved solids, inorganic solids.
Metal-plating	Acid, metals, toxic, low volume, mainly mineral matter, heavy metals
Oil fields and refineries	High dissolved salts from field; high BOD_5, COD, odor, phenol, and sulfur compounds from refinery
Paints and inks	Contain organic solids from dyes, resins, oils, solvents, COD, etc
Acids	Low pH, low organic content
Detergents	High in BOD_5 and saponified soaps

ANNEX 3.21: INCIDENT REPORT RELATED TO LIQUID WASTE

Date	
Incident	
Location	
Entity Responsible	
Action Taken	
Monitoring/follow-up Schedule	

ANNEX 3.22: COMMON EFFLUENT TREATMENT PLANTS FOR WASTEWATER MANAGEMENT

As of today nearly all industrial estates provide Common Effluent Treatment Plants (CETPs) to manage the wastewater generated from the industries. However the of the CETP performance is dependent on its technology and the design parameters, usually it's seen that the CETPs are over designed considering the growth of industrial units in the estate, the over design can be as high as of 2/3rd of the expected wastewater flow. It's seen that after some initial months of operation the flows further reduces as the industries cut down on the water consumption to reduce the CETP charges.

Box 5 Viability of CETPs

At Sachin in North India, waste minimisation was an integral part of the CETP design. A detailed Cleaner Production opportunity assessment was done by the consultants in individual units to reduce the water consumption and assess the waste water generation to design the CETP. Thus the cost of CETP is reduced substantially.

Samut Prakan Province located at the mouth of Chao Phraya River on the banks of the Gulf of Thailand. It is a province with an industrial zone that houses a number of industrial facilities. Samut Prakan is now facing severe pollution problems due to the untreated discharge of industrial emissions. The coastal area and the fisheries are subject to the direct impact from the industrial emissions. The impacts also affect consumers who consume the fisheries' products contaminated with the heavy metals. Under the Cleaner Production for Industrial Efficiency (CPIE) a CETP was proposed. The total estimated flow from the industrial estate was 500mgd which accounted for a huge investment for the CETP. A 20-20 program for reduction of the waste water flow was launched through out the estate to cut down the flow by 20% by individual units, this program made the CETP economically viable for the estate.

Lessons learnt: CETPs (any common environmental infrastructure) should be planned and operated in phases and waste minimisation at individual industry level should be considered to reduce the capital cost of CETP.

ANNEX 3.23: TECHNICAL BACKGROUND ABOUT SOLID WASTE

Definitions

- **Solid Waste**
  Solid waste is any garbage, refuse, sludge, or other discarded material resulting from industrial, commercial, institutional, and residential activity. Discarded materials include those that are disposed of, abandoned, recycled, or are inherently waste-like.

- **Industrial Solid Waste**
  Solid Waste resulting from industrial establishments is composed of both industrial solid waste and municipal solid waste. Industrial solid waste is non-hazardous waste resulting from manufacturing and processing plants consisting of sludge and solids. Municipal solid waste it is composed of durable and nondurable goods, containers, food scraps, yard waste, and inorganic waste generated by residential community.

Concepts

- **Management of Solid Waste**
  The piling-up of industrial solid waste occupies large amount of land and causes secondary pollution to air, surface water and ground water. Accordingly, there is a need for the proper disposal of the solid waste. This can be achieved by integrated solid waste management system.

  Solid waste management system is systematic organization and administration of activities that provide for planning, financing and operational processes for managing municipal and industrial solid waste. Operational processes include storage, collection, transport, treatment, recycling of materials, combustion and landfilling.

  - ***Storage of solid waste:*** the containment after generation and prior to collection of solid waste in a manner to protect human health and environmental quality.

  - ***Collection of solid waste:*** the act of removing accumulated containerized and/or bulk solid waste from the generating sources. In addition, collection may occur at centralized points (e.g. transfer stations) where generators deliver their solid waste for collection.

  - ***Transfer Station*****:** Waste transfer stations play an important role in the industrial estate's total waste management system, serving as the link between industrial establishments and final waste disposal facility. The ownership, size and services offered vary significantly among transfer stations. However, they all serve the same basic purpose, which is consolidating waste from different industries through multiple collection vehicles into larger, high volume transfer vehicles for more economical shipment to distant disposal. Thus, the primary reason for using a transfer station is to reduce the cost of transporting waste to disposal facilities, and accordingly it is most likely in the case of small ***generators***.

- ***Solid waste transportation:*** the conveyance of solid waste from one place to another through different transportation means. For the case of the industrial estates, only vehicles would be used for transportation.

- ***Recycling:*** is segregation of material, from a solid waste stream that can be used and/or returned to the economic mainstream in the form of raw material for new or reconstituted products which meet the quality standards necessary to be used in the marketplace. This involves prior treatment so that is can be used as raw materials in the same process it is originating from, or in other processes. Recycling of waste is characterized by two major practices:
  - Recovery of a secondary material for a separate end use such as the recovery of a metal from sludge
  - Removal of impurities from a waste to obtain relatively purer substances which can be reused

- ***Treatment:*** is any method, technique, or process designed to change the physical, chemical, or biological character or composition of any solid waste. It includes processes such as crushing, fermentation or composting.

- **Incineration*:*** is the use of controlled flame combustion to thermally break down solid, liquid, or gaseous combustible wastes, producing residue that contains little or no combustible materials

- **Landfilling*:*** is an engineering method of disposing of solid waste on land in a manner which protects human health and environmental quality by spreading solid waste in layers, compacting those layers into the smallest particular volume and covering the compacted solid waste with soil on daily basis.

- **Integrated Solid Waste Management in Egypt**

  A national program for the Integrated Solid Waste Management was initiated during 2000/2001. The program addresses the different categories of solid wastes, entailing municipal, agricultural, healthcare, and construction and demolition wastes as a first priority, and industrial waste, waste generated from cleaning canals, as well as municipal wastewater sludge, as second priority.

  A strategy for municipal solid waste management in Egypt has been developed for a period of 10 years. EEAA has initiated a Landfill Sitting Program and maps of proposed landfills sites in each of the 26 governorates were produced.

ANNEX 3.24: SOLID WASTE COMMONLY GENERATED FROM MAIN INDUSTRIES

Industry	Examples of Solid non-hazardous waste
Textile Industry	• Fabric and yarn scrap, • Off-spec yarn and fabric, • Packaging waste
Rubber and Plastic Industry	• Discarded plastics • Products and packaging • Scorched rubber waste • Rubber dust • Scrap tires
Organic Chemical Industry	• Spent carbon/resins • Packaging material of non-hazardous chemicals.
Pulp and Paper Industry	• Lime mud, • Lime slaker grits, • Green liquor dregs, • Boiler and furnace ash, • Scrubber sludges, • Wood processing residuals
Wood Furniture Manufacturing	• Wood chips • Sawdust
Metal Casting Industry	From foundries: • Waste sand • Off-spec products From die casting • slag or dross generated from molten metal surfaces • refractory materials from furnaces and ladles • metallic fines • spent shot (plunger) tips • heating coils • abrasive cutting belts and wheels • quench sludge • steel shot
Non-Ferrous Metal	From aluminum processing • Red mud produced during bauxite refining, • Slag generated during smelting contains chlorides • From copper processing • Tailings containing waste minerals such as limestone, and quartz • Slag and blowdown slurry/sludge From zinc processing • Solid copper cake generated during purification

ANNEX 3.25: FORM FOR GENERATED SOLID WASTE

Name of Facility:		☐ **Established** ☐ **New**
Contact Person:		
Types and Quantities of Solid Waste		
Industrial Solid Waste		
Type	*Industrial Process*	*Quantity (ton/month)*
Subtotal		
Municipal Solid Waste		
Type		*Quantity (ton/month)*
Subtotal		
Total Solid Waste		
Collection and Transportation Practices		
Transportation is/expected to be carried out by: Contractors ☐ Facility ☐		
If transportation is carried out by one or more contractor, please complete the following:		
Name of contractor		
Permit Number		
Comments on Performance of Contractor if any		
Name of contractor		
Permit Number		
Comments on Performance of Contractor if any		
Collection and Transportation to the transfer station **(This section is filled only in the case if a transfer station is available in the estate)**		
Does The Facility Use The Transfer Station Yes ☐ No ☐		
If yes, transportation to the transfer station is carried out by: Transfer station contractor ☐ Registered contractor ☐ Facility ☐		
Comments on Performance of Transfer Station Contractor		

ANNEX 3.26: INCIDENT REPORT RELATED TO SOLID WASTE

Date	
Incident	
Location	
Entity Responsible	
Action Taken	
Monitoring/follow-up Schedule	

ANNEX 3.27: TECHNICAL BACKGROUND ON HAZARDOUS WASTE

Definitions

- **Hazardous Waste**
  Hazardous waste is waste having possible adverse impacts to human health and the environment as a result of physico-chemical and/or biological properties. rendering it dangerous. According to Law 4/1994 hazardous waste is defined as:
  "Waste of activities and processes or its ashes which retain the properties of hazardous substances and have no subsequent original or alternative uses, like clinical waste from medical treatments or the waste resulting from the manufacture of any pharmaceutical products, drugs, organic solvents, printing fluids, dyes and painting materials".

  Wastes are considered hazardous if they possess one or more hazardous characteristics of the following:

  - Flammable: capable of burning or causing fire.
  - Corrosive: able to corrode steel by chemical reaction as a result of extreme acidic or basic properties and is capable of causing severe damage when in contact with living tissues.
  - Reactive: undergoes violent reactions with air and/or water
  - Oxidizing: waste giving rise to highly exothermic reactions when in contact with other substances, particularly flammable substances and may by yielding oxygen, cause or contribute to the combustion of other materials.
  - Irritant: non-corrosive wastes which, through immediate, prolonged or repeated contact with the skin or mucous membranes can cause inflammation or other skin symptoms.
  - Toxic: waste containing substances which are poisonous.
  - Harmful: waste containing substances and preparations which, if inhaled or ingested or penetrates the skin, may involve limited health risks.
  - Ecotoxic: waste which may have toxic effects on biotic systems.
  - Carcinogenic: waste which, if inhaled or ingested or penetrates the skin, may induce cancer in human beings or increase its incidence.
  - Teratogenic: waste containing substances and preparations which if inhaled or taken internally or penetrates the skin may induce non-hereditary genetic deformations, or increase their incidence.
  - Mutagenic: waste containing substances and preparations, which if inhaled or taken internally or penetrates the skin may induce hereditary inherent deformations, or increase the probability of incidence.

- **Industrial Waste**
  "Industrial waste" constitutes materials which the generator discards or intends to discard (because such materials do not have subsequent on-site use in the form they are generated in), or is required to discard (because the use of such materials is illegal). Common examples include the following:
  - Materials spilled, lost or having undergone other mishappenings which render them unusable for their original purpose.
  - Residues of industrial processes (e.g. slag, still bottoms, etc.)

- Residues from pollution abatement processes (e.g. scrubber sludge, bag house dust, spent filters, etc.).
- Substances that no longer perform satisfactorily (e.g. contaminated acids, contaminated solvents, exhausted tempering salts, etc.)
- Unusable parts (e.g. reject batteries, exhausted catalysts, etc.)
- Any materials, substances or products the use of which has been banned by legislation.
- Any material that is disposed of, involving burning and incineration, accumulation, storage or treatment, prior to disposal.

Concepts

- **Integrated Hazardous Waste Management**
  Integrated HW management is a cycle ensuring that HW is properly and safely handled during its whole life cycle, that is, from its point of generation to its final disposal. In this respect, integrated HW management is constituted from a number of essential components, or stages, namely:
  - HW identification upon generation is one of the most significant components. Proper identification ensures that the waste is subsequently managed properly and safely
  - HW segregation, necessary to ensure that non-compatible waste streams (resulting in adverse reactions, as detailed by the table of Annex III.7a) are not mixed together, as well as HW is not mixed with non-hazardous waste.
  - HW storage, which can be at the site where it is generated, or off that site
  - HW transportation, from points of generation and/or storage to recycling, treatment or disposal facilities.
  - HW treatment which relies on a variety of processes and operations rendering the waste less hazardous, and/or decreasing its volume to facilitate disposal.

HW final disposal, usually by land-filling in especially engineered landfills.

ANNEX 3.28: HAZARDOUS WASTE COMPATIBILITY CHART

No.	Reactivity Group Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	Acids, Mineral, Non-oxidizing																										
2	Acids, Mineral, Oxidizing																										
3	Acids, Organic		G H																								
4	Alcohols and Glycols	H	H F	H P																							
5	Aldehydes	H P	H F	H P																							
6	Amides	H	H GT																								
7	Amines, Aliphatic and Aromatic	H	H GT	H		H																					
8	Azo Compounds, Diazo Compounds and Hydrazines	H G	H GT	H G	H G	H																					
9	Carbamates	H G	H GT						G H																		
10	Caustics	H	H	H		H				H G																	
11	Cyanides	GT GF	GT GF	GT GF					G																		
12	Dithiocarbamates	H,F GF	H,F GF	H,GT GF		GF GT		U	H G																		
13	Esters	H	H F						H G		H																
14	Ethers	H	H F																								
15	Fluorides, Inorganic	GT	GT	GT																							
16	Hydrocarbons, Aromatic		H F																								
17	Halogenated Organics	H GT	H,F GT					H GT	H G		H GF	H															
18	Isocyanates	H G	H,F GT	H G	H P			H P	H G		H,P G	H G	U														
19	Ketones	H	H F						H G		H	H															
20	Mercaptans and Other Organic Sulfides	GT GF	H,F GT						H G										H	H	H						
21	Metals, Alkali and Alkaline Earth, Elemental	H,F GF	H,F GF	H,F GF	H,F GF	H,F GF	GF H	GF H	GF H	GF H	GF H	GF H	GF,H GT	GF H					H E	GF H	GF H	GF H					
22	Metals, Other Elemental & Alloys as Powders, Vapors, or Sponges	H,F GF	H,F GF	G F					H,F GT	U	GF H								H E	GF H		H,F GF					
23	Metals, Other Elemental & Alloys as Sheets, Rods, Drops, etc.	H,F GF	H,F GF						H,F G										H F								
24	Metals and Metal Compounds, Toxic	S	S	S			S	S			S																
25	Nitrides	GF HF	H,F E	H GF	H,E GF	GF H			U	H G	U	GF H	GF H	GF H					GF H	U	GF H	GF H	E				
26	Nitriles	H,GT GF	H,F GT	H							U												H P			S	GF H

Legend	
Code	Consequences
H	Heat Generation
F	Fire
G	Innocuous and non-flammable gas generation
GT	Toxic Gas formation
GF	Flammable Gas formation
E	Explosion
P	Violent Polymerization
S	Solubilization of toxic substance
U	May be hazardous, but Unknown

Source: EPA's Chemical Compatibility Chart EPA-600/2-80-076 l 1980, US Environmental Protection Agency

27	Nitro Compounds, Organic		H,F GT			H					H E											H,E GF				H,E GF		27														
28	Hydrocarbons, Aliphatic, Unsaturated	H	H F			H																	H E						28													
29	Hydrocarbons, Aliphatic, Saturated		H F																											29												
30	Peroxides and Hydroperoxides, Organic	H G	H E		H F	H G		H GT	H,F E	H,F GT		H,E GT	H,F GT					H E	H	E	H,F GT	H E	H G		H G	H,E GF	H,P GT		H P	,	30											
31	Phenols and Cresols	H	H F						H G										H P			GF H				GF H					H	31										
32	Organophosphates, Phosphothioates, Phosphodithioates	H GT	H GT						U		H E											H									U		32									
33	Sulfides, Inorganic	GT GF	HF GF	GT		H			E										H												H GT			33								
34	Epoxides	H P	H P	H P	H P	U		H P	H P		H P	H P	U								H P	H P	H P		H P	H P					H P	H P	U	H P	34							
101	Combustible and Flammable Materials, Miscellaneous	H G	H,F GT																			H,F G				H,F GF					H,F GT					101						
102	Explosives	H E	H E	H E					H E		H E			H E								H E	H E	H E	E	E					H E	H E		H E	H E	H E	102					
103	Polymerizable Compounds	P H	P H	P H					P H		P H	P H	U									P H	P H	P H	P H	P H					P H	P H		P H			H E	103				
104	Oxidizing Agents, Strong	H GT		H GT	H F	H F	H,F GT	H,F GT	H E	H,F GT		H,E GT	H,F GT	H F	H F		H F	H GT	H,F GT	H F	H,F GT	H,F E	H,F E	H F		H,F E	H,F GT	H E	H F	H F	H G	H F	H,F GT	H,F GT	H,F G	H,F G	H E	H,F GT	104			
105	Reducing Agents, Strong	H GF	H,F GT	H GF	H,F GF	H,F GF	H GF	H G				H GT	H F				H,F E	H E	H GF	H GF	H GF						H GF	H E			H E	H GF	H,GT GF		H	H GF	H E	H,P GF	H,F E	105		
106	Water and Mixtures Containing Water	H	H						G										H G			H GF	H GF		S	H GF								GT GF						GF GT	106	
107	Water Reactive Substances	<---------EXTREMELY REACTIVE!!!! DO NOT MIX WITH ANY CHEMICAL OR WASTE MATERIAL!!!! EXTREMELY REACTIVE!!!!-------------->																																								107

ANNEX 3.29: HW LIST FOR THE MINISTRY OF INDUSTRY AND TECHNOLOGICAL DEVELOPMENT

I) Metal and metal-bearing wastes:

1. Metal wastes and waste consisting of alloys of any of the following :
   - Antimony
   - Arsenic
   - Beryllium
   - Cadmium
   - Lead
   - Mercury
   - Selenium
   - Tellurium
   - Thallium

   Except for non-contaminated metallic waste including bulky metallic mixtures:
   - Antimony scrap and antimony compounds
   - Beryllium scrap and beryllium compounds
   - Cadmium scrap and cadmium compounds
   - Lead scrap and lead compounds
   - Selenium scrap and selenium compounds
   - Tellurium scrap and tellurium compounds

2. Wastes having as constituents or contaminants of any the following:
   - Arsenic and arsenic compounds
   - Mercury and mercury compounds
   - Thallium and thallium compounds
   - Metal carbonyls
   - Hexavalent chromium compounds

3. Galvanic sludges
4. Waste liquors from the pickling of metals
5. Leaching residues from zinc processing, dust and sludges, such as jarosite, hematite, etc.
6. Waste zinc residues, containing lead and cadmium in concentrations sufficient to exhibit hazardous characteristics.
7. Ashes from the incineration of insulated copper wire
8. Dusts and residues from gas cleaning systems of copper smelters
9. Spent electrolytic solutions from copper elctrorefining and metal electrowinning operations
10. Waste sludges, excluding anode slimes, from electrolyte purification and electrowinning of copper.
11. Spent etching solutions containing dissolved copper
12. Waste cupric chloride and copper cyanide catalysts
13. Precious metal ashes from printed operation boards
14. Waste acid batteries except of clean lead scarp extracted from batteries in non dispersible form.
15. Unsorted waste batteries
16. Waste electrical and/or electronic assemblies or scrap containing components such as accumulators, prohibited batteries, mercury-switches, glass from cathode-ray tubes

and other activated glass, PCB-capacitors, or contaminated with constituents to exhibit hazardous characteristics.

II) Waste containing inorganic constituents, which contain metals and organic materials:

17. Glass waste from cathode-ray tubes and other activated glass
18. Waste inorganic fluorine compounds in the form of liquids or sludges.
19. Waste catalysts
20. Waste gypsum from industrial processes contaminated with hazardous constituents to an extent sufficient to exhibit hazardous characteristics.
21. Waste asbestos

III) Wastes containing organic constituents, which contain metals and organic materials:

22. Waste from the production or processing of petroleum coke and bitumen
23. Waste mineral oils unfit for their originally intended use
24. Waste thermal (heat transfer) fluids
25. Wastes from the production, formulation and use of resins, latex, plasticizers, glues/adhesives
26. Waste nitrocellulose
27. Waste phenols and phenol compounds
28. Waste ethers and ether compounds
29. Waste leather dust, ash, sludges and flours when containing hexavalent chromium compounds or biocides or infectious substances from fluff-light fraction from shredding
30. Waste organic phosphorus compounds
31. Waste organic solvent either halogenated or non-halogenated
32. Waste halogenated or non- halogenated non-aqueous distillation residues arising from organic solvent recovery operations
33. Wastes arising from the production of aliphatic halogenated hydrocarbons (such as chloromethane, dichloro-ethyelene, vinyl chloride, vinylidene chloride, allyl chloride and epichlorhydrin)
34. Wastes, substances and articles containing, consisting of, or contaminated with polychlorinated biphenyl (PCB), polychlorinated terphenyl (PCT) polychlorinated naphthalene (PCN) or polybrominated biphenyl (PBB), or any other polybrominated analogues of these compounds.

IV) Wastes which contain organic or inorganic constituents:

35. Wastes from the production and preparation of pharmaceutical products, including off-specification and expired products.
36. Waste from the production and formulation of pesticides.
37. Wastes from the manufacture, formulation and use of wood-preserving chemicals.
38. Wastes that contain, consist of, or are contaminated with inorganic or organic cyanides
39. Waste oils and water, hydrocarbons and water mixtures, emulsions
40. Wastes from the production, formulation and use of inks, dyes, pigments, paints, and machines used for latex and varnish painting
41. Waste acidic or basic solutions with a pH lower than 2 and higher than 11.5
42. Wastes from industrial pollution control devices from cleaning of industrial off-gases.

43. Wastes that contain, consist of, or are contaminated with any of the following:
    - Any congener of polychlorinated dibenzo-furan
    - Any congener of polychlorinated dibenzo-dioxin
44. Wastes that contain, consist of, or are contaminated with peroxides.
45. Waste packages and containers containing residues of hazardous substances hazardous wastes.
46. Waste consisting of, or containing, off specification or outdated chemicals.
47. Waste chemical substances arising from research and development.
48. Spent activated carbon.
49. Waste containing, and/or consisting of Chlorofluorocarbons (CFCs)
50. Waste PVC
51. Metal-bearing wastes arising from melting, smelting and refining of metals:
    - Zinc skimmings and aluminum skimmings
52. Slag's from copper processing or refining containing arsenic, lead or cadmium
53. Waste photographic films and photographic paper containing silver halides and metallic silver or precious-metal-bearing ashes from incineration of photographic films.
54. Cleaning cloths, absorbing materials, filter materials, protective clothing contaminated with hazardous substances or hazardous waste.

Scrap plastic of non-halogenated polymers and co-polymers (not completely polymerized including post consumer wastes).

ANNEX 3.30: COMMONLY GENERATED HAZARDOUS WASTE FROM DIFFERENT INDUSTRIES

Industrial Sector	Waste type
Pulp and paper industry	- Sludges from bleaching processes contaminated with chlorinated organic compounds, dioxins, furans and chlorophenols, peroxides - De-inking sludges from paper recycling contaminated with organic solvents and heavy metals
Leather and fur industry	- Degreasing waste containing solvents such as ethers, waste sludges containing hexavalent chromium compounds. - Tanning liquor containing chromium - Sludges from effluent treatment containing chromium - Waste tanned leather contaminated with chromium
Textile industry	- Finishing waste containing organic halogenated and non-halogenated solvents - Wastes from bleaching processes containing peroxides, sodium hypochlorite, chlorine - Highly alkaline effluents - Waste dye stuff and pigments containing azodyes, heavy metals (Cd, Cr) - Sludges from effluent treatment containing cadmium, arsenic, lead, hexavalent chromium, arsenic, mercury, halogenated organic solvents
Inorganic chemical industry	- Sulphuric acid - Hydrochloric acid - Hydrofluoric acid - Phosphoric acid - Nitric and nitrous acid - Calcium hydroxide - Sodium hydroxide - Ammonia - Salts and solutions containing cyanide - Waste containing heavy metals and heavy metal oxides (antimony, lead, arsenic, mercury, cadmium, hexavalent chromium, metal carbonyls, beryllium. - Waste containing arsenic - Waste containing mercury - Inorganic pesticides and biocides and wood preserving agents. - Spent activated carbon
Organic chemical industry	- Aqueous washing liquids and mother liquors (non-halogenated and halogenated organic solvents, - Organic halogenated solvents

Industrial Sector	Waste type
	- Halogenated still bottoms - Halogenated still bottoms - Halogenated filter cakes - Sludges from effluent treatment containing heavy metals, halogenated and non-halogenated organic solvents
Wood processing	- Inorganic wood preservatives (chromate copper arsenate, - Non-halogenated organic wood (creosote) preservatives - Organo-chlorinated (chlorophenolics --penta-chlorophenols) - Organo-metallic wood preservatives - Waste pigments (lead, chromium, cadmium
Dyes and pigment industry	- Aqueous washing liquids and mother liquors - Halogenated organic solvents - Halogenated still bottoms - Sludges from effluent treatment - Waste pigment and dyes - Waste oils/water, hydrocarbon /water mixtures and emulsions
Paint and varnish industry	- Waste paint and varnish containing heavy metals (cadmium, chromium, lead, mercury, etc..) - Waste from paint or varnish removal containing organic solvents - Aqueous suspensions containing paint or varnish
Soap, fat, grease detergents, disinfectants and cosmetics	- Aqueous washing liquids and mother liquors containing non-halogenated organic solvents, halogenated organic solvents, vinyl chloride, chloromethane, vinylidene chloride, etc. - Waste organic halogenated solvents - Halogenated still bottoms and reaction residues - Halogenated filter cakes and spent absorbents - Sludges from effluent treatment (heavy metals, waste oils/ water, hydrocarbon/ water mixtures and emulsions)
Lead thermal metallurgy	- Slags from primary and secondary smelting (Pb, Cd. As, Cr, Hg, and other heavy metals) - Dross and skimmings (lead, antimony and other heavy metals) - Calcium arsenate - Waste sulphuric acid (from secondary smelting) - Flue gas dust and other particulates (heavy metals) - Sludge from gas treatment (heavy metals)
Zinc thermal metallurgy	- Slags from primary and secondary smelting (heavy metals)

Industrial Sector	Waste type
	- Leaching residues, dust and sludge such as jarosite, hematite, etc - Dross and skimming from primary and secondary smelting (heavy metals) - Flue gas dust and other particulate
Metal treatment and coating of metals	- Cyanidic alkaline waste containing heavy metals - CyanidicCyanide alkaline waste not containing heavy metals - Cyanide free waste containing chromium - Acidic pickling solutions - Waste acids and alkalis

In addition to the above types of waste, which are specific to the different industrial sectors, there are other types of hazardous waste that can be common to most industrial activities. These wastes include:-

- **Waste oils, fats and grease:**
  - Waste machining oils containing halogens
  - Waste machining oils free of halogens
  - Waste machining emulsions free of halogens
  - Synthetic machining oils
  - Hydraulic oils containing PCB, PCT
  - Insulating or heat transmission oils containing PCB or PCT
  - Chlorinated/ non-chlorinated insulating or heat transmission oils
  - Synthetic insulating or heat transmission oils
  - Brake fluids
  - Chlorinated/ non-chlorinated engine, gear and lubricating oils
  - Spent waxes and fats
  - Steam degreasing waste
  - Oil/ water separators oils and sludges
  - Oil/water emulsions

- **Waste from packaging and empty containers:**
  - Packaging containing residues of/or contaminated by hazardous substances

- **Waste from absorbent, filter materials, wiping cloths and protective clothing**
  - Absorbents, filter materials, wiping cloths and protective clothing

- **Discarded equipment and its components**
  - Transformers and capacitors containing PCBs or PCTs
  - Discarded equipment containing CFCs
  - Discarded equipment containing free asbestos

- **Chemicals and gases in containers**
  - Waste containing inorganic/ organic chemicals, e.g. laboratory chemicals and fire extinguishing powder

- **Batteries and accumulators**
  - Ni-Cd batteries
  - Mercury containing batteries
  - Electrolyte from batteries and accumulators

- **Spent catalysts**
  - Spent catalysts containing dangerous transition metals or transition metal compounds
  - Spent catalysts containing phosphoric acid
  - Spent liquid used as catalysts

- **Waste from specific physico/ chemical treatment of industrial waste (e.g. dechromation, decyanidation, neutralization)**
  - Metal hydroxide sludge

- **Laboratory and research chemicals**
  - Expired chemicals
  - Reaction residues
  - Waste solvents
  - Waste acidic and alkaline solutions

- **Waste from wastewater treatment plants**
  - Grease and oil mixtures from oil/water separation
  - Sludges from treatment of industrial waste water
  - Solutions and sludges from regeneration of ion exchange

- **Expired chemicals**
  - Outdated chemicals
  - Off specification chemicals

ANNEX 3.31: HAZARDOUS WASTE DOCUMENTATION REPORT

Series No.	Date	Facility	Types of HW	Amount Generated	Disposal Practices

ANNEX 3.32: INCIDENT REPORT RELATED TO HAZARDOUS WASTE

Date	
Incident	
Location	
Unit Responsible	
Action Taken	
Monitoring/follow-up Schedule	

ANNEX 3.33: TECHNICAL BACKGROUND ON AMBIENT NOISE POLLUTION

Definitions

- **Noise**
  Noise is often referred to the undesirable annoying sound. Generally, sound may be defined as any pressure variation that the human ear can detect. Just like dominoes, a wave motion is set off when an element sets the nearest particle of air into motion. This motion gradually spreads to adjacent air particles further away from the source. Depending on the medium, sound propagates at different speeds. In air, sound propagates at a speed of approximately 340 m/s. In liquids and solids, the propagation velocity is greater than 1500 m/s in water and 5000 m/s in steel.

- **A-Weighted Sound Level**
  The ear is less efficient at low and high frequencies than at medium or speech-range frequencies. Therefore, to describe a sound containing a wide range of frequencies in a manner representative of the ear's response, it is necessary to reduce the effects of the low and high frequencies with respect to the medium frequencies. The resultant sound level is called A-weighted (noise level) and is measured in dBA by noise meters.

- **Background Noise**
  The total of all noise in a system or situation, independent of the presence of the desired signal. The term "background noise" is often used to mean the noise in the environment, other than the noise from the source of interest.

Concepts

- **Types of Noise Sources**

  - *Point Source*
    If the dimensions of a noise source are small compared with the distance to the listener, it is called a point source, for example exhaust fans. The sound energy spreads out spherically, so that the sound pressure level is the same for all points at the same distance from the source, and decreases by 6 dB per doubling of distance. The point source could be static or mobile.

  - *Line Source*
    If a noise source is narrow in one direction and long in the other compared to the distance to the listener, it is called a line source. It can be a single source such as a long pipe carrying a turbulent fluid, or it can be composed of many point sources operating simultaneously, such as a stream of vehicles on a busy road. The sound level spreads out cylindrically, so the sound pressure level is the same at all points at the same distance from the line, and decreases by 3 dB per doubling of distance. This holds true until ground and air attenuation noticeably affect the level.

- **Environmental Noise Propagation**
  The noise heard by a receptor depends on its distance from the source and on the following factors:
  - *Type of source (point or line)*
  - *Distance from source*

- *Atmospheric absorption*
- *Wind*
- *Temperature and temperature gradient*
- *Obstacles / barriers such as buildings*
- *Ground absorption*
- *Reflections*
- *Humidity*
- *Precipitation*

- **Meteorological Effects**

  - *Wind*
    Wind speed increases with altitude, which will bend the path of sound to "focus" it on the downwind side and make a "shadow" on the upwind side of the source. At short distances, up to 50 m, the wind has minor influence on the measured sound level. For longer distances, the wind effect becomes greater; the noise level slightly increases downwind while considerably decreases upwind depending on wind speed and distance. This is why downwind measurement is preferred so that the deviation is smaller and the result is also conservative.

    - Temperature
      Temperature gradients create effects similar to those of wind gradients, except that they are uniform in all directions from the source. On a sunny day with no wind, temperature decreases with altitude, giving a "shadow" effect for sound. On a clear night, temperature may increase with altitude, "focusing" sound on the ground surface.

- **Getting an Average**
  Assessing a fluctuating noise level means getting a value for a level that is, in simple terms, the average level. The "equivalent continuous sound level", (Leq), had it been a steady level during the measurement period, would represent the amount of energy present in the measured, fluctuating sound pressure level. The Leq is measured directly with an integrating sound level meter. Leq is a measure of the averaged energy in a varying sound level. It is not a direct measure of annoyance. Extensive research, however, has shown the Leq to correlate well with annoyance.

- **Location for Measurements**
  Legislation often specifies where measurements should be made, for example at property boundaries. Other factors also need to be taken into account when measuring because sound levels vary at different heights above ground level. They will also vary depending on the distance between the measurement point and facades and obstacles. These requirements must be noted and applied. This will often mean making measurements:
  - away from facades
  - away from obstacles
  - downwind
  - in dry conditions with a wind speed of less than 5 m/s
  - with the microphone 1.2 - 1.5 m above ground level

ANNEX 3.34: NOISE SOURCES WITHIN THE ESTATE

Noise source	*Type*	*Contribution level expected*
Road traffic noise	*Static/line or mobile/point*	*High*
Aircraft noise	*Mobile/point*	*High*
Noise from railroads	*Mobile/line*	*High*
Construction noise	*Static/point*	*Moderate*
Noise in industry - *Food processing* - *Steel and metal working* - *Garment and weaving* - *Ceramics* - *Grinders and mills*	*Static/point*	- *Low* - *High* - *Moderate* - *Moderate* - *Moderate*
Noise in buildings	*Static/point*	*Low*

ANNEX 3.35: NOISE MEASUREMENTS REPORT

Location: ----------

Series No.	Date	Meteorological Data	Measurements	Allowable limits	Compliance Status	Potential Sources

CHAPTER 4: MANAGEMENT OF ON-SITE AND OFF-SITE EMERGENCY

4.1. OBJECTIVE

The main objective is the sound management of emergency situations to protect human (heath & life), environment and investments.

In this respect, specific objectives include:

- Preparing a comprehensive well-formulated emergency plan for the estate
- Ensuring that required capabilities needed in case of emergencies are acquirable, either from the estate or from external entities
- Ensuring the integration of capabilities available at the facility-level

Annex 4.1 is a technical background related to emergencies.

4.2. ROLES AND RESPONSIBILITIES

- **Estate Management**
  - Coordinating between the emergency plans of individual facilities and setting the overall plan for the estate and the national emergency plans.
  - Make available the necessary maps, data, and means of communication, warning and calling, specialized staffs to manage the emergency situations.
  - Forming working groups to implement the plan in terms of response, rescuing, medical aid, evacuation, monitoring, communication and surveying.
  - Identifying needs for combating emergency situations and coordinating with other entities for their establishment and acquisition
  - Ensuring training of individuals and groups to face emergency situations
  - Undertaking mock drills for emergency preparedness.

- **Facility**
  - Prepare emergency plans at facility level to address hazards identified and analyzed (Annex 4.2 provides guidance for the development of emergency plan on the facility level)
  - Coordinate and cooperate with the estate management for estate-level emergency plan and reflect its requirements on facility-level emergency plan
  - Provide necessary information regarding potential hazards, emergency plans and capabilities

- **Other Concerned Parties**
  - They are responsible for coordinating with the estate management regarding the emergency preparedness and response. The plan should allocate specific roles to each entity on all levels and should ensure the efficiency of communication on the national level.
  - Such bodies include the concerned administrations in the ministries of Labor, Health, Housing, Interior, Electricity and Water Supply, Agriculture, Irrigation, Environment, Defense and Petroleum.

4.3. ACTIVITIES UNDERTAKEN BY THE ESTATE MANAGEMENT TO FULFILL ITS RESPONSIBILITIES

4.3.1. Monitoring and Updating of Status

- **Data to be Collected**

  Data required includes:
  - Emergency plans of the facilities and their effectiveness
  - Hazards due to mobile sources
    - Transporting explosives (oil substances, liquefied and compressed gases in tanks and cylinders) and hazardous substances within the industrial estate
    - Overhead and underground electric power lines.
    - Fresh water and drainage lines and networks.
    - On-site means of transportation, circulation and craning, especially cranes and elevators.
  - Collective capabilities in the estate to address emergency situations
  - Previous emergencies and their extent as well as actions addressing them.

- **Data Collection Mechanism**
  - Hazards on the facility level is identified using the facility emergency plan. In case the plan has not been prepared, the estate management requests that such plan be prepared to ensure the safety of the facility. In order to ensure the effectiveness of the facilities emergency plans, the estate management may coordinate with the regulatory agencies mandated to review the plans.
  - Emergency capabilities are identified by adding up all capabilities at the facility-level, indicated in the individual emergency plans
  - Hazards on the estate-level due to mobile sources are identified based on the knowledge of substances that are transported through the estate either from the facility records or from observations
  - Hazards from the adjacent developments are identified through observation or information acquired from the concerned governorate department.
  - Hazards liable to reach neighboring facilities are indicated from the emergency plans. The estate layout indicating the location of different units within the facilities could also be used to identify sources of hazards in one facility that are adjacent to other facilities
  - Previous emergencies could be investigated through interviews with the facilities or reviewing facilities records regarding these cases.

- **Monitoring Frequency**

  The review of hazards and emergency preparedness systems should be undertaken every year. However, the review is also undertaken in incidents after emergency situations and at the establishment of new facilities

- **Data Documentation**

  The industrial estate should prepare records and forms and organize the procedure in a portfolio that contains:
  - Estate-level emergency plans
  - Detailed information sheets for each expected incident that include:

  - A definition of the incident in terms of type, source, effect, predictability and period of fighting.
  - Identifying possible consequences.
  - Institutions that would help in case of emergency.
- Detailed information sheets and forms of emergency plans on the industrial estate level and the related maps.
- Maps with exit routes, available resources and supplies as well as sources of hazards
- Forms and information about the training of emergency groups.
- Forms and information about the regular mock drills to evaluate emergency plans and observations on such evaluations.

4.3.2. Data Analysis and Identification of Needs

- **Data Analysis**

  The collected data is analyzed to identify required actions and indicate the needs for
  - The need for requirements to deal with emergency at the estate level.
  - Frequent and common hazards in the estate
  - Lessons learnt from previous emergencies
  - Similarities between hazards in different facilities that may lead to increased risks
  - Hazards that require outside aid from higher levels because they exceed the collective capabilities within the estate
  - Hazards liable to reach neighboring facilities which might include:
    - Hazards of explosion due to chemical or electrical factors, or due to pressure vessels or steam caldrons.
    - Hazards of using explosives in various processes.
    - Hazards of gas leakage
    - Hazards resulting from industrial dust and fumes.
    - Hazards resulting from problems in gas and electricity networks.
  - Available capabilities in the estate and the needed resources
  - Effectiveness of the individual emergency plans based on the review of the responsible regulatory agencies

4.3.3. Actions

4.3.3.1. Routine Actions

These actions are undertaken at the estate level.

- **Preparation of the Estate-Level Emergency Plan**

  This is an activity that is undertaken in coordination with industrial facilities. The estate management is expected to direct the operations in the case of an incident.

  The industrial estate emergency plan should coordinate between facilities to identify possible emergency incidents and the methods of dealing with them. The plan should also define the methods, capabilities and limits of cooperation with neighboring establishment whether bilateral or otherwise. The estate-level plan integrates the individual emergency plans and provides guidance for:

- Potential hazards at the estate level
  - Description of the incident scenarios
  - Probability of the incident
  - Expected magnitude and extent of the incident
  - Possible consequences

- Prevention and protection plan
  - Responsibilities of the different concerned parties in all stages
  - Preparedness plans
  - Prediction and early warning

- Response plan
  For each of the identified incidents, the following is detailed:
  - Confronting emergency and controlling the occurrence of the incident.
  - Required supplies/equipment
  - Responsibilities of the different concerned parties in all stages
  - Working groups
  - Guidance for the working groups
  - Locations, mechanisms and responsibility of communication
  - Alarms and mobilization
  - Preparing alternative scenarios to deal with the incident according to its occurrence.
  - Evacuation plan
  - Aid plan

- Post-incident plans
  - Rehabilitation plans and restoring the pre-incident status
  - Disposal or cleaning of contaminated supplies/equipment
  - Evaluation and follow-on activities

- Cooperation and coordination between the estate management and the concerned parties.

- Documentation and reporting
  - Identifying the mechanism of receiving, recording and directing data.
  - Format of incident report

- Routine activities
  - Training of working groups and concerned parties
  - Practicing, simulation and mock drilling
  - Evaluation and testing methods of warning, call and confrontation
  - Evaluation of performance
  - Need for plan modifications in cases of the occurrence of incidence, new facilities, change in available capabilities

- **Coordination with External Entities**
  - The estate management should coordinate with the concerned entities regarding emergency management. They should agree on:

  - Means of communication with public emergency bodies (the police, ambulance, fire department) and other concerned institutions.
  - Individuals or groups responsible for communicating with outside institutions and higher authorities.
  - Identifying individuals and working groups responsible for receiving, coordinating and cooperating with the outside institutions that support the industrial estate in the emergency.
- The estate management should also coordinate with the concerned regulatory entities to ensure the periodic review of the facilities emergency plans to ensure effectiveness and indicate deficiencies

- **Awareness and Training**
  The plan should be announced all over the estate with locations/sources of emergency equipment and role of different entities/individuals. Training is required for the working groups and all those assigned emergency response duties.

- **Simulations/Mock Drills**

Emergency simulations will be undertaken with the aim of:

- Improve effectiveness and check the implementation of knowledge acquired
- Validate environmental emergency plans and put into practice and improve response techniques and procedures
- Improve the design and execution of future exercises

4.3.3.2. Need-based Actions

a. Interventions on the Estate Level

- **Need for the Establishment of Emergency Units in the Industrial Estate**
  Based on the results of the analysis, the need for the establishment of emergency units within the estate is identified in cooperation with concerned parties. Those units include rescue units, ambulance, evacuation units, fire department or emergency tanks. The sound evaluation of hazards decides on the efficiency of emergency fighting capabilities inside the estate, on the cases where external help is needed or establishing independent emergency units.

- **Periodic Updating of the Estate Emergency Plan**
  Emergency plans are based on expected hazards in the industrial estate according to a realistic evaluation of hazards. This evaluation requires systemic revision of the major principles of the emergency plan. The review is either annually and is also undertaken after incidents occur. Evaluation is also needed in case of specific changes in the industrial estate like the operation of new facilities or new circumstances that might introduce additional hazard prospects.

b. Interventions on the Facility Level

- **Updating Individual Emergency Plan**
  The estate management should request the facilities to update their emergency plans to account for emergencies resulting from other sources or emergencies that might affect neighboring facilities.

Given that the industrial estate emergency plan is formulated on the basis of the establishment's plans, any change in the latter due to changes in the circumstances of the establishment should be communicated to the estate - that in turn should take such changes into consideration it in its overall plan. Modifications in facility's emergency plans should be communicated to the estate management to be reflected on the estate-level emergency plan.

ANNEX 4.1: TECHNICAL BACKGROUND ON ON-SITE AND OFF-SITE EMERGENCY

Definitions

- **Hazards**
  It is the possibility of damage that would threaten safety, health, environment or property. The hazards might lead to incidents/accidents including:

  - **Simple Incident**
    It is the accident that may cause injury or serious property damage within the capabilities of the individuals in the work place.

  - **Hazard Incident**
    It is the accident that may cause severe injury or serious property damage and is beyond the capabilities of the individuals in the work place, yet, could be confronted by the emergency capabilities in the facility.

  - **Extended Incident**
    Is the accident that may cause death and injury in addition to extended damage of property or the environment and is beyond the local capabilities of the facility and can be addressed by the emergency capabilities in the estate.

  - **Disaster**
    It is the accident that cannot be faced with either local or estate capabilities and would require national cooperation.

  - **Emergency Plan**
    It is a written plan that comprises the precautions and procedures necessary to face possible hazards and the ensuing consequences affecting the working staff or neighboring institutions or the environment. The execution of such a plan would require mobilizing all required resources.

  - **Explosives**
    There are substances or processes that can explode under the stress of heat, flames, pressure, collision or friction.

  - **Threshold Limit**
    It is the concentration of substances, pollutants or exposures in the work environment that the worker might be safely exposed to during his working time.

  - **Threshold Quantity**
    It is the quantity of the hazardous substance that is used, handled or stored in the facility and beyond which the facility should be identified as of major hazard.

  - **Hazard Analysis and Evaluation**
    It is the process of defining the type and category of the expected hazard in the establishment and analyzing its possible causes, expected results, preventive measures and remedies.

- **Major Hazard Facility**
  It is the facility that permanently or temporarily produces, prepares, exchanges, uses or stores one or more hazardous substances or types of such substances in quantities more than the threshold quantity.

Concepts

- **Defining the Emergency Plan**
  It is a well-designed course of actions combining temporal, spatial and human factors gathered to face possible emergency hazards in the work environment with maximum efficiency and minimum damage in optimum time. The plan consists of well-designed reactions to face such hazards based on:
  - Preventive actions: These are designed to prevent the co-incidence of elements or circumstances that might together lead to hazards.
  - Reactive actions: Pre-planned defensive action to respond to hazards in the work environment resulting from a breach of the preventive system due to unexpected flaws or weaknesses.

  The plan should be clear, simple and implementable. It should also be practical in the light of the available capabilities. Moreover, there should be systematic and regular mock drills to evaluate the elements of the plan or amend it to cope with any changes in the work environment.

- **Main Principles for an Emergency Plan**
  - Defining human, spatial and temporal elements in the work environment and informing all involved parties of the possible hazards associated with each of the above-mentioned elements ('the spatial' would cover defining hazardous and safe zones, 'the human' element would cover pointing out assignments, duties and rights while 'the temporal' element defines the work cycle)
  - Implementing actions needed to address and control the hazards and prevent the occurrence of incidences.
  - Establishing a mechanism for facing all possible hazards.

ANNEX 4.2: GUIDANCE FOR THE PREPARATION OF THE EMERGENCY PLAN

- **Identification of Hazards**
  These include potential hazards related to equipment, substances and constructions under maximum production capacity during operation and storage to identify the type and amount of hazards that might lead to inflammation, explosion, break down, leakage or spread of hazardous substances or structural collapse. These hazards include:

  - Hazardous substances used or stored as well as their quantities and types
  - Health and environmental consequences and extent of human and economic damages inside and outside the facility as well as actions and remedies required.
  - Potential breakdowns in the systems and programs of safety measures, various components, safety valves, control mechanisms, mechanical systems breakdowns, energy resources, pressure vessels in addition to controlling temperatures, deviations from regular operating systems based on the machine design, welding, technical inspection and monitoring plus identifying the effect of natural phenomena and accidental incidents.
  - Efficiency of regular maintenance programs
  - Identifying organizational, technical and human mistakes that might lead to incidents or disasters, identify training needs for the same.
  - Structural and architectural defects in constructions and checking violations of possible precautions, requirements and safety measures in the selection of on-site equipment and machines.
  - Efficiency of emergency plans to face possible on-site and off-site disasters and specifying the required human and material resources and the equipment necessary to execute the plan in addition to performing regular mock drills.
  - Hazards due to inappropriate selection of locations for storage including inside and out-door storage, oil tanks or any explosive material

- **Preparations**
  Identifying the human, administrative and organizational elements as well as the equipment and locations necessary to fight hazards.
  - Identifying human resources for the management of emergency incidents
  - Identifying the required types of training for participants in the plan with specific execution timelines.
  - Drawing up maps of available resources in cases of emergency crises or disasters locating the emergency management center and locating points for distributing supplies and equipment for fire fighting, rescue, protection, medical aids and the equipment for removing debris. The maps should also locate evacuation points and safe shelters.
  - Identifying the required individual and group protection and rescue supplies
  - Drawing up maps and detailed sketches locating escape paths and evacuation plans - partial and total - in case of emergency, and specifying the time-line for execution.
  - Identifying the concerned parties bound to provide support and services in emergency incidents specifying the kind of help and coordination, especially in rescue missions and fire fighting, explosions and spread of toxic and hazardous

substances, ambulance and medical care. The mechanism of asking for help should also be specified.

- Identifying fire prevention supplies (number, types and distribution of fire fighting equipment maps and of fire fighting water and also related annexed points in addition to back up water tanks - warning equipment - electronic fire fighting equipment, escape staircases - back-up power supplies..)
- Checking programs of regular maintenance of the equipment and constructions of the worksite, policies of renovation to avoid sudden problems and breakdowns.

- **Execution**

The plan should include levels of execution performed by individuals or groups according to the following steps:

- **Warning and Calling Plan**

  The selected warning method should be effective in communicating the hazard warning message to all workers on-site and in ensuring their awareness of the nature of the hazard giving them the chance to face it or escape from it. The warning should be both visual and auditory to reach all workers on-site whether manually, mechanically or electronically.

- **Confrontation**

  This is undertaken according to the type of hazard, its spread and consequences through trained human personnel either directly or manually, or through automated or remote control systems or otherwise.

- **Supplies**

  This is performed according to the type of danger, its location and spread. The suppliers are either trained personnel who continuously supply the fighting groups with equipment and tools or an electronic system to guarantee the continuity of competent work to overcome the hazards and its consequences.

- **Ambulance and medical services**

  There should be an ambulance car or a field clinic on -site to receive the injured and provide them with medical care and immediately transport to hospitals.

- **Recording**

  The above-mentioned steps are recorded in terms of time and duration of execution, cost, efficiency and the responsible group in each step.

- **Checking the hazard site and the consequences**

  After overcoming the danger, an accurate and comprehensive survey of the incident site should be performed to make sure the hazard is totally removed and to restore the situation to the pre-accident status. The timing of this step is decided according to reconstruction, re-operation or resuming work in the unit.

- **Maintenance of the used equipment**
  The maintenance team in the emergency service performs the maintenance services for all the used tools, equipment and supplies. The team then redistributes or stores such tools after estimating the cost of using such tools and maintaining them.

- **Checking and analysis**
  A specialized team studies the incident to identify its causes and analyze its results and consequences. The team then issues technical recommendations to put off further similar accidents.

- **Performance evaluation**
  The performance of the plan execution is evaluated and recommendations are issued to avoid any shortcomings that might lead to a similar accident.

- **Evaluating the emergency plan before actual execution**
  The plan should be regularly evaluated and tested through announced or unannounced mock drills where warning is operated to evaluate performance. Such mock drills should occur at fitting intervals.

- **Announcement of the plan**
  The emergency plan should be typed and announced all over the site with locations of emergency equipment and the role of each individual in each emergency incident according to positions, not names. The plan should be up-dated to respond to any changes in the units to achieve realistic execution.

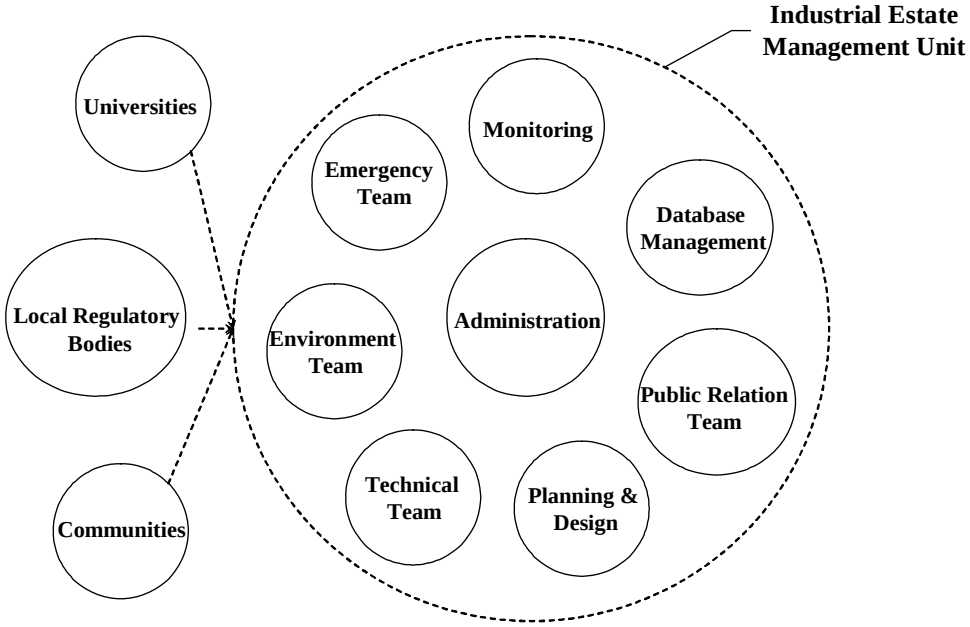
  The call plan should clearly be specified in the emergency plan. In time of emergency, authorized decision makers who must be contacted should be specified with their addresses, phone numbers and methods of emergency call through an emergency car.

  Public emergency phones should be listed (Government - ambulance- fire departments - police - security institutions)

CHAPTER 5:CASE STUDIES AND CLEANER PRODUCTION BEST PRACTICES

5.1. INSTITUTIONALIZING INDUSTRIAL ESTATES MANAGEMENT

New industrial estates in developed countries show the trend of institutionalizing industrial estate management. Management of industrial estate includes general administration, planning & design, monitoring, technical, environmental, emergency issues and communication with stakeholdersThe industrial estate management unit should ideally have internal divisions/units with qualified personnel with pre defined responsibilities to manage the estate. The estate may prefer to have these units on board or associate with experts/organizations to service the estate. The figure below provides a general organizational set up of an industrial estate management unit.



The units within the industrial estate management should have a strong interaction to provide timely feedback and corrective measures.

Institutionalizing the estate's management has led to explore innovative ways to improve their economic and environmental performance. Refer to **Box 6.** Jebel Ali Free zone is one such example where the industrial estate management unit has an environment health and safety unit.

Box 6: The Case of the Jebel Ali Free Zone, Dubai[28]

Jebel Ali Free Zone Authority (JAFZA), Dubai was established in February 1985 to develop and manage the Free Zone's proposed commercial and industrial development. The Jebel Ali Free Zone is the largest engineered port and industrial estate in the world. In 1995, 793 companies were located at this industrial estate. Considerable efforts have been made here to address environmental risks.

A unique feature of JAFZA is its strong **Environment, Health and Safety (EHS) Department,** whose broad functions range from legislative to regulatory. The present EHS-FZ Department of the Environment, Health, Safety and Security Division was the primary EHS regulatory unit during the establishment of the erstwhile Free Zone Industrial Operations Control Department more than a decade ago. The unit had grown rapidly alongside the rapid increase in the number of JAFZ companies. Now, it has become a full-fledged Department that monitors and controls the Environment, Health and Safety aspects of all JAFZ companies. The Department has developed manuals for health and safety standards and for environmental control requirements. The Department is also responsible for maintaining the ISO14001 certification (the JAFZ is ISO 14001 certified)[29]. The EHS Department plays a pivotal role in the smooth functioning of the JAFZ, as will be elaborated in the following sections.

Planning, zoning and screening activities

JAFZA has a **Master Plan** to incorporate environmental considerations in development. This includes consideration of air quality, noise, water and wastewater management, solid and hazardous waste management. The environmental considerations presented in the Master Plan are also being used to address issues in older facilities that exist in the rest of the Free Zone.

The nature of industrial activity in the JAFZ is mixed. The Environment Unit of the EHS-FZ Department reviews all projects with potential environmental impacts. The industry is then recommended and allocated an area in certain zones in JAFZ according to their category, be it petrochemical, chemical, heavy/light manufacturing/fabrication or mixed types of industries.

Assessment of projects is carried out at the initial stages for the prospective clients of JAFZ to familiarize with the EHS policies and practices. Only those companies who respect EHS requirements are permitted to operate in the Free Zone. Subsequent to the initial approvals, the companies need to go through the stages of Drawing Review, Facility Completion and Operation Fitness Inspection that will certify the operations of the facility to be in line with environmental requirements. Companies or industries with a potential to cause a major environmental impact are advised to

[28] Unless otherwise mentioned, sourced from *The Environmental Management of Industrial Estates* by the United Nations Environment programme. Available at: www.uneptie.org/pc/ind-estates/pdf_documents/%20TR39/TR39-Eng.pdf%20 , www.uneptie.org/pc/ind-estates/pdf_documents/ TR39/TR39-Eng.pdf (Accessed March 27, 2004)

[29] More specific information on the various activities of the EHS Department (classified into sub-topics) can be obtained from http://www.jafza.co.ae/ehsmain.htm

carry out Environmental Impact Assessment Studies in line with JAFZA guidelines prior to the construction of the facilities.

The JAFZ also has a strict screening procedure for new applications to set up operations. Industrial activities that are banned by international law or agencies like the UNEP are not allowed here e.g., recycling of toxic metals, activities involving cyanide processing etc.

Environmental standards, monitoring and waste management

The EHS Department manages the waste generated inside the Free Zone according to the standards of Dubai Municipality[30]. The scope of the regulations includes solid and hazardous waste, air quality and wastewater management.

Solid waste material from facilities in the JAFZ such as paper, metal and wood is recycled. Private contractors collect the recyclable material and process them in their facilities outside the JAFZ. These private contractors are approved by the Dubai municipality.

Hazardous wastes are particularly monitored and require specific approvals from EHS Department as well as Dubai Municipality.

The EHS Department monitors air quality, effluents from sewage treatment plants operated by the Department using its own laboratory service with in the zone. The JAFZA has also set up Ambient Air Quality Objectives for the Zone[31]. Portable air samplers/analyzers are also available to monitor industrial emissions. In-house control for industries is recommended. Industries are required to install continuous monitors and recorders. All point sources of air emission in JAFZ have provisions for point source sampling. These are intermittently monitored to enable collation of records on the status of air quality in JAFZ.

Industries in the Free Zone generating wastewater from their operations have to abide by strict discharge/disposal standards of JAFZA/Dubai Municipality. Companies are allowed to treat their waste and dispose the same to the harbour or open sea. The costs are borne by the waste generators themselves based on an established tariff for such discharges[32]. Regular monitoring and reporting of wastewater discharges/disposal are sought from the companies and strict implementation of environmental requirements is solicited.

All Free Zone industries are required to adopt cleaner production principles and

[30] For information on Dubai Municipality's rules and regulations, refer to: http://vgn.dm.gov.ae/DMEGOV/dm-dos-subcategory?category_id=4&category_name=%20Environment (Accessed March 30, 2004)

[31] Refer to http://www.jafza.co.ae/pollutioncontrol.htm#airqp for more information on the same. Accessed March 31, 2004.

[32] For more information on rules and imposed tariffs concerning EHS issues, refer to http://www.jafza.co.ae/freezonerules/jafz-rules.htm (Accessed March 31, 2003)

[33] More information about cleaner production (e.g. its key elements, synergies with other similar sounding approaches, etc.) can be referenced from http://www.uneptie.org/pc/cp/understanding_cp/home.htm (Accessed March 31, 2003)

waste minimization programs by implementing Recycle, Reuse and Recovery (RRR) practices. In fact, one of the primary objectives of the EHS Department is to implement JAFZA's environmental requirements/corporate policy and provide a preventive rather than reactive approach in the control of pollution. In line with this objective, the EHS Department also provides advice to industries on matters of cleaner production[33].

Finally, the Department conducts inspections of companies to assure compliance with regulations. This assessment, compliance and monitoring system has spawned a unique private environmental service industry within the JAFZ itself.

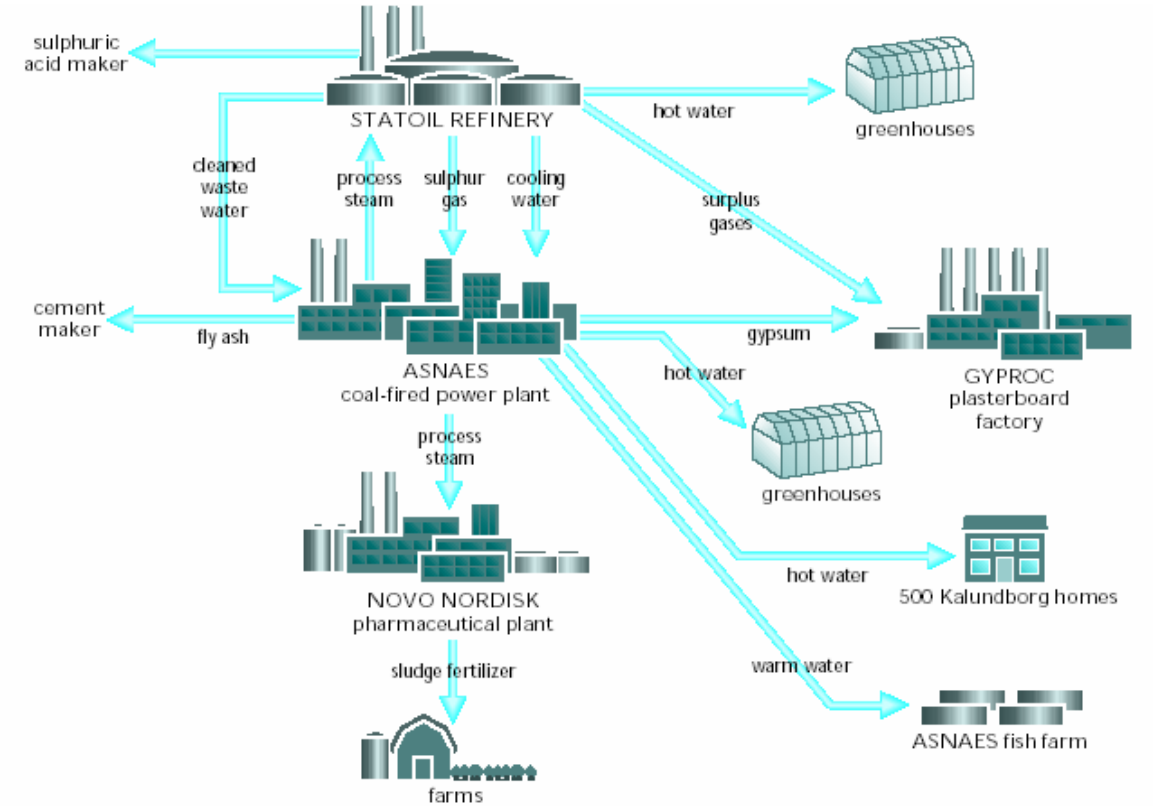
As seen in **Box 6** the establishment of facilitating enterprises such as Environmental Management / Co-ordination / Promotion Units within the Industrial Estates has provided major boosts to their everyday running.

5.2 POOLING RESOURCES TO MANAGE ENVIRONMENT AND COSTS

The concepts like 'Industrial Ecology' or 'Industrial Symbiosis' attempt to ape nature ecosystems wherein the total material and energy through put is kept minimal by utilizing other entities wastes/byproducts/energy as a primary source of material /energy. The above concepts are integrated model of industrial ecosystem which reuses and recycles the waste generated efficiently back into the system and reduces the overall environmental damage, costs and liabilities of the industrial units. The industrial estates practicing these concepts are referred as Eco Industrial Parks (EIP).

The following figure shows the Industrial symbiosis in Kalundborg, Denmark[34], the figure provides the robust inter linkages of material and energy utilization among the entities of the industrial estate.

[34] Figure sourced from, 'The Environmental Management of Industrial Estates', UNEP, Industry and Environment.



Industrial symbiosis in Kalundborg, Denmark

Kalundborg industrial estate has evolved to become an EIP. Taking this as an example many industrial parks/estates were based on the principles of Industrial Ecology. *(Burnside Canada, Brownsville Texas to name a few)*. However on the developing countries front the principles of Industrial Ecology evolved naturally to address the costs and liabilities.

Industrial units in the estates which have been in co-existence have innovatively built linkages for material and energy utilization. To further reduce the costs the estates have also built a common environmental management infrastructure. This has helped the small industrial units which cannot afford individual treatment facilities to pool for common infrastructure, thus reducing their liabilities. Refer **Box 7** below.

Box 7 Industrial Ecology and Common Environmental Infrastructure

Ankleshwar and Nandesari Industrial Estates in Gujarat, India

In Ankleshwar and Nandesari Industrial Estates 'Industrial Ecology' network by trading the waste and by products within the estate in Gujarat, India are good examples of mixed industrial estates hosting small-medium scale industries and having informal waste sale/exchange networks for by-products and energy.

These industrial estates have a Common Effluent Treatment Plant (CETP), and Common Secured Landfill for disposing hazardous wastes, operated by a private operator. The industrial units share this common environmental infrastructure and pay stipulated fees depending on the quantum of wastewater and Hazardous waste generated.

The Jajmau Industrial Cluster of Leather Tanneries, Kanpur (India)[35] and the Ranipet Industrial Cluster of Leather Tanneries, Tamil Nadu (India), both leather tanning clusters discharged their effluent with a very high load into water bodies and farmlands was a serious cause of concern during the last decade. This resulted in a number of directions by the Supreme Court to compel (a) the Pollution Boards to enforce environmental regulations and (b) the tanneries to comply with the rules. Now many smaller tanneries (in clusters) have been connected to central effluent treatment plants (CETPs). Further environmental mitigation interventions came in the form of chrome recovery for the leather tanning units at Jajmau. The Pollution Board introduced policies aimed at promoting Central Chrome Recovery Plants (CCRPs), which was oriented towards small-scale leather units.

The 90% efficient Combined Heat and Power (CHP) generation: At the Kalundborg Industrial estate an Eco Industrial Park, Asneas thermal power plant supplies power and excess heat to the neighboring industries and steam for district heating. By this way Asneas power station uses almost 90% of the primary energy content of the coal and serves as a common CHP for the industrial estate and the neighboring district.

5.3. SAFER INDUSTRIAL ESTATES

Disaster/emergency preparedness and response plan forms a crucial aspect for any industrial estate. Industrial estates with heavy industries like petrochemicals, organic chemicals etc can lead to heavy destruction of the industrial estate and the neighbouring population in case of disaster. The industrial estate authority should provide full time (24 hours) trained staff for handling emergency situations.

To address this issue, Awareness and Preparedness for Emergency at Local Level (APELL) was developed by the United Nations Environment Programme, in partnership with industry associations, communities and governments following some major

[35] Barriers and Opportunities for Promoting Trade in Environmentally Friendly Products- A Study of India's Leather Industry. Available at: www.cuts-india.org/Leather%20Sector%20Study.doc (Accessed March 28, 2004)

industrial accidents that had serious impacts on health and the environment. APELL is now being implemented in nearly 30 countries around the world.

APELL is a ten-step process for the development of an integrated and functional emergency response plan involving local communities, governments, emergency responders and others. This process creates awareness of hazards in communities close to industrial facilities, encourages risk reduction and mitigation, and develops preparedness for emergency response. APELL can apply to any risk situation, whether industrial or natural. It can be initiated by any party, although companies can be expected to take the lead.

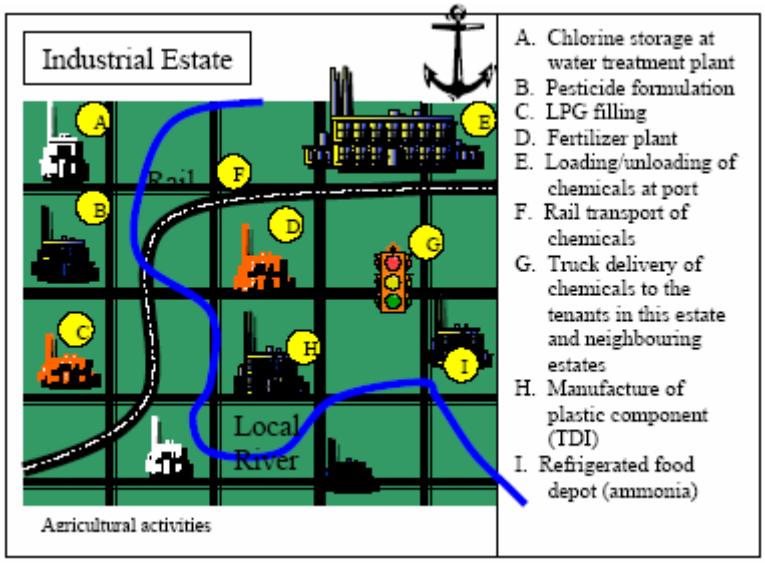
A testament to the usefulness of the APELL process is evident through its integration with the National Emergency Response Plan of the 8th National Economic and Social Development (1997-2001) Plan in 1995 by Thailand. The Department of Industrial Works (DIW), Ministry of Industry serves as a "National APELL Focal Point" and plays a major role in promoting and encouraging APELL by means of communication, education, publishing and training (see section on **Mechanisms to support APELL in Thailand**) to create local awareness and preparedness of emergency response through out the country.

Refer **Box 8** below, for incorporation of APELL on industrial estates in Thailand[36]

Box 8 Incorporation of APELL at Map Ta Phut Estate Thailand

The Map Ta Phut Industrial Estate in the Rayong province of Thailand is one such estate. This is an estate housing several high risk industries where workers and the neighbouring community are most likely to be affected in the case of emergency (see the Figure below for typical hazards on an industrial estate).

Typical hazards on an industrial estate[37]



Thus, the need for emergency planning and preparedness was great. While some emergency preparedness and response activities did exist, there were not as structured and detailed as the APELL process. APELL had been introduced to service this particular need and fill in these gaps. Consequently, the APELL Co-ordinating Group was formed and the Emergency Response Drill was first carried out in 1994. Hazards identification and evaluation were undertaken by participating industries. As a result of the APELL initiative, industries and local council members, police, fire department, local health officials and community leaders are also contacted and give valuable inputs to the overall process. The initiative was ultimately duplicated at another major industrial estate – the Bang Poo Industrial Estate of the Samutprakarn province of Thailand.

Mechanisms to support APELL in Thailand

The following are the support mechanisms put in place by the Government of Thailand in a bid to support the APELL process.

[36] Unless otherwise mentioned, sourced from *The Implementation of APELL in Thailand*. Available at: www.uneptie.org/pc/apell/events/senior-level%20meeting/pdffiles/APELL%20in%20Thailand.pdf (Accessed March 24, 2004)

[37] APELL and Industrial Estates. Available at: www.uneptie.org/pc/apell/publications/ pdf_files/APELL-IE-final.pdf (Accessed March 24, 2004)

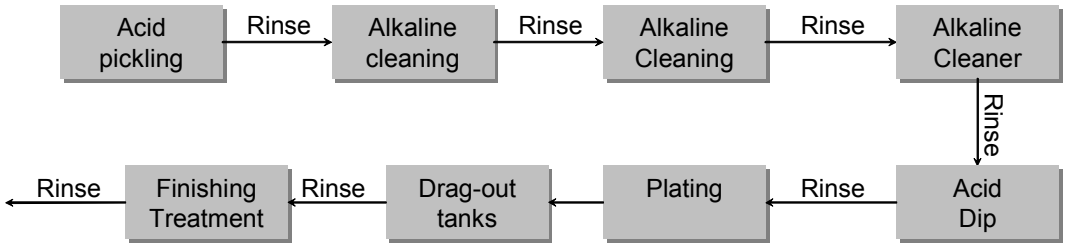
- Chemical database of chemical industries and Emergency Response Equipment Information Centre for Petroleum and Petrochemical Industry on the website: htpp://www.diw.go.th and htpp://www.emergencythailand.com[38]
- Hot line 24 hours, 7 days Emergency Response Information Voice mail: 1564 or Tel.: (662) 280 7180-93.
- Notification of Ministry of Industry No. 3 B.E.2542 (1999) issued under the Factory Act, B.E.2535(1992), regarding "Measures for protection of safety at work on Risk Assessment and Risk"
- Notification for the Management for Major Hazard Control for 12 categories of High Risk Industries [issued on 18 November B.E 2542(1999)].
- Providing advice concerning accident/incident investigations and reporting about the causes of personal injury, property damage and environment.
- Providing technical advice on Awareness and Preparedness for Emergency, Risk Management and Major Hazard Control and Emergency Response Plan; these activities fall under the scope of the Safety Technology Bureau, DIW (e.g. Safety Clinic, etc.)

[38] Note that this was an on-going process during the time the reference document cited in this case study (see footnote #93) was released.

ANNEX 5.1: BEST PRACTICES FOR ELECTROPLATING SECTOR

Introduction to the Electroplating[39]

Electroplating involves the deposition of a thin protective and/or an ornamental metallic layer on a metal surface electrochemically. The activities in involved are pre-treatment (cleaning, degreasing), plating, rinsing, passivating and drying. Refer the flow chart below[40].



Sources of Pollution

The sources of pollution are the cleaning and pre-treatment stages; these processes involve use of chlorinated hydrocarbons, surface stripping agents like caustic soda, acids. The other source of waste (usually high in volume/unit of product) is the rinse water, spillages and draining of the electrolyte bath which contains complexing agents such as cyanides solvents, toxic metals and oil and grease.

The solvents and vapours from hot plating baths results in elevated levels of volatile organic compounds (VOCs) and in some cases, volatile metals compounds (may contain chromates). Approximately 30% of solvents and degreasing agents used can be released as VOCs when baths are not regenerated.

Still bottom wastes, cleaning and changing of process tanks and the treatment of wastewaters can generate substantial quantities of wet sludges.

Waste Characteristics

Wastes water generated during electroplating processes (extremely variable 1liter to 500 liters per m^2 of surface plated) are typically associated with the solvents and cleansers applied to the surface and the metal-ion-bearing aqueous solutions used in the plating tanks. Metal-ion-bearing solutions are commonly based on hexavalent chrome, trivalent chrome, copper, gold, silver, cadmium, zinc, and nickel.

The air emissions contain toxic organics (such as trichloroethylene and trichloroethane). The sludges contain high levels of toxic organics and/or metals.

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[39] Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997.

[40] Source: Metals Handbook, Ninth Edition; Volume 5, Surface Cleaning, Finishing, and Coating, 1982, American Society for Metals & Sustainable Industry: Promoting Strategic Environmental Protection in the Industrial Sector, Phase 1 Report, U.S. EPA, OERR, June 1994.

Best Practices for Cleaner Production

The pollution prevention programs should focus on reduction in water use and on more efficient use of process chemicals. Following the Cleaner Production options for the sector.

Improved operating procedures / Scheduling improvements

1. The carry over of plating baths (drag out) by work pieces results in high pollutants in waste waters this can be minimized by effective draining of bath solution from the plated part, by measures like making drain holes in bucket type pieces if necessary and increase the dripping time and maintain the density, viscosity and temperature of the baths to minimize drag out.
2. The life of the process bath can be maximized by monitoring and controlling the parameters of bath, like pH, metal ion concentration, temperature.
3. Increase the efficiency of rinsing waters by agitation of rinse water or work pieces.

Recycling reuse, recovery/ Waste stream segregation

1. Process baths can be recycled after concentration and filtration. Spent baths can be sent for recovery and regeneration of plating chemicals, acids and other process ingredients, wherever feasible.

Input material changes / substitution

1. Reduce and avoid the use of toxic chemicals in the process, e.g. use trivalent chrome instead of hexavalent chrome, prefer water based surface cleaning agents wherever feasible, instead of organic cleaning agents. Replace cadmium with high quality corrosion resistant zinc plating. Use cyanide-free systems for zinc plating where appropriate. Where cadmium plating is necessary, use bright chloride, high alkaline baths or other alternatives. However alternate complexing agents to cyanides may cause problems in wastewater treatment for they may result in the release of heavy metals.

Process and equipment modification

1. Recover the drag out for make-up for the process tanks, e.g. Place recovery tanks and drain boards before rinse. Clean racks between baths to minimize contamination of the drag out.
2. Reduce the consumption of rinse water by either using counter current washing or spray rinse wherever feasible.

End of Pipe Treatment (EOP) /Pollution Control Measuresl

Air Emissions: Exhaust hoods and good ventilation systems protect the working environment but the exhaust streams should be treated to reduce VOCs (using carbon filters which enable the reuse of solvents) and heavy metals to acceptable levels before venting to the atmosphere. Acid mists and vapours should be scrubbed with water before venting. VOCs can also be managed by combusting after scrubbing adsorption or other treatment methods.

Wastewater: Cyanide destruction, flow equalisation, and neutralization and metal removal are minimal requirement of electroplating plants. Cyanide treatment should be carried upstream of other treatment processes. If hexavalent chrome (Cr^{+6}) occurs in water this should be reduced to trivalent form using reducing agents (such as sulfide) followed by precipitation and sedimentation/filtration. For small facilities possibilities of sharing a common treatment plant should be considered. The main treatment processes are

equalization, pH adjustment for precipitation, flocculation and sedimentation/filtration. It is preferred that the degreasing baths are treated separately. Modern waste water treatment plant use ion-exchange, membrane filtration, these treatments allow to remove the toxics and recycle the waste water back to processes having low water quality demand.

Solid and Hazardous waste: The wet sludges from the facilities and the treatment plants should normally be managed as hazardous waste or sent for metal recovery. Electrolytical methods may be used to recover metals. Sludges are usually thickened dewatered and stabilised using chemicals (such as lime) before disposal in a secured landfill.

Useful References for Further Readings

1. Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997 Source: http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/55dairy.pdf

2. EPA Office of Compliance Sector Notebook Project: Profile of the Metal finishing Industry Source: http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/#industry

3. Green Productivity Practices in Select Industry Sectors, Asian Productivity Organisation.

ANNEX 5.2: BEST PRACTICES FOR FOOD PROCESSING SECTOR

Introduction to the Food Processing Sector

Food processing industries include alcoholic and non-alcoholic breweries, canning and packaging of fruits and vegetables, confectionaries, slaughter house, meat processing, poultry, fish, dairy and dairy products, grain mills and sugar industry. The focus of this document is on dairy and dairy products, meat processing, and manufacture of bakery products.

Sources of Pollution

The pollutants are mainly losses from production. The sources of pollution load are waste waters from process, equipment and floor washings these are high in BOD_5 content. The solid waste mainly arises from spoiled raw material (e.g. spoiled fruits) this solid waste is highly putresible.

Waste Characteristics[41]

The air emissions from the food processing industries are typically from the boilers, the characteristics are dependent on the fuel used (coal, oil or gas). Large coal fired boilers may emit high concentrations of sulphur dioxide (SO2), nitrous oxide (NOx), carbon monoxide and dioxide (CO and CO2) and particulates (soot and dust from combustion). Odour can be a significant nuisance issue for neighbouring facilities and residential areas. Odour problems are mainly due to poor housekeeping and inadequately operated wastewater treatment plants.

The waste waters from food processing industries are usually high in volume and organic load arise from cleaning, cooling and production purposes. The waste water from fruit and vegetable processing may contain pesticides. The main parameters of concern for effluent are Biological Oxygen Demand (BOD) and Suspended Solids (SS).

The solid waste generated is spoiled raw materials, peelings, contaminated products etc. This waste if not managed properly can lead to hygiene, odour problem and contamination of products.

Best Practices for Cleaner Production

The pollution prevention programs should focus on reduction in water use and on more efficient use of process chemicals. Following the Cleaner Production options for the sector.

House keeping / material handling and storage

1. Use dry cleanup methods; provide brooms, vacuums, and absorbent. Scrape up and scoop up particulate matter before wash down. This technique prevents the unnecessary addition of waste to the wastewater stream[3] and reduces the volume of waste water generated.
2. Minimizing the loss of product. Prevent product from becoming waste when it hits the floor. Provide catch pans under problem areas of production lines.

[41] Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997 Source: http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/55dairy.pdf

Improved operating procedures / Scheduling improvements

1. Sequential scheduling of the products that use the same production line or equipment can reduce cleaning requirements.
2. Maximizing the dedication of process equipment. This can reduce equipment cleaning frequency and waste generated.
3. Transfer solids and particulate matter by mechanical means (e.g. augers or conveyors) or manually rather then using water as a conveyer, this helps minimize loadings to the wastewater treatment system.

Recycling reuse, recovery/ Waste stream segregation

1. Reuse or recycle excess, off-specification materials and samples taken for quality control testing. For example, off-spec material can be added to an often already existing waste stream that is used for animal feed[3]. (e.g. Whey from cheese manufacturing industry can be used as animal feed).
2. The cooking water can be reused repeatedly if the oil is skimmed off and the oil can be sold for oil production.

Input material changes / substitution

1. Use detergents which don't contain harsh chemicals e.g. phosphorus based cleaning agents.
2. Use all purpose solvents in place of solvents dedicated for particular uses. Minimize the use of solvents, e.g. spot apply solvent rather than pouring.

Process and equipment modification[42]

1. Minimizing the amount of cleaning solution used. If water is the cleaning agent, use sprays or jets of water to clean tanks or equipment. Use automotive shutoffs on hoses and at wash stations. Where possible, small amounts of concentrated waste collected should be recycled or used as a raw material. Rinse machinery and tanks less often.
2. Use raw material cans/containers having a higher slope gradient to allow complete draining of raw material (e.g. milk) this reduces the pollutant load in wash waters.
3. The conventional refrigeration systems using chlorofluorocarbon (CFC) have proven to deplete ozone due to their high ozone depleting potential (ODS). Substitute these high ODS refrigerants lower ODS refrigerants like ammonia.

End of Pipe Treatment (EOP) /Pollution Control Measures[43]

Air emissions: Odour control by ventilation, biofilters and scrubbing may be required. Dust control at milk powder plants is provided by fabric filters.

Waste water treatment: Pre-treatment of effluents comprises of screening, flow equalisation, neutralisation and air flotation (for dairy to remove fats and solids), followed by biological treatment. If land is not a constraint land treatment or pond systems are potential treatment methods. Other possible biological treatment systems include trickling filters, rotating biological contactors, and activated sludge treatment.

[42] A Pollution Prevention Guide for Food Processors Three Rs for the 90s: Reduce, Reuse, Recycle Source: http://www.dnrec.state.de.us/del-proc.htm

[43] Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997.

Pre-treated effluents can be discharges to municipal sewers if capacity exists and with the approval of relevant authority.

Solid and Hazardous waste: The solid waste generated from the food processing industries is usually organic and putrescible. This waste has a high nutritional value and can be effectively used as an animal feed. Solid waste which has decayed can be composted to prepare manure.

Useful References for Further Readings

1. A Pollution Prevention Guide for Food Processors is a fact sheet with general tips, improved operating procedures, process and equipment modifications. Source: http://www.dnrec.state.de.us/del-proc.htm

2. Pollution Prevention Guidebooks: Food and Kindred Products is a short document that describes the types of pollution prevention solutions implemented by food processing companies in New Jersey. Source: http://www.njit.edu/njtap/isr20.htm

3. Clean Technologies in U.S. Industries: Focus on Food Processing gives a brief overview of the US food processing industry with an emphasis on pollution prevention and clean technologies. Source: http://www.p2pays.org/ref/09/08853.htm

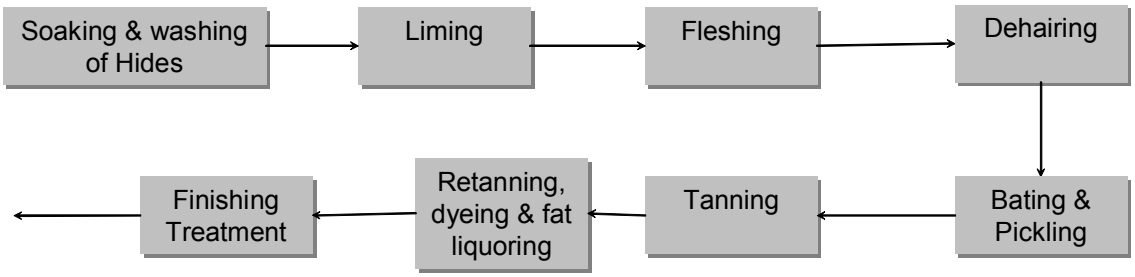
4. Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997 Source: http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/55dairy.pdf

5. Cleaner Production Guidance Manuals, SEAM, Egypt, Source: http://www.seamegypt.com/Manuals/FoodSectorReport/content.htm

ANNEX 5.3: BEST PRACTICES FOR LEATHER TANNING SECTOR

Introduction to the Leather Tanning Industry

The tannery operation consists of converting the raw skin, a highly putrescible material, into leather, a stable material. The process involves a sequence of complex chemical reactions and mechanical processes. The preliminary tannery processes or beam house processes (cleaning, trimming, deliming etc). Tanning (in the tanyard); and finishing, including dyeing and surface treatment. A wide range of processes and chemicals, including chrome salts, is used in the tanning and finishing processes. Refer the figure below for the process steps involved.



Sources and Characteristics of Pollution[44]

The main sources of pollution are the waste water arising from the above processes, solid waste generated from fleshing and dehairing process. The air emissions are from bating and pickling process.

Composite untreated wastewater, amounting to 20–80 cubic meters per metric ton (m^3/t) of hide or skin, is turbid, colored, and foul smelling. It consists of acidic and alkaline liquors, with chromium levels of 100–400 milligrams per liter (mg/l); sulfide levels of 200–800 mg/l; nitrogen levels of 200–1,000 mg/l; biochemical oxygen demand (BOD) levels of 900–6,000 mg/l, usually ranging from 160 to 24,000 mg/l; chemical oxygen demand (COD) ranging from 800 to 43,000 mg/l in separate streams, with combined wastewater levels of 2,400 to 14,000 mg/l; chloride ranging from 200 to 70,000 mg/l in individual streams and 5,600 to 27,000 mg/l in the combined stream; and high levels of fat.

Significant volumes of solid wastes are produced, including trimmings, degraded hide, and hair from the beam house processes. The solid wastes can represent up to 70% of the wet weight of the original hides. In addition, large quantities of sludges are generated. Decaying organic material produces strong odours.

The air emissions are because of hydrogen sulphide is released during dehairing, and ammonia is released in deliming, solvent vapours from spray application, degreasing, and finishing (for example, dye application).

[44] Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997 Source: http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/55dairy.pdf

Best Practices for Cleaner Production 1

Tanning sector wastewater is highly toxic due to presence of heavy metals like chromium and the highly putrescible solid waste. The pollution prevention programs should focus on substitution of chromium from tanning process and better use of the solid waste generated. Following are some Cleaner Production options for the sector.

Improved operating procedures / Scheduling improvements

1. Use low float methods such as having 40-80% floats. Recycle liming, pickling and tanning floats. Recycling sulfide losses (up to 20-50%) and lime loss (up to 40-60%).
2. Use techniques which reduce the pollution load, like hair save method which prevents the dissolving of hair in chemical and thus can be recovered.
3. The chrome needed for tanning can be reduced by splitting the limed hides.

Recycling reuse, recovery/ Waste stream segregation

1. Chrome bearing wastewater can be segregated for chromium recovery; chrome from the wastewater is precipitated and acidified and reused in the process.
2. Reuse the wastewaters for washing e.g. recycle lime wash water to soaking stage. Reuse treated wastewaters in the process to the extent feasible (in process like soaking and pickling).
3. Tanning sector provides a huge potential to reuse the solid waste generated, e.g. the tanned shavings for leather board, hide trimmings for use in glue, gelatin and tallow products.

Input material changes / substitution

1. The strength and toxicity of wastewater from the tanning process can be reduced by changing the input material. e.g. Substituting insecticide/fungicide with salt or chilling methods for preserving raw hide eliminates toxic compounds in the wastewater. Process fresh hides to reduce the quantity of salts in the wastewater.
2. Substitute hexavalent chromium with trivalent chromium, titanium, aluminum or vegetable tanning agents in tanning process to reduce the toxicity of wastewater.

Process and equipment modification

1. Reducing the amount of chemicals used in the tanning process reduces their strength in wastewaters, e.g. split limed hides to reduce the amount of chrome needed for tanning. Using sulfide and lime as 20-50% solution to reduce sulfide levels in wastewater.
2. Close monitoring and control on process parameters can save up to 50% process water consumption.

End of Pipe Treatment (EOP) /Pollution Control Measures2

Air Emissions: The VOC emissions from the finishing process should be controlled by minimising the solvent release and good ventilation.

Wastewater: The wastewater treatment consists of screening, physico-chemical treatment for removing solids contributing to BOD_5/COD, biological treatment for removing the dissolved organic load. The chrome bearing waste stream, soaking liquor, sulfide rich lime stream should be segregated for chemical recovery.

Solid and Hazardous waste: majority of solid waste should be recovered and used as a raw material for other products. Refer to the 'Recycling reuse, recovery/ Waste stream segregation' section. The chrome bearing sludge from ETP should be disposed off in a secured landfill.

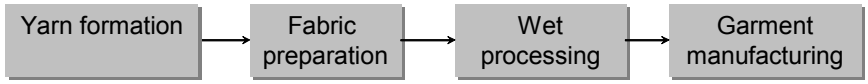
Useful References for Further Readings

1. European Bank for Reconstruction and Development, Sub-sectoral Environmental Guidelines; Cement, Source: http://www.ebrd.com/enviro/index.htm
2. Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997 Source: http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/55dairy.pdf
3. Best Available Techniques for the Pulp and Paper Industry, Integrated Pollution Prevention and Control (IPPC) European IPPC Bureau. February 2001. Source: http://eippcb.jrc.es/pages/FActivities.htm

ANNEX 5.4: BEST PRACTICES FOR TEXTILE MANUFACTURING SECTOR

Introduction to the Textile Industry

The textile industry is one of the oldest in the world. It can be categorized according to the activities; Yarn formation (fiber[45] preparation, spinning) fabric formation (warping, slashing, weaving, knitting), wet processing and garment manufacturing. Refer the flow diagram below for generic processes in the industry.



This document will primarily focus on wet processing (major source of pollution), of natural fibers (cotton) which include preparation (scouring, desizing, bleaching, mercerizing) dyeing and finishing of the fabric.

Sources of Pollution

The main source of pollution load in the textile industry is from the wet processing operations mentioned above. The process waste water is a major source of pollutants. It is typically alkaline and has high BOD_5 and COD, solids, oil and possibly toxic organics, including phenols (from dying and finishing) and halogenated organics (from bleaching). The waste water from the dying section are highly coloured and may contain heavy metals.

Waste Characteristics[46]

Emissions of volatile organic compounds (VOCs) results from cleaning of fabrics during preparation processes, use of inks in printing, Emissions of particulates, formaldehydes and di-isocyanates arise from textile finishing processes. The VOC concentration may vary from 10mg carbon/m^3 for the thermosol process to 350 mg carbon/m^3 for drying and condensation process. The other air emissions include dust, oil mists, acid vapours, odours and boiler exhausts.

Process wastewater is a major source of pollutants. It is typically alkaline and has high BOD_5 (700 to 2,000 mg/l) and COD (approximately 2 to 5 times the BOD level), solids, oil and possibly toxic organics, including phenols (from processes such as bleaching). Dye waste waters are usually coloured and may contain heavy metals such as copper and chromium. Wastewaters from scouring and washing processes can also contain pesticides, if they were used for preservation of natural fibers.

Waste sludges arise from tank cleaning and spent process chemicals containing toxic organics and metals.

Best Practices for Cleaner Production

The pollution prevention programs should focus on reduction in water use and on more efficient use of process chemicals. Following are some Cleaner Production options for the sector.

[45] Fibers can be natural (cotton, silk, wool) or man made/synthetic (nylon).

[46] Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997 Source: http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/55dairy.pdf

Improved operating procedures / Scheduling improvements

1. Manage/schedule the batches to minimise waste at the end of cycles, like schedule darker dye shades after lighter shades.

Recycling reuse, recovery/ Waste stream segregation

1. Use counter current washing systems to conserve water.
2. Recover and reuse process chemicals wherever possible. Like recovery of caustic soda from mercerizing wash waters.

Input material changes / substitution

1. Substitute toxic chemicals with lesser toxic/non toxic chemicals in sulphur black dyeing process, e.g. glucose (instead of sodium sulphide) and sodium perborate or hydrogen peroxide (instead of dichromate) can be used in the above process. However use of glucose results in increased BOD_5 in the waste waters.
2. Change the class of dye used and improving the fixation efficiency of dyes may reduce the problem of removing dye from wastewater, e.g. Aniline black dyes can be substituted with sulphur dyes.
3. Use process chemicals, which give a better product quality and less polluting, e.g. substitute chlorine, sulphur bleaching by peroxide bleaching, this provides even, long lasting brightness.
4. Air emissions can be reduced by using non formaldehyde releasing chemicals in finishing operation. Like *N*-methylol compounds can be substituted by polycarboxylic acid.

Process and equipment modification

1. Combining operations help in reducing the process chemicals and time. e.g. process like dyeing and finishing, scouring and desizing can be combined.
2. Maintain low liquor ratios, e.g. Jet dyeing machines can be operated at 1:3 up to 1:6. Thus, the dyeing operation consumes less water and chemicals, and generates less effluent. Since the dyeing process depends on dye concentration, the lower liquor ratio increases the dyeing rate and dye fixation.
3. Match process variables to type and weight of fabric, this reduces wastes by 10 to 20%.

End of Pipe Treatment (EOP) /Pollution Control Measures[47]

Air Emissions: Scrubbers, adsorbers using activated carbon and routing the vapours through combustion system are some common EOP treatment options for VOCs emissions.

Wastewater: The EOP treatment of wastewater consists of screening, equalisation, sedimentation followed by biological treatment. Further treatment can be provided if further BOD_5 reduction is required by extended aeration (e.g. oxidation ponds). Carbon adsorption is can be used to enhance colour removal. Upto 90% recovery of size is feasible by partial recycling of prewash and additional ultra filtration of diluted wash water.

[47] Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997.

Solid and Hazardous waste: Residues and sludges often contain toxic organic chemicals and metals. These should be disposed in a secured landfill. Sludges containing halogenated organics and other toxic organics should be treated (e.g. incineration) before disposal of the residue in a secure landfill.

Useful References for Further Readings

1. European Bank for Reconstruction and Development, Sub-sectoral Environmental Guidelines; Textile Manufacture, Source: http://www.ebrd.com/enviro/index.htm
2. Pollution Prevention and Abatement Handbook, Toward Cleaner Production; The World Bank Group, 1997 Source: http://wbln0018.worldbank.org/essd/essd.nsf/GlobalView/PPAH/$File/55dairy.pdf
3. EPA Office of Compliance Sector Notebook Project: Profile of the Textile Industry Source: http://www.epa.gov/compliance/resources/publications/assistance/sectors/notebooks/#industry
4. Best Available Techniques for the Textiles Industry, Integrated Pollution Prevention and Control (IPPC) European IPPC Bureau. February 2001. Source: http://eippcb.jrc.es/pages/FActivities.htm
5. Cleaner Production Guidance Manuals, SEAM, Egypt, Source: http://www.seamegypt.com/Manuals/TextileSectorReport/content.htm