INDUSTRIAL WASTE MANAGEMENT : A STUDY OF PUBLIC ENTERPRISES

BY
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Declaration

The material embodied in this thesis is original and has not been submitted in part or full for any other diploma or degree of any university.

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There is a common saying that 'industrial waste' pollutes the environment. In a 'Modern Industrial System' industrial waste is not discarded as complete garbage, because ideal entrepreneurs do produce special goods by 're-cycling' the wastes. This not only saves the environment from pollution but also helps the economic development of the country. Pollution of environment caused by industrialization needs to be minimized by the co-operation and control of the Department of Environment (DoE) along with entrepreneurs. There needs to be a common rule to the effect that any industry found responsible for environment to the extent it generates pollution will create understanding about social obligation as far as consideration of pollution is concerned. Waste Management depends more on execution of rules and regulations than on speeches, rhetorics and public notice.

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If all these aspects are considered, 'Industrial Waste Management' may be said to constitute an important subject of public and private enterprises. At first we should consider the public enterprises of Bangladesh. Most of the large-scale industries are still state owned. The quantity of materials lost in production process in public enterprises also focuses on the realization of the importance of this matter. On the other hand worldwide movement against environment pollution is gaining momentum.

In Bangladesh research conducted on 'environment' is scanty; there is no extensive research on 'industrial waste management'. For this reason

specific data are not available on this subject. This vacuum has prompted me to undertake research on 'industrial waste management'. Although there are many limitations we can safely contend that the study offers a few guidelines about 'industrial waste management'.

I under take all responsibility for any incorrect innovation, data and facts. I am indebted to all those who helped me with their advice and co-operation and supplied me with relevant data. Dr. Mrs. Shahnaz Khan, my supervisor, advised me with guidelines for the completion of this study. For this reason I am extremely grateful to Dr. Mrs. Shahnaz Khan. Professor Md. Assaduzzaman my co-supervisor has also guided and helped me much. I am grateful to him. The successful completion of this study would not have been realized without the co-operation of some helping hands in Dhaka and Chittagong. I gratefully acknowledge the assistance of the officers, staff and workers of Chittagong Steel Mills Limited, Triple Super Phosphate Complex Limited (TSP) and Amin Jute Mills Limited. I would also like to acknowledge the support provided by the staff of Dhaka University and the 'Department of Environment' in Chittagong. Finally I owe special thanks to Abdullah Al Masud, Abdul Hamid, Kazi Fakrul Islam, Masud Helal, Md. Alamgir, Abu Taher and others.

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ABSTRACT

Industrial Waste Management is most important for industries as appropriate use of waste is not possible without the study of waste management. In developed countries there has been an extensive study on waste management. Many environmentalists believe that industry and technology are the enemies of environment. But recently in the United Kingdom and the United States of America some studies proved that technology is not always the adversaries. Because if emitted waste could be re-cycled then it would be an alternative way for economic development. Recycling of waste in Bangladesh is also an important subject for the study. Importance of waste management is increasing day by day for mitigation of environment pollution in Bangladesh. The study has identified that emitted wastes of the industries are polluting the environment. We need to study how these pollutions are occurring. The identification and solution of this problem is the main object of the study. The study has identified that there is no conception about industrial waste management in the industries of Bangladesh. There is also no distinctive department for waste management. So it is not possible to appropriately collect, recycle and dispose of waste as well as identify the bad effects and minimization of the bad effects of waste. If there is a distinctive department on waste management in the industries than it will be possible to solve the various problems. The study further identified some specific views on an appropriate waste management system of the industries. However the findings showed that there is no appropriate nature of waste management. It simply involves disposal of the waste. This is administered by general management.

The emitted wastes of the industries are pollute the environment severely. Executives, officers, workers and neighbors of industries have no proper idea about the problems. The role of Department of Environment (DoE) is also limited. So it is not possible to mitigate the pollution of environment by existing methods. The study also enabled us to know the bed effects of used chemicals in the production process. But we could not know the quantity of bad effects on the environment which would help us to indicate a guideline for its minimization. Nonetheless the validity of data about bad effects and minimization of waste has been ensured. In conclusion it was proved that the main reason of environment pollution is the absence of proper idea and distinctive department for waste management. The present study has given few guidelines regarding these problems and options to support extensive research on industrial waste management. For industrial waste management is associated with reducing the process loss of raw materials at production process, re-use and re-cycling of wastes, appropriate disposal of wastes, identifying the bad effects of waste on environment and minimization of bad effects. Establishment of a distinctive waste management department at all middle and large scale industries is necessary. Regular observation and monitoring system by the DoE is imperative. The management pattern of industries is traditional and defective. Introduction of industrial waste management system calls for restructuring the total management system. The study has also pointed out that what is urgently needed is to create consciousness among officers, workers and neighbors of industries about 'Waste Management and Environment' through discussions, seminars, symposiums in industrial enterprises and also at the national level.

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LIST OF TABLES / DIAGRAMS

ABBREVIATIONS CHART

BOD = Biological Oxygen Demand

CBA = Cost Benefit Analysis

CBC = Carpet Backing Cloth

COM = Commercial

CoPA = Control of Pollution Act

CUFL = Chittagong Urea Fertilizer Limited

DoE = Department of Environment

EA = Environmental Assessment

EDF = Environmental Defense Fund

EEC = European Economic Community

eg. = for example

EIS = Environmental Impact Statement

EMP = Environmental Management Plan

EPA = Environmental Protection Act

ES = Environmental Statements

ETP = Effluent Treatment Plant

GM = General Manager

IEE = Initial Environmental Examination

IfOR = Institute for Oklogisches Recycling

Inst. = Instrumental

KPM = Karnaphuli Paper Mills

KRC = Karnaphuli Rayon Complex

LDC = London Dumping Convention

Ltd. = Limited

MKT = Marketing

MoEF = Ministry of Environment and Forest

NEMAP = National Environment Management Action Plan

NOC = No Objection Certificate

OECD = Organization for Economic Co-operation and Development.

PAN = Peroxyacetal Nitrate

FARM = Fibrous Agricultural Raw Materials

PICs = Products of Incomplete Combustion

R&QC = Research & Quality Control

RA = Risk Assessment

SSP = Single Super Phosphate

TSP = Triple Super Phosphate

UK = United Kingdom

UNCED = United Nations Conference on Environment and Development

US = United States

CHAPTER-I
INTRODUCTION

1.1. Significance of the Study:

The importance of the study of 'Industrial Waste Management' can hardly be over emphasized. Appropriate use of waste is not possible without the study of Waste Management. In developed countries there has been an extensive study on Waste Management. We may cite examples from developed countries to understand the significance of Waste Management in Bangladesh.

Many environmentalists in foreign countries believe that industry and technology are the enemies of environment. There appears to be much evidence to support this view. According to UK environmentalists, "this century, over 90% of our wetlands have disappeared, 75% of turtle doves we sing about at Christmas and almost 50% of our skylarks and black birds have been lost because of intensive agriculture and urbanization". (Gallagher; 1998:5). According to Gallagher, "environmentalists point to our continued wasteful use of materials, most of which are used once and then thrown away to be buried in holes in the ground. They see all this exacerbated by a world population forecast to grow to 12 billion by the middle of next century, creating the equivalent of a new China every 12 years and placing us unsustainable pressure on the planets resources". (Gallagher; 1998 : 5).

Faced with these gloomy prospects, environmentalists have called for

tough laws to prevent causing damage to the environment. In the UK, any one can go to jail for up to two years and there are unlimited fines in the crown courts for those guilty of disregarding their environmental responsibilities. The Environment Agency is often judged on the prosecutions that it brings rather than the environmental improvements that it achieves. It has been called 'toothless and weak' by one environmental group because it sent only four people to jail and prosecuted just 500 individuals or companies in its first year.

However, industry and technology are not always the adversaries. According to Ed Gallagher, "the largest flaw in the environmentalist argument that innovation and technology are harmful to the environment is the large number of 'win-win' situations in which the environment and industry can benefit. There are at least three ways in which industry can save or make money by taking full account of its environmental responsibilities and possibilities". (Gallagher; 1998 : 5).

First opportunities to save money were demonstrated very clearly in a study done on the Aire and Caulder rivers in 1992. Eleven firms worked with regulatory agencies and consultants to reduce their polluting loads to land, air and water by 25% and, at the same time, they saved themselves £ 3 million a year in operating costs. These savings were achieved in both the most modern and the more antiquated plants. The largest savings of almost £1 million were at an American soft drinks company at its most modern plant in Europe. Around two thirds of the projects had pay-back periods of less than nine months and many required little investment at all. Equally

impressive savings have been repeated in similar projects around the country in the North-West, in the Midlands, and in north-Wales. They are conclusive proof that investment in clean technology, waste minimization and energy efficiency benefits both the environment and industry.

The second opportunity is the growing market for reused and recycled products. A leading photocopies manufactures is marketing products made from recycled and reused components which sell at a 30% discount to products made from completely new materials, and is gaining market share. Markets for scrap metal are sufficiently buoyant to permit one metals recycler to invest in several millions of pounds of automatic equipment to separate ferrous and non-ferrous metals and to employ graduates learning Chinese and Japanese to help with the export effort. Some markets for re-cycled materials, such as recycled paper, are still highly erratic but it is surely only a matter of time before normal commodity market disciplines and more sophisticated trading techniques are brought to bear.

Third, there is a huge market for pollution control and abatement equipment and services. This market is estimated to be around £180 billion worldwide and growing fast. The UK has a trade surplus of around half a billion pounds in this market, dwarfed by the £ 17 billion surplus of the US and Japan. Nevertheless, this is a significant foothold from which further opportunities to make money can evolve.

Normal economic forces increase prices, as goods become scarcer when population increases. A new driving force for cleaner technologies, waste minimization and the re-use and recycling of materials will come from

changes in taxation. Political parties seem committed to reducing direct taxes on people and increasing taxes on materials and pollution. We have seen a start in the UK with the landfill tax. These new taxes could have a dramatic effect on their economy, which will benefit the far-sighted. Goods will need to be of higher quality and greater durability than those currently available, and will fuel service and accessory business employing people who are unable to find work in automated factories. These changes will undoubtedly put pressure on some industries. The second-rate-or even the average-company may not survive in some market segments as the overall demand for their products reduces. Only the best will remain. But there will be many new opportunities for new industries and new entrepreneurs to supply the needs of people living in the next century. It has always been so. Their economic system, which brought them the high standards of living that they enjoy, has never been static. The difference now is that the environment will play an increasingly large part in transforming industry and society within the lifetime of this and the next generation of business leaders.

Although studies on 'Industrial Waste Management' are scarce in Bangladesh, the above mentioned points are considered of importance in the situational context. In Bangladesh if particularly industrial waste is a standpoint as an appropriate management then our industrial waste can be produced by re-cycling. Foreign specialists have stressed re-use and re-cycling of waste. This technique may well be tried in Bangladesh. In a least developed country like Bangladesh re-cycling of wastes is extremely significant. Bangladesh imports raw materials from foreign countries which

involves huge foreign currency. Due to the absence of an appropriate management much waste remains unused. As such, the significance of waste management can hardly be over emphasized. Since there is inadequate research in this field it seems difficult to indicate which appropriate initiative can be taken with regard to the re-use and re-cycle of wastes.

Environment is important so far as waste is concerned. Since the world is stressing on environment, Bangladesh should also emphasize this dimension realizing it's global significance. As we do not know how we are responsible for environment pollution, we are worse sufferers than people of the developed countries. Bangladesh is characterized by tornado, floods, drought etc every year. So we need to emphasize on environment to save it from the bad effects of waste. We can also go for production of equipment or goods which help pollution control or abatement. By this type of initiative it is possible to save the environment from pollution and we can earn more foreign currency which would develop the economic condition of Bangladesh. For the above purposes we need to conduct extensive study in the area of industrial waste management.

1.2. Objectives of the Study:

The management of industrial wastes is not an easy task. It involves appropriate management for recycling and waste disposal. Mismanagement leads to effects on the quantity and quality of production as well as the environment. With this consideration in view the objectives

of this study will focus on the management of produced wastes, 'specially re-cycling, methods of disposal and treatment, identifications of bad effects and minimization of the bad effects of waste'. To attain these objectives, the study will delve into the following points -

1. The nature of industrial waste management:
    a) Location of the industries;
    b) Type of produced goods;
    c) Type of produced wastes;
    d) Organizational setting of the industries;
    e) Distinctive department on waste management;
    f) Waste re-cycling system;
    g) Waste disposal system and treatment plant;
2. The negative effects on the environment:
    a) Type of chemicals used in the production process;
    b) The effects of waste on land, agricultural production, water, air and human health.
3. The minimization of bad effects of waste: The study will address itself to the following questions:
    a) Have any specific directions or guidelines of the 'Department of Environment' on industrial waste management specially saved the environment from the bad effects of waste?
    b) What are the steps taken by the industrial authority for minimization of this problem?

c) What others measures can be taken for minimization of bad effects of waste?

4. To indicate some specific views on an appropriate waste management system from the findings of the study.

1.3. Methodology/Study Method:

The Study of Industrial waste management focuses not only on 'primary data' but also on 'secondary data'. Primary data collection is essential for this type of study, because we need an analysis from the collected data about the situation of industrial waste management in Bangladesh, the problems involved in this regard and the minimization of these problems. On the other hand we reviewed literature of industrial waste management for collection of secondary data. Secondary data help us analyze the previous research works and to identify the points which do not reflect established theoretical concepts. We shall try to see whether the industries covered in the study pertain to the theoretical framework of waste management discussed earlier. Based on this conception data collection methods used in the study are mentioned below: -

a) Selection of Field and Sample:

Three different industries - 1) Amin Jute Mills Limited of Bangladesh Jute Mills Corporation. 2) Chittagong Steel Mills Limited of Bangladesh Steel and Engineering Corporation. 3) Triple Super Phosphate (TSP) Complex Limited of Bangladesh Chemicals Corporation were selected for primary data collection. These industries are from three different corporations to

preserve the validity of data. In any research validity is the most important consideration. Validity is concerned with the soundness of data, and effectiveness of the measuring instruments. Validity raises questions like: What does the research intend to measure? How well and how comprehensively, how accurately does it measure? The selected three industries are situated at important places of Chittagong city which is the largest port and industrial city of Bangladesh. Amin Jute Mills is situated in the industrial area of Sholoshar. Chittagong Steel Mills and TSP Complex are situated in the largest industrial area of Patenga. The location of the industries will help to promote acceptance of data as one of the three industries is situated close to a residential area. The other industries are situated on the bank of the river Karnaphuli.

On the basis of 'Purposive Sampling Method' 88 persons of various groups like executives, unit principals, workers and neighbors were selected. In this method, certain units are selected purposively for judgement by the researchers. In this selection, the researchers try to make the selection as representative. The investigator selects the relevant and representative samples as far as possible. The investigator also ensures that the frequency and the distribution of the sample remain similar. However, if this method is seriously followed a small sample may even become highly representative. (Aminuzzaman; 1998).

Classification of Sample:

Table : 1

Name of sector Corporations	Name of Industries	Interviewee			
		Number of Executives	Number of Officers	Number of Workers	Number of Neighbors
Bangladesh Jute Mills Corporation	Amin Jute Mills Ltd.	1 Person	6 Persons	12 Persons	10 persons
Bangladesh Steel & Engineering Corporation	Chittagong Steel Mills Ltd.	1 Person	7 Persons	16 Persons	10 Persons
Bangladesh Chemicals Corporation	TSP Complex Ltd.	1 Person	4 Persons	10 Persons	10 Persons
	Total	3 Persons	17 Persons	38 Persons	30 Persons
	Grand Total	: 88 Persons			

b) Methods of Data Collection:

Data and information for social research are scattered all around. Data need to be conscientiously identified, carefully selected and methodically collected. Validity and objectivity of research to a great extent, depend on as to how the data have been gathered. For this study data has been collected from primary source on the basis of sampling. (Aminuzzaman; 1991). Three methods were used: questionnaire, interview and observation. Data collected from the managers and officers of all the three industries were based on a questionnaire; schedule type interview was also used. Data were collected for stability and personal opinion from workers and

neighbors by interview method. On the other hand, observation method was used to assess the real situation by directly observing. We observed production process and waste management of all three industries. Although Chittagong Steel Mills was partially in production process it was in running condition with full manpower and administration, so no question can arise as to the validity of data.

1.4. Limitation of the Study:

This study gives only a general impression about industrial waste management in three public enterprises in Bangladesh. The study was done in a period of a little over a year -- a period of observation that cannot allow any researcher working in this field to give a detailed analysis of the complex subject like industrial waste management in Bangladesh.

I myself faced some limitations in the study due to the absence of appropriate research on industrial waste management in Bangladesh. For this reason secondary data was hardly available. Non-availability of data rendered it difficult for me to make an in-depth study. However, secondary data from the study of developed countries provided guidelines for the research.

Another important side of waste management is re-use and re-cycling. We tried to see whether re-cycling options in the industries were present. But we could not identify how specific goods were produced from specific waste.

The study enabled us to know the bad effects of used chemicals in the production process. But we could not know the quantity of bad effects on the environment which would help us to indicate a guideline for its minimization. Nonetheless the validity of data about bad effects and minimization of waste has been ensured.

CHAPTER-II

THEORETICAL FRAMEWORK

No theoretical base has yet developed regarding industrial waste management in Bangladesh. Very little progress has been made in this area. This awareness is mainly concentrated on environment. It is limited to comments on newspapers only. Common discussions cannot give us proper ideas about the pollution of environment. It also fails to give us any information about the disposal of industrial waste.

Bangladesh is a disaster prone country. Natural calamity is a common incident of Bangladesh. Although Bangladesh is an economic promising country, natural calamity hinders this economic progress. Because its economy depends on nature. The study of environment is necessary. From the Environment point of view the study of industrial waste is also important. Proper management of industrial waste is essential as industrials waste affects environment. Due to non-availability of literature regarding waste management in Bangladesh context we will discuss the available literature in developed countries. Literature of industrial waste management can be reviewed in two ways: (1) the issues relating to waste management to which researchers have given priority. In this way we can present the study of all researchers differently, (2) to set objectives of the study and to focus how the researchers comment on it. In this study the second way will be followed as in this way we will find fruitful direction from the literature review of waste management. On the other hand we will

try to analyze whether the same condition is available in the concerned industries of the study or not. It will therefore be easier to ascertain decisions regarding issues which should be included in the waste management system of the concerned industries of Bangladesh.

The literature review of industrial waste management will focus on the following concepts of 'industrial waste management' - industry, management, waste, waste management, waste recycling, methods of waste disposal and treatment, and environmental impact assessment.

Industry: According to the 'Chambers 20th Century Dictionary' industry is an "economic activity, any branch of manufacture and trade" (Patrick; 1993:642). It means production oriented business, industry whether government or private Organization. We are primarily concerned with only field of the manufacturing industries, or "industrial enterprise" as it is commonly called. Guided by management, an industrial enterprise combines land, worker and capital in variable proportions to make a producing unit turning out tangible goods. The term "land" covers not only "standing room", i.e. physical location of industrial plant, but also natural resources (natural raw materials), character of the soil, rainfall, temperature, the earth's waters, and other features associated with land. "Worker" includes brainwork, manual work, and all the characteristics of individuals engaged in personal services. "Capital" refers chiefly to buildings, tools, machines, equipment and materials, produced by man and used in further production. In common use, capital often lumps together

land, money, buildings, equipment, and materials, as being the total investment in an industrial enterprise.

The essence of industrial production is the transformation by factory methods of raw materials into things wanted by society. Industries are divided into broad classes according to the nature of the industry, the use made of the product, and the amount of service obtained from the product before it is consumed or becomes unfit for further use. Thus, industries which manufacture materials, tools, machines, and equipment for use in the operations of other factories are producer-goods industries. Those which turn out products intended for direct use of the people in daily living are consumer-goods industries. Each is further classified as durable-goods, non-durable goods, and semi-durable goods industries. A durable item, like a dynamo, an automobile, or a watch, provides service over a long period of time. Non-durable goods, like industrial catalysts or fuel, are used up in one or a few operations. The semi-durable goods fall in between. The type of goods produced is especially important to management. Within the field of industrial enterprise we see hundreds of thousands of producing units at work. These units vary inform of ownership and in the way they are organized for operation. A knowledge of this basic industrial structure is essential to successful management of an enterprise, because it largely determines the conditions of production. (Bethel; 1971).

Management:

According to 'The Oxford English Dictionary' management means, "to control the course of affairs by ones own action".

A careful examination of the writings of management scholars and practicing managers reveals a number of definitions of management. While some give lengthy definitions, others simply define it as the process of getting things done through people. For our purposes, we will define management as the process of integrating resources and tasks toward the achievement of stated organizational goals.

Managers - those who practice management - are responsible for giving directions to the organizations they manage. They must translate organizational goals into unit objectives, organize resources (people, finances, and equipment) in a manner to achieve results, and see to it that the stated goals are met.

Although this definition may be simple, the manager's job rarely is, because problems must be faced continually, and new, different situations crop up constantly. Equipment shortages, employee motivation problems, rising costs, consumer and community reactions, and the like confront managers daily. Getting everything to work smoothly is the challenge that makes management such an interesting field. Management is concerned with resources, tasks, and goals. More importantly, however, management involves a process; in other words, a systematic and organized way of doing things. All managers, regardless of their particular organizational affiliations, engage in a systematic, interrelated set of activities designed to achieve an objective. Understanding this process is the key to successful management.

We can identify the major managerial activities that are important for our discussion. First, managers focus on deciding what to do. This involves establishing the framework for performance, or planning the work to be done. Second, managers decide how to do it; in other words, organizing to establish order and function and to design their unit to achieve the stated goals. At this stage, the production manager focuses on selecting people to make up the team; training them to do their respective jobs; establishing authority, responsibility, and accountability relationships; and acquiring and allocating the necessary financial and physical resources. Third, a concern for directing performance becomes dominant. In essence, the focus is on leading employees in the most effective manner possible. Fourth, managers become involved in evaluating performance. This is the control function, which, for the Industry Manager, involves evaluating individual and group performance, examining financial indicators of effectiveness and efficiency, and investigating any problems that may have developed in communication, resource allocation, and interpersonal relationships. Finally, the manager looks at what needs to be changed. This emphasis on adaptability concerns evaluating all previous activities, - plans, goals, employee selection and training, motivation, group behavior, and control systems - to determine what factors or activities may or may not need change so that goals are achieved.

It should be pointed out that the four activities of planning, organizing, leading, and controlling - what we will term the management functions - are unique activities. The change component, however, generally occurs

within each of the four management functions and is not considered as a separate activity. (Szilagyi Jr; 1984).

Waste:

According to the 'Oxford Advanced Learners Dictionary of Current English' waste means "waste products, unwanted after a manufacturing process". (Oxford; 1974:967). Industries discard some materials as process loss after producing goods from raw materials. Sometimes these discarded materials are converted into products or by-products through re-cycling. But when it is treated as reject material then it is complete or non-usable waste.

In the United Kingdom, the legal definition of waste is as given in Section 75 of the 'Environmental Protection Act' 1990 as :(a) any substance which constitutes a scrap material or other unwanted surplus substance arising from the application of any process; and (b) any substance or article which requires to be disposed of as being broken, worn out, contained or otherwise spoiled. Any thing which is discarded or otherwise dealt with as if it were waste shall be presumed to be waste unless the contrary is proved. (Petts & Eduljee; 1994:6).

In the UK waste management involves the disposal of three distinct forms of waste: a) municipal b) hazardous c) radioactive. Hazardous wastes can originate from the household but most come from the industrial sector. They are defined as wastes which cause harm because they are toxic, corrosive, flame-able, explosive, reactive or pathological. (Smith; 1993). In

practice, social priorities, public perceptions, and legal practicalities, have led to selectivity of regulatory control over wastes in most countries (Wynne, 1987). In the UK, 'controlled waste' is defined for the purposes of the 'Environmental Protection Act' (EPA) 1990 as comprising household, industrial and commercial waste, based on the source of the waste arising. (Petts & Eduljee; 1994). Many everyday commodities are the result of complex industrial processes producing wastes which can contain substances which are dangerous to life. These wastes are classed as special wastes in the UK. (Brown ; 1992). Industrial waste arising from a major proportion of wastes regulated by 'Control of Pollution Act' (CoPA) account for 17 per cent of waste arising. Industrial waste includes power station wastes and blast furnace and steel slag which together amount to 19 million tons annually (5 per sent of total arising). A further 50 million tons a year (12 per cent) is generated by a wide variety of industrial activities and includes such substances as residues from food manufacture, horticulture, containers and packaging. (Brown; 1992:156).

Waste Management:

The management of wastes at all stages of production, handling, storage, transport, processing, treatment, and ultimate disposal, is a relatively recent social and political imperative. In little more than two decades most developed countries have advanced from an ethos of removing waste from the point of arising and depositing it in the most expedient and economical alternative location, to the control of waste production, provision of

appropriate treatment options and the engineering of final land disposal, so as to minimize environmental impact and maximize resource recovery. The optimum provision, assessment, siting, and control, of waste management facilities to achieve the developing objectives of environmental protection constitutes a continuing regulatory, professional, and social challenge in the 1990s. (Petts & Eduljee; 1994).

In many nations, waste management has emerged as a dominant environmental issue at an operational planning level. It is a problem that features a high degree of public attention to site-specific, community-based environmental protection issues focused on the practice of land-filling, alternatives to land-filling and the special problems associated with disposing of hazardous and radioactive wastes. It also is a problem that is continuing to grow in its severity and its impact. For example, the US 'Environmental Protection Agency' (EPA) alone presently spends in excess of $1.4 billion annually on the problem of solid waste disposal. (Smith; 1993).

Waste management represents a new challenge for environmental protection. Meeting that challenge requires a reconsideration of approaches to planning in the resolution of waste management problems and a re-evaluation of traditional applications of impact assessment to the problems of pollution control. In particular, waste management poses the following questions for impact assessment at an operational planning level:

a) Problem identification:
    i) How tractable is the problem?

ii) How have issues of risk and uncertainty been assessed?

b) Impact assessment:

i) What waste management facilities are required?

ii) How should they be located?

iii) What provisions are required for mitigation and monitoring?

c) Interest representation:

i) Who are the affected stakeholders?

ii) How should their concerns be address?

iii) How can issues of conflict and mistrust be resolved?

The central issues facing impact assessment for waste management relate to:

a) The determination of what facilities and/or actives are required

b) Facility siting and location

c) The mitigation of impacts

d) The monitoring of effects.

Certainly within waste management there are significant benefits that could be derived from initiating effects monitoring and public concerns monitoring at the scooping stage and surveillance monitoring to accompany the implementation and operation of a waste management strategy:

a) Effects monitoring would assist in the determination of risk and the evaluation of alternative management options.

b) Public concerns monitoring would enable the incorporation of the political dimension of the siting process with the phased analysis of environmental suitability.

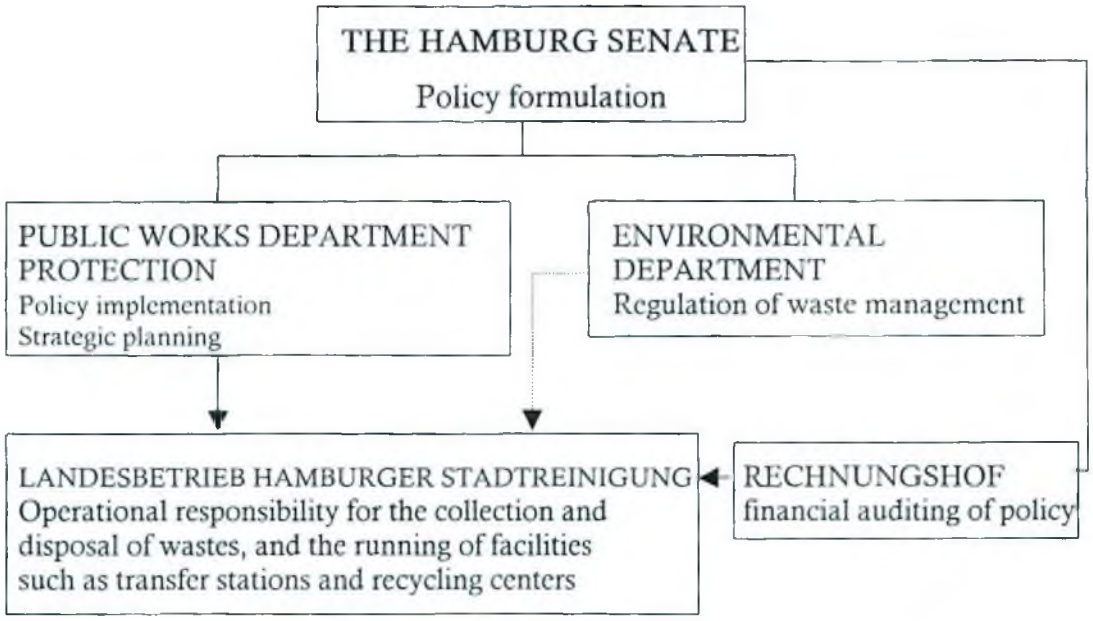
c) Surveillance monitoring would assist in screening for cumulative effects and the ultimate public assurance of risk reduction.

The experience with waste management indicates a number of areas where impact assessment can be strengthened at an operational planning level. The approach to impact assessment itself needs to become more overtly political. Moreover, as this occurs, the process of planning must be adjusted throughout the various stages of impact assessment. (Smith; 1993).

Prominent researcher Matthew Gandy has presented an organizational structure on the waste management of Hamburg. This organizational structure is important for the study:

The organizational structure of waste management in Hamburg

Figure : 1



Source : Freie and Hansestadt Hamburg (1989) citied in Gandy (1993).

The core of German waste management policy is contained within the '1972 Waste Management Act' and with the exception of provisions for nuclear waste, the obligations for waste management are handled by regional and local government in Germany. In the city based Lander, such as Hamburg and Bremen, the responsibility for both waste collection and waste disposal is passed to the city Senate (Kromarek, 1986). Under the fourth amendment to the 1972 Waste Management Act, which came into force in November 1986, there is now a focus on recycling and waste reduction as an integral element in waste management (Hedlund, 1988).

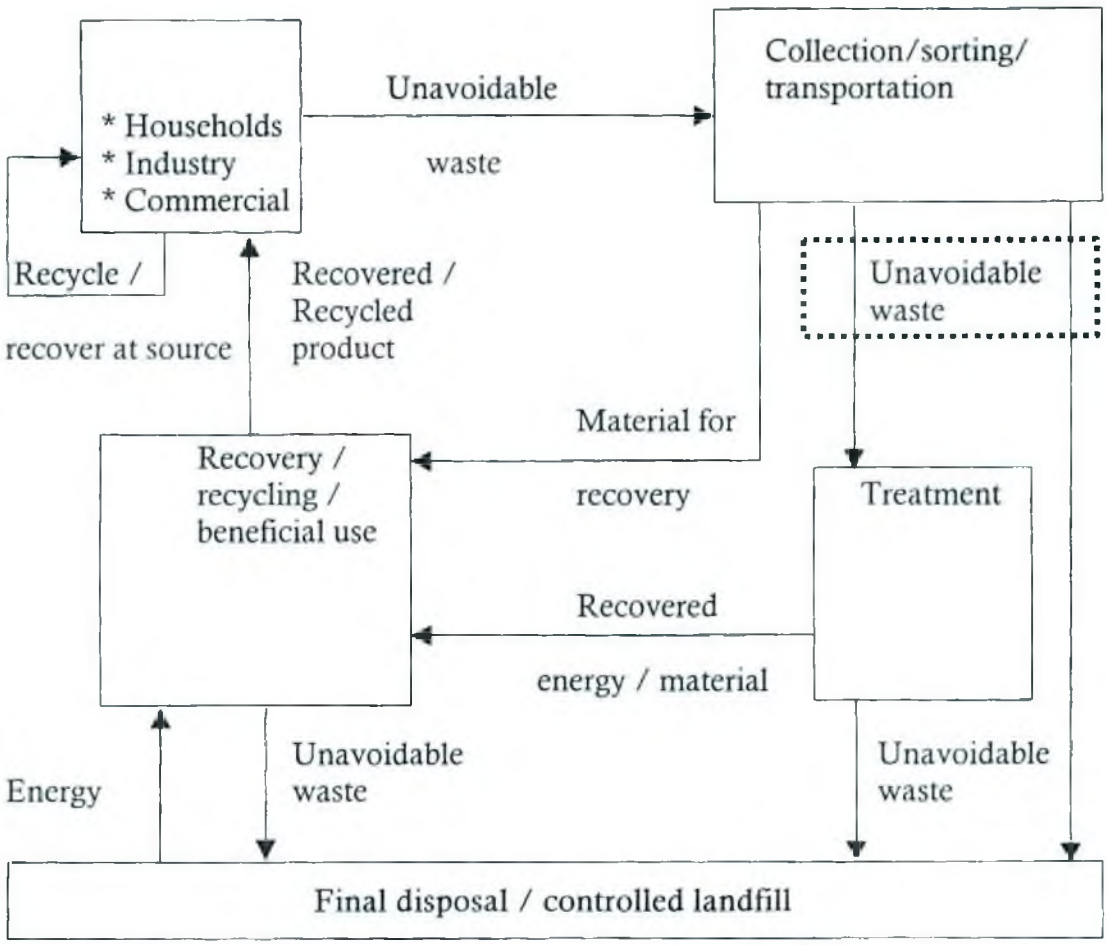
Other important legislative developments include the TA Abfall technical regulations for waste management initiated in 1984, concerning higher environmental standards in waste disposal with a particular emphasis on incineration emissions and the more recent legislative controls on packaging introduced in June 1991. (Cited in Gandy; 1993).

The city of Hamburg carries out the collection and disposal of all its municipal waste. Figure 1 shows that the planning and client side of waste management is the responsibility of the city's public works department, the Baubehorde, and the operational side of waste management is handled by its former department, now the Landesbetrieb Hamburger Stadtreinigung. The public works department is one of eleven different departments, and the environmental regulation of waste management activities is handled separately by the environment department, the Umweltbehorde. The city's environment department is, for example, responsible for monitoring the problems of contaminated ground and surface water, and the emissions of noxious gas from former landfill sites. In addition to the environmental regulation of waste management, there is also an independent financial auditing office within the Senate called the Rechnungshof, as shown in Figure 1. (Gandy; 1993).

Petts and Eduljee have pointed out a waste management cycle in their research work. We can use this cycle to serve the research purpose:

The waste management cycle:

Figure : 2



Source : Petts & Eduljee (1994)

The framework for waste management introduces, with emphasis on three elements: (i) the formulation of policy, (ii) the regulatory and control regime, and (iii) the availability of appropriate treatment and disposal techniques and facilities in order to implement the selected waste

management route for a particular waste stream. This route is determined after consideration of the following hierarchy of options :

- Waste reduction at source.
- Waste recycling and re-use.
- Recovery of raw materials and / or of energy.
- Treatment of wastes.
- Disposal of the residues from treatment, and of other unavoidable waste.

A generalized waste management cycle can be depicted, as in Figure 2, indicating the interaction between the various options. The cycle commences with the generation of waste by industry, households, commercial premises, etc. Following the above hierarchy, the first priority is for these generators to reduce waste generation at source, and to implement appropriate segregation and recycling policies. Unavoidable waste is then packaged, collected and transported either to interim storage facilities (e.g. transfer stations or civic amenity sites where further sorting of materials for recovery or recycling is possible) or directly for recovery, treatment or disposal. The treatment of wastes serves two purposes : (i) the recovery of materials and / or the energy content of the wastes, and (ii) the conversion of wastes to a form that permits its ultimate disposal in a safe and responsible manner. Even at the point of final disposal the objective should be to continue to utilize any inherent characteristics of the waste to optimize reduction of its polluting potential and to extract the latent by-products.

Throughout these stages a single waste stream may change composition, form, concentration, ownership, location (including beyond national boundaries) and control. 'Environmental Assessment' can be used both to assess the complete waste management cycle as an integrated entity (in order to identify the combination of options that causes the least impact on the environment), and to assess the efficacy of selected elements of the waste management cycle. in particular, the focus is upon the following components of the waste management cycle, after wastes have been mixed, packaged, stored and collected from the point of generation:

- Transportation of wastes to a treatment facility.
- Reception, acceptances and storage at the facility.
- Treatment of wastes to convert them into a form suitable for safe disposal.
- Transportation of treated wastes to the final disposal site.
- Reception, acceptance and deposition at the final disposal site.

As indicated in Figure 2 this sequence of actions can be shortened by circumventing the treatment stage prior to final disposal of the wastes. This will apply, for example, in the case of municipal wastes destined for direct landfill, or for wastes that are treated in-house, the residues of which are then transported directly to a land-fill. (Petts & Eduljec; 1994 : 20).

Waste Recycling:

The study of waste is a neglected area within the social sciences though waste management issues have been extensively examined within other disciplines, particularly engineering. At an early stage in his study Gandy decided that a survey of the users of recycling facilities to examinee their motivations and patterns of participation would not be a very fruitful exercise, since this has already been extensively carried out (Coggins et al., 1989a, 1989b; Hay et al., 1990; Vining and Ebreo, 1990). Another heavily trodden path in waste management and recycling research is the technical and economic appraisal of different policy options (Ball, 1988; Barton, 1989; Organization for Economic Co-operation and Development (OCED), 1983; Pearce and Walter, 1977; Pieters and Verhallen,1986; Turner and Thomas, 1982).(Cited in Gandy; 1993).

Many researchers have conducted studies on the topic of waste recycling. They have discussed elaborately various aspect of waste recycling. Gandy has represented the most important of these studies in a table, presented below.

The objectives of recycling policy in developed economies :

Table : 2

Environmental Objectives	Key Proponents
Integral part of 'steady state' or sustainable economies	Daly (1977)
Reduced energy consumption in the production process	Chapman (1974); Schertz (1984)
Reduced pollution emissions in the production process and from the disposal of waste	IfoR (1988; 1989)
Environmental education benefits	Castle (1986)
Economic Objectives	Key Proponents
Regeneration of urban economies	Elkin and MoClaren (1990)
Reduced expenditure on waste disposal	EDF (1987); Pollock (1987)
Income for charities and local authorities from the state of materials	Castle (1986)
Reduced balances of payments deficit in raw materials	Chandler (1983); Dyson (1974)
Geo-political resource security against producer cartels	Hayes (1978); Risch (1978)
Social Objectives	Key Proponents
Employment creation in economically depressed areas	Vogler (1981); SPD(1986)
Promotion of 'soft' technologies and decentralized forms of social and economic organization	Hahn (1991)
Employment creation for the long-term unemployed and for handicapped persons	Turner and Thomas (1982)
The fostering of positive 'social norms' in the community.	Vining and Ebreo (1990)

Source : Gandy (1992a)

There are a variety of environmental justifications for recycling which can be found in the literature : the conversation of finite resources as a move towards 'steady state' or sustainable economies (Daly; 1977; Hayes; 1978; Schumacher, 1974; Thomas, 1979, 1984; Young, 1991); the reduction of energy consumption in production (Castle, 1986; Cointreau et al., 1984; Lindberg and Akagi, 1974); the limiting of pollution emissions involved in the production process, and in the disposal of waste (IfoR, 1988); and the environmental education benefits of participation in recycling (Castle, 1986;Greater London Council (GLC), 1986b). The relative importance of these different environmental objectives also varies : the saving of energy is usually seen as paramount over the recovery of materials, if these is to be a trade-off between the two goals (Boustead and Hancock, 1984; Schertz, 1984). Furthermore, the recycling of different components form the waste stream has a differential environmental impact depending on which materials from the focus of recycling policy. Global environmental features widely within the rationale for promoting recycling at local, national, and international levels. It is of interest, that most of these potential environmental benefits relate to global or regional problems such as the reduction of greenhouse gas emissions from the production process and landfill sites, yet the location and operation of recycling facilities also have a local environmental impact, suggesting that comprehensive recycling programs may involve a trade-off between local and global environmental objectives. (Cited in Gandy; 1993).

A number of economic arguments can also be found in the literature, particularly the claim that recycling may reduce of the costs of waste

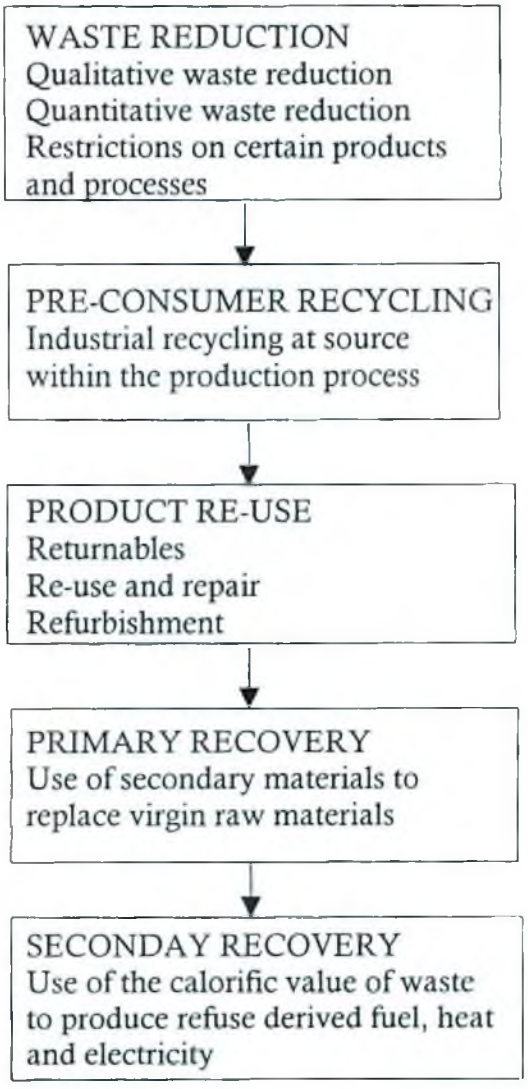
disposal for urban areas which face fewer cheap landfill opportunities (Environmental Defense Fund (EDF), 1987; McClaren, 1992; Pollock, 1987). The income derived from the sale of materials is also seen as a useful additional source of income for local government, voluntary organizations and others involved in recycling activities (Castle, 1986). A number of other macro-economic benefits can be found in the literature : the reduced balance of payments deficit in raw materials (Butlin, 1977; Chandler, 1983; Cointreau et al., 1984); and increased geo-political resource security against producer cartels, which was a frequent argument in the literature of the 1970s (Hayes, 1978; Risch, 1978). A further consideration is the global impact of western resource use on the Third World and the connection between equity in resource management and economic development. (Gandy; 1993).

A frequent social justification for recycling is the potential job creation, especially for depressed areas with high unemployment (Chandler, 1983; EDF, 1987; Jacobs, 1969; Letcher and Sheil, 1986; Vogler et al., 1981). The employment potential of recycling depends on the nature of the scheme adopted, with the highest employment associated with low technology community-based schemes: it has been estimated that for every 600 tons of waste, one job is created by recycling (Quigley, 1987 quoted in EDF, 1987) compared with 0.4 jobs if the waste is sent to landfill (Rockefeller Institute, 1986). Examples include the advocacy of community based industries for paper making in preference to the capital intensive paper industry (Sweetman, 1979) and similar arguments have been made for small-scale glass making (Vogler, 1980). Job creation has also formed part of most

alternative 'ecologically' oriented waste management strategies, and is a key element in the environmental Keynesianism associated with the red/green arguments of the mid-1980's. (Gandy; 1993).

The hierarchy of recycling options :

Figure : 3



Source : IfoR (1988) and Porteus (1987) citied in Gandy (1993).

The first step within the hierarchy of options is waste minimization and waste prevention in the production process and this is seen as integral to alternative 'ecologically' based waste management strategies. Waste reduction can either refer to a reduction in the toxicity of waste (qualitative waste reduction) or to a reduction in the quantity of waste produced (quantitative waste reduction). The Berlin based Institute for Ecological Recycling (IfoR) claim that some 90 per cent of pollution results from the production process, and not in the eventual disposal of products. From this perspective, the recycling of materials and also the reduction of waste volume and weight through incineration cannot properly be referred to as waste prevention.

The second step, where the production of wastes is unavoidable, is their re-use within the production process itself. This is easier than post-consumer recycling, since uncontaminated and economically handle-able quantities of waste are in proximity to industry as potential new raw materials. Indeed, some items sold as recycled products are made in just such a way, and contain no post-consumer waste, whereas in other cases there may be a mixture of pre-and post-consumer wastes which have been recycled. The economic and logistical advantages of recycling within the production process are reflected of similar materials from the municipal waste stream.

The third stage, is the re-use and repair of products to prolong their usefulness before entering the waste stream, including the use of returnable beverage containers and the elimination of built-in obsolescence in consumer durable. In the case of returnable, which have been widely

argued for by environmental groups, there is debate over the trade-off in overall objectives between energy saving in their cleaning and transportation in comparison with the manufacture of new containers. The political aspects of pursuing different options within the recycling hierarchy is an important issue, since product recycling and the mandatory use of returnable is strongly opposed by the private sector, as being incompatible with the principles of a free market economy.

The fourth stage is the primary reclamation of materials to create new raw materials. This forms the one focus of this study and of contemporary recycling policies within OECD nations and includes a variety of measures, such as the collection of waste paper and glass cullet, the magnetic separation of ferrous scrap at some incineration plants and waste transfer stations, and the production of compost from putrescible waste. The primary recovery of materials can be carried out by three main methods. It is useful to distinguish between : 'collect' or kerbside schemes; 'bring' systems based around the use of on-street collections facilities such as bottle banks and recycling centers; and centralized sorting plants, which have sometimes been linked with the production or refuse derived fuel (RDF) or other secondary recovery technologies. These three organizational approaches ('bring', 'collect', and centralized sorting) differ in the levels of public participation required; the extent and nature of the costs incurred; the potential levels of materials recovery which can be attained; technical and logistical difficulties in their implementation; and the relative role of 'hard' and 'soft' technologies.

The fifth stage is the recovery of energy from the caloric value of materials. This includes the production of refuse derived fuel (RDF); the use of incineration plants integrated into combined heat and power systems (CHP); the recovery of landfill gas as a fuel source; and high temperature pyrolysis of tiers and plastics. The secondary recovery option of incineration is highly contentious is terms of its legitimacy as a form of recycling and is widely criticized from within the environmental movement because of emissions and residual ash concerns. (Gandy : 1993:45).

Matthew Gandy has mentioned a few important steps of recycling which are significant aspect of waste management:

- The need for one government department to overcome the split of responsibility between the 'Department of Energy', the 'Department of Environment' and the 'Department of Trade and Industry';
- The appointment of a minister for recycling;
- The relaxation of capital controls and provision of financial assistance to the funding of recycling facilities;
- The need for government funding for community recycling initiatives and employment generation;
- National level co-ordination between local authorities and the recycling industry;

- The introduction of a national policy with clear recycling targets;
- The use of fiscal measures such as 'green taxes' on non-recyclable products;
- The extension of the 'polluter pays principle' to waste producers;
- Financial support for the high running costs of kerbside collection schemes;
- The creation of markets for recycled products, including the use of public purchasing policy. (Gandy; 1993 : 103).

Methods of Waste Disposal and Treatment :

For the save of environment waste disposal and treatment is an important area of industrial waste management Petts & Eduljee have discussed elaborately:

Number of licensed waste disposal and treatment facilities in the UK-1991[1]

Table : 3

	No.	%
Landfills	4196	63
Civil amenity[1]	559	8
Transfer stations[2]	936	14
Storage [3]	274	4
Treatment[4]	122	2
Incineration[5]	212	2
Miscellaneous[6]	366	7
	6665	100

Source : Department of Environment cited in Petts & Eduljee (1994).

The cornerstone of any waste management framework is the provision of appropriate treatment and disposal facilities which can provide the best environmental option for the handling of different waste streams in the optimum location relative to the source of arisings. The numbers and types of licensed facilities in the UK are given in Table 3. In the UK, the predominant disposal route for controlled wastes is handling (85%), followed by incineration and sea dumping at 4% respectively. Other miscellaneous, disposal routes account for the remaining 7% of controlled wastes. For 'special' wastes, 70% go directly to landfill, 5% are incinerated, 15% are subjected to physicochemical treatment and 10% have been deposited at sea.

Wastes previously upon landfill are high compared with some other European countries: with reference to municipal waste, for example, contrasting markedly with Sweden where some 60% is incinerated with energy recovery contributing 13% of total district heating requirements. In the UK, geology and hydro-geology have provided for the exploitation of landfill to a greater extent than in countries such as the Netherlands, and the reliance upon the private sector to provide disposal and treatment capacity has inevitably encouraged the development of relatively low-capital-cost facilities. Just as in European Community social and legislative influences have affected marine disposal, so we expect to witness a fall in the percentage of waste going to landfill in the UK although it is likely that by the end of the century landfill will still be the predominant disposal route. (Petts & Eduljee; 1994).

European Community Directives concerning Waste Disposal :

Directive 91/156/EEC amending Framework Directive 75/442 EEC on the reduction, recycling and safe disposal of waste, has to be implemented by 1 April 1993. The Directive stipulates that :

- there must be competent authorities responsible for implementing the Directive;
- they must produce waste disposal plans;
- disposal and recovery facilities must have a permit (unless they fall within permitted exemptions);
- the polluter pays principle should apply; and
- member states are to encourage recycling. (Brown; 1992:159).

Environmental Impact Assessment:

'Environment' means the total of all those physical, chemical, biological and social economic factors that impinge on an individual, a community or population. On the other hand 'Environmental Assessment' is a formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and augment positive effects. Another term important for waste management is 'Environmental Impact Statement (EIS). It means a document or report which contains the results of an EIA study. The EIA is also referred to in some countries as Environmental Statements (ES). On

the other hand 'Environmental Planning' means all planning activities with the objectives of preserving or enhancing environmental values or resources. (Dot & Ha; 1995:73).

Environmental Impact Assessment, or Environmental Assessment (EA) the term used in UK legislation, has a history of over 25 years of formal development. The philosophy and practice of Environmental Assessment has been assimilated into a broad range of cultures and political systems across the world, its acceptance not only reflecting the desire and need to integrate environmental considerations into decision- making but also the inherent simplicity and flexibility of the approach. However, this assimilation has been limited, in terms both of the scope of application and of the effectiveness of practice. The role of Environmental Assessment to provide for the integration of environmental considerations into policy and strategy for sustainable development – at international, national, and local level.

The international flurry of activity related to the promotion of environmental protection has spurned new management tools, such as environmental auditing, product assessment and life-cycle analysis, most of which still await effective definition as well as implementation. Existing tools, primarily developed for other purposes, such as Risk Assessment (RA) and Cost-Benefit Analysis (CBA) are recognized as being applicable with adaptation to environmental decision-making, while others such as social impact assessment often still seem to be divorced from the process. The relationship between Environmental Assessment and most of these

other tools remains blurred, not least in terms of their relative scope. Amongst industry, decision-makers, and the public, there appears to be some confusion as to the role of Environmental Assessment relative to other assessment process and to decision-making procedures.

An examination of Environmental Assessment for waste management, and in particular the provision of appropriate and acceptable waste treatment and disposal facilities, provides evidence of all of these questions and uncertainties, and also of variable practice and quality. It also reflects concern over the waste management practice itself, public resistance to the siting of new facilities, and continuing disagreements as to the exact nature and significance of the environmental risks arising from the activities, and particular technical, management, and communication demands upon the Environmental Assessment process. Waste management also provides for ample evidence of the effects of the limited application of Environmental Assessment.

Hazardous Wastes:

The present methods of storage and disposal of many chemical wastes and other toxic substances pose severe risks to human health and to the viability of other species and ecological processes. All countries produce and dispose of hazardous substances on an increasing scale, but many of them, specially developing countries, lack awareness of the hazardous wastes. After decades of uncontrolled dumping, industrialized countries and an increasing number of developing countries have discovered that the

cost of ignorance and neglect is extremely high in terms of air, water, and land pollution and consequent harm to health and productivity.

Estimates of the costs of cleaning up existing dangerous sites range from $1 billion in Denmark to $10 billion in the Federal Republic of Germany and $23 to 100 billion in the United States. Some of the unsatisfactory dumping has exposed people directly to hazardous chemicals. In two major cases in the Netherlands and the United States, homes were built on reclaimed land containing paint solvents, pesticides, chemicals used in making plastics, and the sludge from the bottom of stills. Hundreds of families had to be evacuated from the sites of both cases.

Several physical, chemical, and biological methods can be used to reduce the bulk or toxicity of the waste. Of all the treatment technologies available, properly designed incineration systems can provide the highest overall degree of destruction and control for the broadest range of hazardous waste streams. Ideally, incineration should produce carbon dioxide, water vapor, and inert ash. But small quantities of a multitude of other more dangerous emissions may be formed.

As control on hazardous waste disposal has been tightened in some countries, industries have increasingly started exporting their waste started foreign countries.

Despite some encouraging examples of new low- waste technologies, recycling, and other innovative measures, few of the potential gains have so far been achieved. About 4 to 5 percent of hazardous wastes are being

recycled in some OECD countries, but using existing technologies there is a great potential for recovering up to 80 percent of waste solvents and 50 percent of the metals in liquid waste streams in the United States. Japan seems to have advanced the furthest of any major industrial country toward recycling and reusing its industrial waste, largely thanks to a cooperative relationship between industry and government. In Japan, the United States, and Western Europe, there are waste exchanges operating on the simple premise that one industry's waste can be another's raw material. They have succeeded to varying degrees in promoting the recycling and reuse of industrial waste.

Until more production processes that produce far less hazardous waste can be devised and implemented, technical and regulatory measures will be necessary. They will be needed to ensure safe handling and disposal of the existing output of waste, especially in the developing countries. These measures should include methods to evaluate alternative means and sites of waste disposal and to assess the implications of importing such wastes. But few developing countries have established the basic foundation of a hazardous waste management system. Most have no regulation, no trained manpower, and no facilities capable of adequately treating and disposing of hazardous wastes. An active exchange of information and experience between developed and developing countries could do much to advance the latter's capabilities to deal with such wastes. Special emphasis should be put on strategies of waste minimization, recycling, and reuse that could yield large economic and environmental gains.

Each government should be responsible for educating its own citizens about their role effects on the environment, as both producers and consumers, and for otherwise motivating them to adopt less harmful practices. The developed countries have most of the available pool of technical skills, and therefore most of the responsibility, for devising less harmful techniques of production in all fields, and for assisting the developing countries to acquire and use them. Also, as their standards of consumption tend to be advertised in and therefore copied by the citizens of developing countries, they have the greater responsibility for promoting less harmful patterns of consumption. The developing countries have the primary responsibility, however, for evaluating and modifying foreign consumption patterns so as to harmonize them with their local climate, resources, and culture in order to maintain the productivity of their resource base and the healthfulness of their environment. (The United Nations; 1990).

Objectives of Environmental Assessment:

The literature and advocates have always seen the potential of the Environmental Assessment process in much broader terms than most of the legislation which has been enacted to date. The following definition provides an early example of the expectations which have surrounded Environmental Assessment, not least in terms of the recognition of the important link between strategic and project Environmental Assessment (EA) :

"an activity designed to identify and predict the impact on the bio-geophysical environment and on man's health and well being of legislative proposals, policies, programs, projects, and operational procedures, and to interpret and communicate information about the impacts". (Munn cited in Petts & Eduljee; 1994 : 35).

Even this definition does not explicitly recognize the post-development role of EA i.e. that EA is not just a prediction and evaluation process, but one where decisions and actual impacts can be monitored and audited.

Fundamentally EA is iterative assessment and decision process, rather than a specific technique, which attempts to determine the impacts of policies and/or activities on the environment so that there is an opportunity for interested parties to decide whether those impacts are acceptable. The definition of the environment is cast wide to include the receiving environmental media and their physical components, living receptors occupying these media, and the built, cultural, and social environment. EA is not a formal decision-making process in its own right, rather it is a management tool. As such it has a number of objectives which relate to the identification of potential problems in the decision process, provision for the balancing of costs and benefits, the reduction of unacceptable impacts, and the provision of interdisciplinary inputs to environmental decisions. Management decisions require the status quo to be a relevant consideration and the 'do nothing' alternative is an important consideration in the EA process.

There is no universally accepted definition of the purpose and nature of EA. It is a term which has evolved over the years in the light of developing environmental concerns, policy, assessment techniques, and practice. The lack of a common definition can be seen as a disadvantage, encouraging variability of approach between different countries and agencies, and a lack of clarity as to the requirements for potential users. Certainly EA must be a dynamic process, constantly under review to ensure that its purpose and application is directly relevant to the needs of the time.

Scope of Ecological Impacts :

The primary potential sources of ecological from waste disposal and treatment activities are :

- Land-take and excavation.
- Construction activity disturbance and damage.
- Noise, dust, and litter.
- Accidental spillage's and leakage's.
- Direct emissions to air, soil, and water.
- Landfill gas.
- Leachate.

These are sources which relate to the construction, operation, and restoration and completion phases. The construction phase has the

potential to have the most direct impact in terms of physical loss and disturbance, while the operational and restoration phases have the potential to have the primary impact in terms of exposure of plants and animals to contaminants.

Scope of Air Pollution Impacts:

Air pollutants can be divided into two categories : (i) pollutants such as dust, acid gases, halogenated hydrocarbons, etc., that are released from anthropogenic (human) activity or are due to natural causes, and (ii) pollutants such as ozone and peroxyacetyl nitrate (PAN) that are formed as a result of chemical reactions in the atmosphere. Of the waste treatment and disposal methods that are commonly used, thermal processes and landfills emit by far the major proportion of primary pollutants to the atmosphere during normal operation, in comparison with processes such as physicochemical treatment or biological treatment. Emissions from thermal processes such as incineration include the products of complete combustion (carbon dioxide, water and the acid gases), the fraction of materials such as particulate and metals not retained by their air pollution abatement system, as well as the products of incomplete combustion (PICs).

In addition to releases to atmosphere that are the part of the normal operation of waste treatment plants and processes, accidental releases of pollutants can occur as a result of incidents such as the spillage of a volatile chemical, the mal-operation of an item of plant, a fire involving organic wastes, or an uncontrolled chemical reaction during the inadvertent mixing of incompatible chemicals. These releases are over a short duration and are

typically at rates and quantities that are far in excess of those pertaining to normal operation.

The impact of a release to atmosphere can be of two types :

1. Direct : i.e. those in which direct contact with the chemical in the air result in an adverse effect. Examples include health effects caused by inhalation (e.g. asthma), nuisance effects from odors, and the effects of acid deposition on vegetation.

2. Indirect : i.e. higher-order effects in which the receptor is in contact with environmental media (e.g. soil or water) or materials which have been contaminated by chemicals in the air. An example is the ingestion of foods affected by atmospheric deposition.

Scope of Human Health Impacts:

The manifestations of air pollution in humans extend from lowering the amenity value of the environment (e.g. from odors) to more severe health effects such as respiratory illness or cancer. Short-term, acute exposures can arise during emergency situations on a site (such as in the case of a spillage or fire involving chemicals), during periods of mal-operation or during adverse weather conditions when pollutants emitted into the atmosphere accumulate rather than disperse. These may be reversible (as in the case of brief exposure to moderate concentrations of acid gases) or could result in death, for example, through exposure to a lethal concentration of hydrogen cyanide. Longer-term, chronic effects include respiratory diseases such as asthma that are exacerbated by pollution episodes involving the traditional

pollutants such as suspended particulate matter, sulfur and nitrogen oxides, toxic effects caused by the intake of harmful levels of chemicals, and cancer. In general, pollution associated with the traditional pollutants is not an issue that impacts on the waste management industry, except when the assimilative capacity of the atmosphere is approached or exceeded. As we have seen earlier in this section, emissions of these types of chemicals are insignificant compared to other sources such as road traffic and power stations. The emissions of prime concern to the waste management industry are metals and a range of organic chemicals, especially the chlorinated species.

No human activity is risk-free, and waste management is no exception. The risk of accidents to handlers of waste and operators of waste treatment and disposal facilities is recognized: exposure to these risks is presumably accepted by such individuals as an occupational hazard subject to stringent control. Any chronic risk to health as an occupational hazard is also subject to control and surveillance. For the public, exposure to risks arising from facilities perceived to provide few benefits is a contentious issue, prompting many debates as to acceptable levels of risk. Public concern over waste operations is often conditioned by the existing environment and the effects perceived to result from exposure to the environmental emissions and pollutants. Studies such as those conducted by Townsend and Davidson (1982) and Townsend *et al* (1988) have examined ill-health in areas of the UK which have suffered higher than average incidence of respiratory and other illness, and have suggested a tentative link between ill-health, environmental pollution and industrial activity, though social

factors and activity patterns were accepted as prime contributors. The population in these areas have demonstrated a heightened awareness and concern over public health during the processing of planning applications relating to proposed waste facilities and in evidence to public inquiries. (Petts & Eduljee; 1994).

In the above-mentioned discussion we presented example of several countries on industrial waste management and environment. In Bangladesh a study related to environment, entitled is 'Environment and Development' ('Report of the Task Force's on Bangladesh Development Strategies for the 1990's -Volume-IV) was published in 1991. This study was related to the environment of Bangladesh and various points of industrial waste were also discussed. An analysis of this study is presented in the following discussion. This report consists of 25 sections or chapters grouped into 6 parts. Part I consists of a discussion about the people and economy of Bangladesh. Part II consists of 4 sections which discusses the physical resources like land, rivers, water and energy. In section 8 there is a discussion about bio-mass energy which constitutes about 73 percent of total energy consumption. Part III constitutes only one section where have dealt with different types of natural calamities faced by Bangladesh have been dealt with. Part IV consists of 6 sections and contains discussions about agriculture and agricultural resources including fisheries, livestock, forestry and bio-diversity. In Part V the pollution aspect of the problem including the impact of the global atmospheric pollution problem of the Greenhouse effect have been elaborated. In the final part of the report or

Part VI different measures were recommended in order to move towards sustainable development.

Generally the wastes produced by industries in Bangladesh are of primary types (agro-based industries, textiles, jute mills and tanneries, etc.) where the pollutants are "generally" bio-degradable. In recent times problems of hazardous/toxic wastes from chemical industries, electroplating, fertilizer, paper mills and other chemical industries are gradually becoming a matter of concern. There are three main industrial zones in Bangladesh. They are concentrated around the three principal urban centers of Dhaka, Chittagong and Khulna. There are some industries scattered all over the country and some concentrations can be seen in Pabna, Comilla and Tangail. The most important cottage Industry (in terms of employment and value added) namely the handloom industry is spread all over the country. Because of a very poor industrial resource base, industries are based on imported raw materials which includes textile raw materials, intermediate chemicals, metal ores and scraps. The trend is likely to rise further aggravating environmental pollution and degradation due to industrial wastes.

Agro-based industries include jute, pulp and paper, match, sugar, tobacco, leather, salt, agricultural industries etc. The two industries pulp and paper and leather are of great concern from the environmental point of view. Paper and pulp industries are dependent on baggage and jute cuttings (fibrous agricultural raw materials) or FARM. Estimate of total agricultural

residue for 1983-84 was 70 million tons of which 38% was burnt as fuel (equivalent to 67% of total bio-mass fuel and 52% of total energy).

The leather tanning industry is concentrated in a few location in Dhaka and Chittagong. Totally in the private sector the industry is composed of some 170 tanneries of small, medium and large size with a total annual production of 7 million square meters of leather from approximately 10 million cow, goat, sheep and buffalo. 85% of the total products are processed at Hazaribagh an area measuring about 25 hectares within Dhaka city. It is important to note that 30% of total raw hide production takes places during the Eid-ul-Azha festival.

Basic resources like land, water and air are adversely affected due to industrial activity. Examples are overuse of fibrous agricultural raw materials resource base, inundation of large area due to construction of hydro-electric power station, pollution of land, water and air due to careless dumping and discharge of wastes on land, loss of land due to mining activities.

Most industrial units, large and small, discharge liquid effluent to water bodies generally flowing canals and rivers or oxidation lagoon. Contaminants are few and include ammonia, chromium and other heavy metals from fertilizer and tanneries, mercury from chloralkali units, phenols from pulp and paper refinery, plastic, pharmaceuticals and paint industries. To these are added acids and alkalis, S. S. and other organic and inorganic load which may be expressed as BOD and COD.

All the urea factories are located on the banks of big rivers. Ammonia concentration in Sitalakhya river 1/2 km down stream from the UFFG effluent discharge point had ranged between 1 and 3 mg/e and this value may rise as high as 30 (Concentration of 1.2 to 3 mg/e ammonia is toxic to aquatic life) depending on load condition and equipment breakdown. However, the discharge of concentrated streams are controlled by holding the same in lagoon. CUFL being a recent plant controls ammonia by steam stripping.

Chromium wastes are discharged from Leather plants, Chemical plants (including urea fertilizer plants) which use chromium base inhibitors in cooling water are also potential sources. Hexavalent chromium (unstable form readily converted to trivalent for which limit is less than 4 mg/1) is carcinogenic and the threshold limit is 0.1 mg/1. A table shows typical characteristics and volume of waste from tannery industries in Hazaribagh. The variation in data are large and any figure exceeding 100 1 per kg. of hide should be considered as high. Cumulative waste water from all the industries is 4000 m^3/day maximum concentration of chromium near the effluent discharge point in Buriganga is 6 ug/1 Similar level is reported for lead and zinc.

Waste water Characteristics from Tannery Industries

Table : 4

Parameter	Range of variation
PH	4 – 10
Total alkalinity (as $Caco_3$)	185-6, 475 mg/1
Electrical conductivity	1670-93,000 u-mohs/cm
Chloride	175-18,000 mg/1
Chromium	2.6-2800 mg/1
COD	120-9600 mg/1
Ammonia-nitrogen	12-1970 mg/1

Source : Report of the Task Force : 1991

Mercury losses occur from Karnaphuli Paper Mills and Sonali Pulp and Paper Mills were reported to be 3000 and 560 kg per annum. These values are much higher than usual 200 per ton of chlorine used. Methyl mercury (organic form) is highly toxic and methylation occurs by bio-degradation. United States standard permits a concentration of 20 to 1000 mg/1000 1 where there is sufficient flow of receiving waters.

Phenols are common pollutants in chemical industries. The acceptable limit in drinking water is 0.002 mg/1. Phenol impairs odor to receiving water and so with it fish also smells at concentration as low as 0.1 mg/1. Average concentration of these pollutants from the above industries are reported to be 2000 mg/1.

Solid wastes generated from chemical industries may pose some difficult problem of disposal. TSP plant generates large amount of 'gypsum' as a reaction product. The utilization of this gypsum has been limited and dumping of large amount of gypsum is a problem due to non availability of adequate space. More serious is the problem of disposal of highly toxic waste sludge from UFFG that has accumulated in the factory from carbon di-oxide absorption tower. It is estimated that well over 22,000 cft. of packing materials along with sludge containing arsenic has piled up. The arsenic content in the sludge is about 40%. The process has since been modified, but large quantity of solid material remain dumped in concrete pit and in the open. The maximum permissible level of arsenic in water is 0.05 mg/1 and thus this sludge shall continue to be a serious source of water contamination of very serious nature.

Thermal pollution may result from the heat discharged into receiving waters. The extent of thermal pollution chiefly depends on the volume of receding water. The power plants at Ghorasal and Siddhirgnaj pose threat of thermal pollution to Sitalakhya River. At Ghorasal cumulative power generation is about 1000 MW. If condenser water is discharged directly about 50% of river section or water volume may register marked temperature rise but the other half may provide a pathway for fish and ensure free floating and drifting fish eggs. The Ghorashal site is subject to further risk due to discharge of effluent from upstream fertilizer plant.

Most liquid effluent are discharged from industries to rivers. The carrying capacity of these rivers depend on the total volume of river water and

amount of polluted discharge. The quality of water of four major rivers (on which industrial concentration are very high) such as Buriganga, Sitalakhya, Bhairab and Karnaphuli are subjected to pollution from urban domestic waste and industrial wastes. The Department of Environment carried out some tests on the water qualities of these rivers during lean period the results of which indicate that industrial waste discharge to the rivers are relatively minor offender, than sanitary wastes from urban areas.

Currently the rivers and streams in Bangladesh received untreated wastes from industrial units, domestic organic wastes and chemicals, particularly run-off containing highly toxic agro-chemicals. These wastes cause pollution of the aquatic environment resulting in fish kills and alteration of the ecological balance in the waters. Very often many of the toxic chemicals in fish are damaging to human physiology and health.

Ahmad and Reazuddin (1986) reported that Karnaphuli Paper Mills (KPM) has no external treatment plant for treating the effluent. The Mill was not only dumping solid wastes fiber, bark, wood particles and inorganic compounds but also was discharging 1050 m^3/h of bamboo and wood extraction products, spent cooking liquor, used bleaching chemical into the river causing pollution of water several mills up and down stream of the river.

Apart from Karnaphuli Paper Mills (KPM) Karnaphuli river receives wastes from Karnaphuli Rayon Complex (KRC) and 5 open channel drain within the urbanized area of Chittagong. Average flow of river is 200

m^3/sec and is affected by tide. Total effluent discharge from KPM and KRC is about $1m^3$/sec and total BOD load is about 11 mt/d.

Analysis of the river water at several places show that mean D.O value seems to be little different from unpolluted up-stream flow. However, close to effluent discharge point D.O. value is small (0.4 mg/1 as against 4 mg/1 in the middle of the river). This indicates severe deoxygenation may occur at least locally.

The assimilative capacity of Karnaphuli river in term of BOD load was estimated to be about 200 mt/d and to maintain DO level to 1 mg/1 load may be increased upto 800 mt/d. Estimated total organic load is about 20 mt/d of which 50% is believed to be domestic.

Large scale fish kills used to occur in Sitalakhya river in Dhaka in the 70's and 80's. These fish mortalities were attributed to raw ammonia discharge into the water by Urea Fertilizer Factory. Bhulyan (1985) recorded presence of ammonia at a level of 200 mg/1 where fish mortality was occurring in the river. Monitoring by DoE near Ghorashal Fertilizer Factory from October, 88 to August, 89 showed that ammonia concentration ranged from 0.016 to 4.15 mg/1, which means concentration sometimes exceeds allowable limit of 3 mg/1.

Occasional fish kill from Surma river have been reported due to effluent discharge from a Paper Pulp Mills, Fenchuganj and Fenchuganj Fertilizer Factory. Hilsa run from the Bay of Bengal has ceased due to pollution.

Fish mortalities in river ways near Mobarakganj Sugar Mills in Jhenidah and Setabgonj Sugar Mills in Dinajpur have been reported.

Most of the factories in Khulna city suburbs are situated in Rupsha, Khalishpur and Shiromoney industrial zones and discharge their waste into local river system. Eventually, this pollutes coastal waters. The toxic chemicals from Khulna Newspaper Mills are directly discharged to Bhairab river. Discharge is about 4500 m^3/h with high concentration of suspended solids and sulfur compounds.

5 Industrial zones with 328 different industries around Dhaka discharges about 49 metric tons of polluting loads into the surrounding rivers of Dhaka. (Mahtab,Task Force Report; 1991).

A number of laws (see: Appendix VI) have been identified which contain provisions regarding conservation of environment and control of environmental pollution from various sources. Of these, the Bangladesh Environment Conservation Act, 1995 deserves specific mention and has been enacted to control and mitigate pollution and environmental conservation. This Act of 1995 has repealed the earlier Environment Pollution Control Ordinance, 1977 and has come into force all over Bangladesh through a Notification of the Ministry of Environment and Forest dated May 31, 1995. (Farooque : 1996: 1). Other notable steps are The Environment Policy, 1992 and The National Environment Management Action Plan, 1995. The following is a short discussion on the above mentioned Rules, Act, Policy and Plan.

Environment Policy, 1992:

In view of the various impacts on environment, the Government of Bangladesh has attached special importance to its protection and improvement. A number of environmental problems, which inter-alia include natural disasters life recurrent floods, droughts, cyclones, tidal bores etc, primary signs of desertification in the northern districts, intrusion of salinity in the rivers, land erosion, fast depletion of forest resources, instability of the weather and climatic conditions etc are prevalent in the country. Against this backdrop, the Government has established the Ministry of Environment and Forest (MoEF) and upgraded the Department of Environment (DoE) in order to coordinate and supervise the activities concerning protection and improvement of the environment. Simultaneously, major problems related to environmental pollution and degradation have also been clearly identified. (Farooque; 1996: 729).

The Objectives of Environmental Policy, 1992 are:

1. to maintain ecological balance and overall development through protection and improvement of the environment;
2. to protect the country against natural disasters;
3. to identify and regulate activities which pollute and degrade the environment;
4. to ensure environmentally sound development in all sectors;
5. to ensure sustainable, long term and environmentally sound use of all national resources; and
6. to actively remain associate with all international environmental

initiatives to the maximum possible extent.

Environmental activities encompass all geographical regions and development sectors of the country. As such, policies towards realization of the overall objectives of this Environment Policy are described in 15 sectors like (1) Agriculture (2) Industry, (3) Health and Sanitation, (4) Energy and Fuel, (5) Water Development, Flood Control and Irrigation, (6) Land, (7) Forest, Wildlife and Bio- diversity, (8) Fisheries and Livestock (9) Food, (10) Coastal and Marine Environment, (11) Transport and Communication, (12) Housing and urbanization, (13) Population, (14) Education and Public Awareness, (15) Science, Technology and Research. Main objectives of the industry sector are:

1. Adoption of corrective measures by polluting industries in phases.
2. Undertaken Environmental Impact Assessment (EIA) for all new industries both in public and private sectors.
3. Impose ban on establishment of industries producing goods which cause environment pollution: close down such already existing industries in phases and discourage use of such polluting products through development/ introduction of their environmentally sound substitutes.
4. Encourage development of environmentally sound and appropriate technology and initiatives on research and extension in the fields of industry. Balance such initiatives with the best use of labor and provision of proper wage.
5. Prevent wastage of raw materials in industries and ensure their sustainable use.

Legal Framework of the Environment Policies is to:

1. Amend all laws and regulations related to protection of environment, conservation of natural resources, and control of environmental pollution and degradation with a view to meet present days need.
2. Frame new laws in all sectors necessary to control activities concerning environmental pollution and degradation.
3. Ensure proper implementation of all relevant laws/ regulations and create wide spread public awareness in this regard.
4. Ratify all concerned international laws/ conventions/ protocols which Bangladesh considers ratifiable and amend/ modify existing national laws/ regulations in line with the ratified international laws/ conventions/ protocols.

Institutional Arrangements of the Environment Policy:

1. A National Environmental Committee with the head of the Government as the Chairperson would be constituted to give overall direction for implementation of this policy.
2. The Ministry of Environment and Forest would coordinate the implementation of this policy.
3. The Ministry of Environment and Forest would take timely steps for appropriate amendment and modification of this policy on the backdrop of changes in the state of environment and socio-economic and other needs of the country.
4. Department of Environment will make final review and approve all Environmental Impact Assessments (EIAs). (Farooque; 1996).

The National Environment Management Action Plan (NEMAP) :

At the national level in Bangladesh, a plan called National Environment Management Action Plan (NEMAP) was formulated by the Ministry of Environment and Forest in collaboration with other ministries and agencies as well as other sectors of civil society in 1995. The National Environment Management Action Plan was started as a project of the Ministry of Environment and Forest of the Government of Bangladesh in 1992 as a follow-up to Bangladesh's commitments made at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janerio, Brazil. The National Environment Management Action plan was formulated specially because of the signing of Agenda 21 at Rio de Janerio. The project was supported by the United Nations Development Program. NEMAP focused mainly on identifying environmentally threatened locations or regions across the country and recommending action plan sector wise (15 sectors mentioned in Environment Policy,1992). (MoEF; 1996).

Environment Conservation Rules, 1997:

These Rules shall be called Environment Conservation Rules, 1997. SRO197- Law197- As empowered vide Article 20 of Bangladesh Environment conservation Act, 1995 (Act 1 of 1995), the Government has hereby made the following Rules:

The Government will take the following into consideration in order to

declare any area as Ecologically Critical Area vide Clause 5 (1) of the Act :

a) Human Settlement.
b) Ancient Monument.
c) Archeological Site.
d) Forest Sanctuary.
e) National Park.
f) Game Reserve.
g) Wildlife Habitat.
h) Wetland.
i) Mangrove.
j) Forest Area.
k) Biodiversity Area and similar other areas.

The activities or processes which cannot be continued or initiated in Ecologically Critical Area shall be specified by the Government as per standards described in Rules 12 and 13.

According to the Rules the entire industrial units and projects have been listed in 4 different categories depending on the extent of impact on the environment and accompanying complexity of obtaining Environmental clearance (see : Appendix IV and V) namely Green, Orange- A, Orange- B and Red.

The validity of Environment Clearance shall be for 3 years for Green Category and 1 year for other Categories from the date of issue. (GoB; 1997).

The forgoing analysis includes an elaborate discussion of Industrial Waste Management in United Kingdom, Germany, Netherlands, North-Ireland and other European Countries, United States of America, Japan and Bangladesh. The discussion revealed that industrial waste management is concerned not only with engineering but also with biological and managerial aspects. Waste is an important subject, which is not possible to execute by overall general management, it needs distinctive management. As such the concerned study has dealt with the re-use and re-cycling of waste, treatment and disposal system of waste and effects of waste on environment in the Bangladesh perspective.

Industrial waste management has a social aspect which is also neglected even in western countries. Social scientists have not concentrated on this topic. So a comprehensive study or research about industrial waste management is an imperative necessity.

Notes:

1. (Number of Licensed Waste disposal and treatment facilities in the UK-1991 - from page 35)

1. Refuse disposal open to the public
2. Licensed for receipt, sorting, consolidation and onward movement at sites remote from disposal facility
3. Storage remote from final disposal
4. Chemical, physical and biological treatment and solidification
5. Hazardous waste, municipal, in-house, clinical, animal
6. Licensable waste recovery facilities and scrap yards.

CHAPTER-III

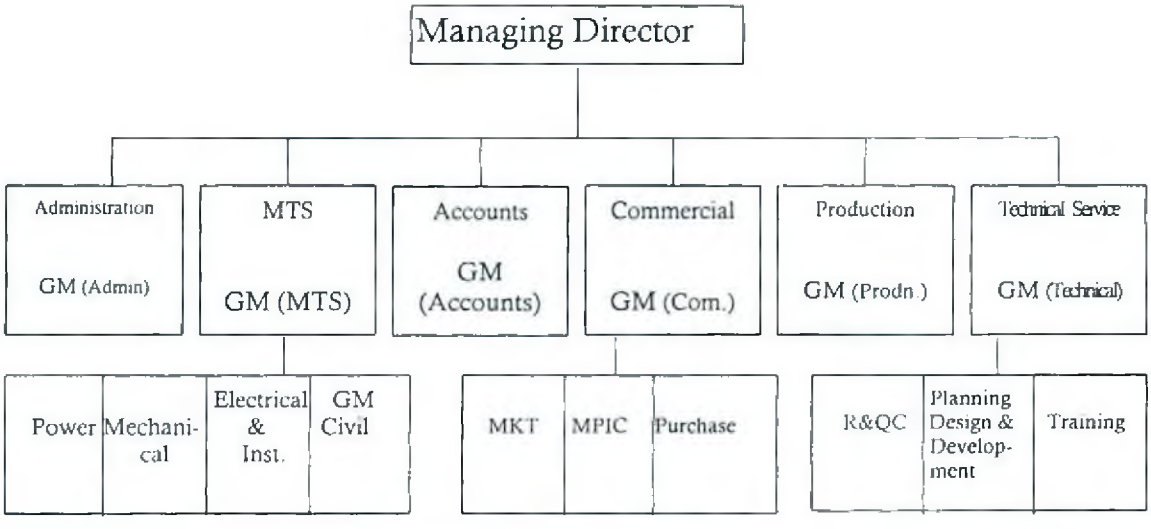
SETTINGS OF THE INDUSTRIES

3.1. Organizational Setting of the Industries :

Every industry has a organizational setting which presents organizational position of officers, staff, and workers according to hierarchy. These positions are distributed by their duties and responsibilities as well as remuneration and other incentives. The organizational setting of TSP Complex, Chittagong Steel Mills and Amin Jute Mills are presented shortly in the following figure:

a) TSP Complex Limited:

Figure : 4



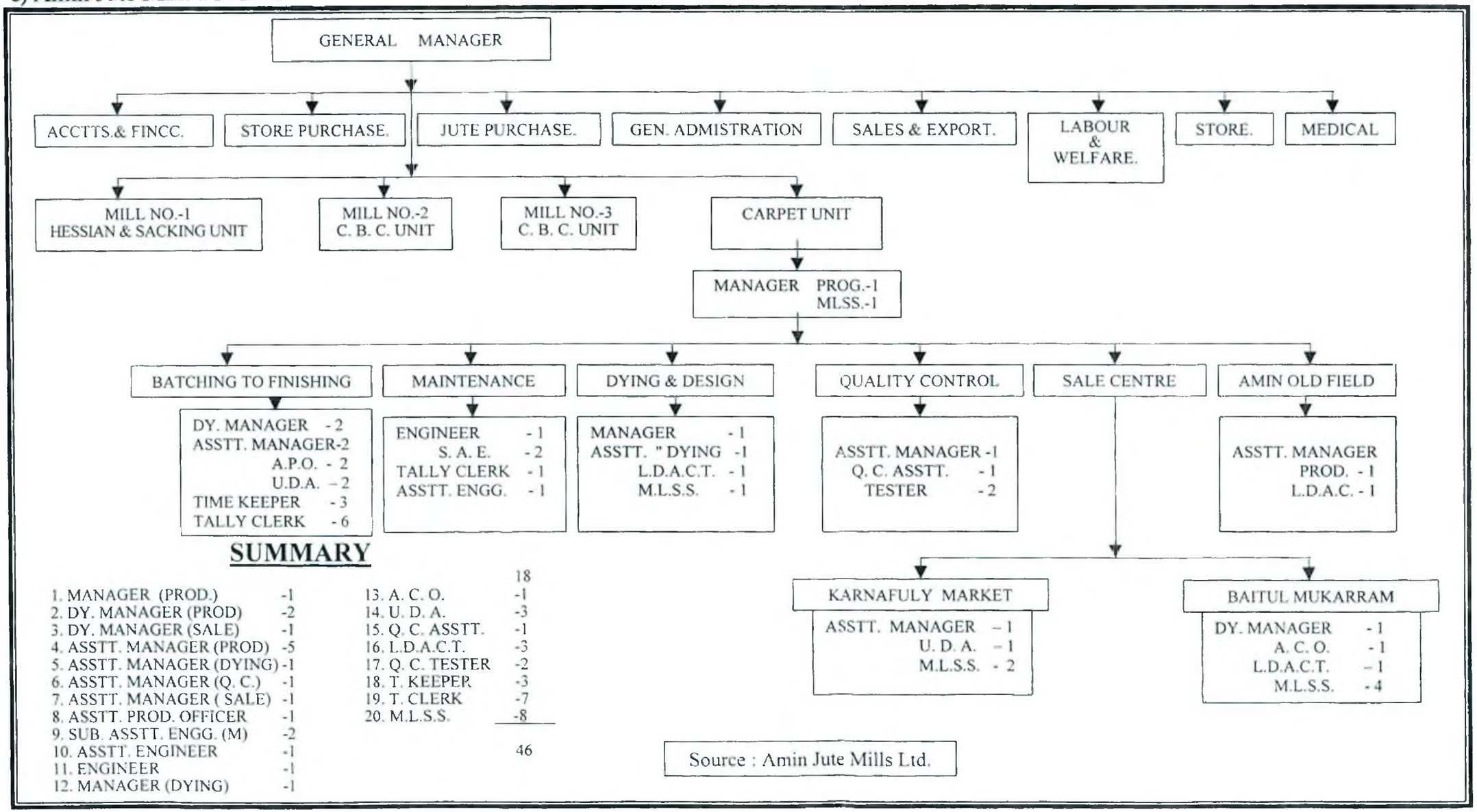
SANCTIONED MAN POWER

OFFICERS	STAFF	WORKERS	TOTAL
218	233	491	942

Source : TSP Complex Ltd.

Figure : 6

c) Amin Jute Mills Limited:



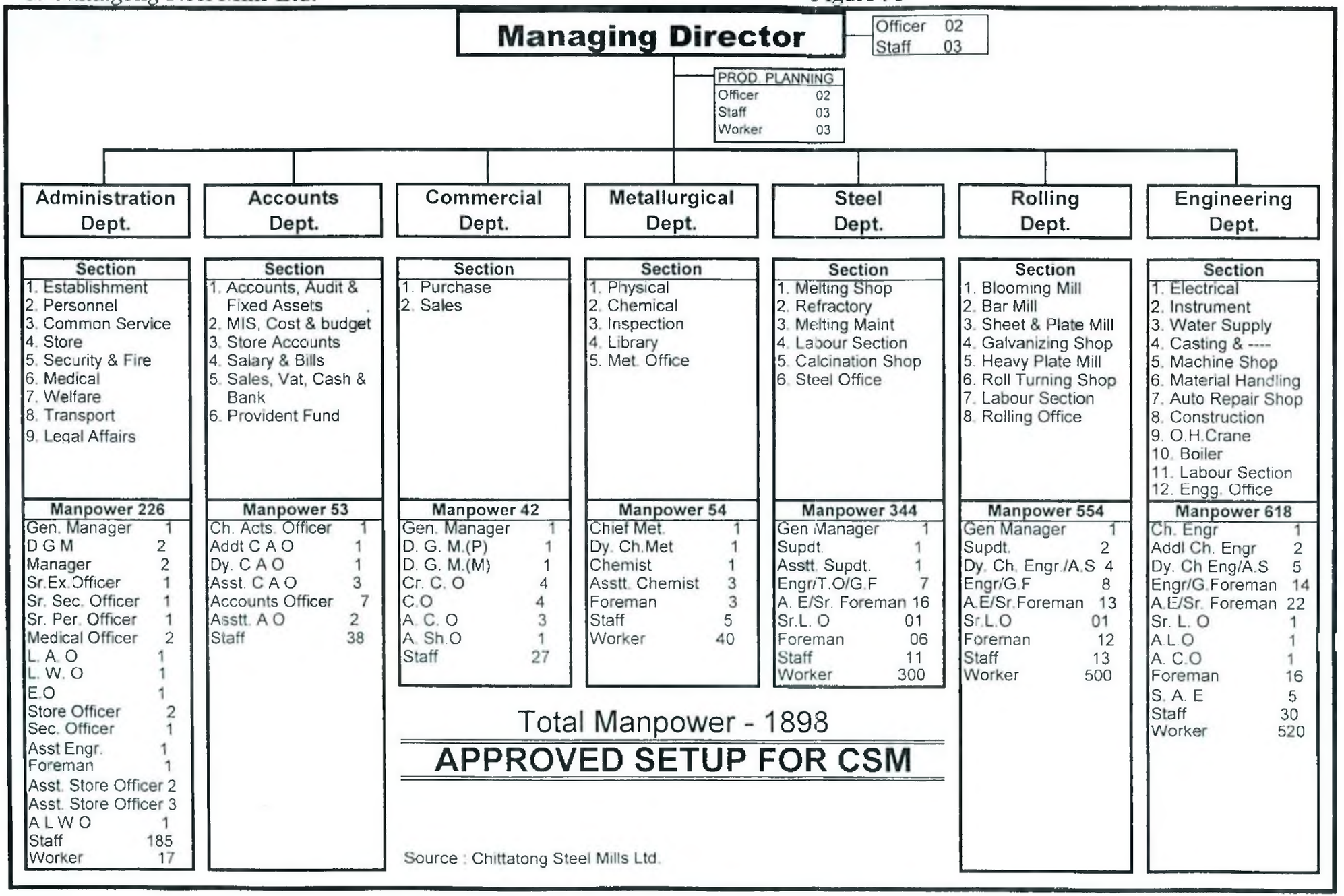
SUMMARY

1. MANAGER (PROD.)	-1	13. A. C. O.	-1
2. DY. MANAGER (PROD)	-2	14. U. D. A.	-3
3. DY. MANAGER (SALE)	-1	15. Q. C. ASSTT.	-1
4. ASSTT. MANAGER (PROD)	-5	16. L.D.A.C.T.	-3
5. ASSTT. MANAGER (DYING)	-1	17. Q. C. TESTER	-2
6. ASSTT. MANAGER (Q. C.)	-1	18. T. KEEPER	-3
7. ASSTT. MANAGER (SALE)	-1	19. T. CLERK	-7
8. ASSTT. PROD. OFFICER	-1	20. M.L.S.S.	-8
9. SUB. ASSTT. ENGG. (M)	-2		18
10. ASSTT. ENGINEER	-1		
11. ENGINEER	-1		46
12. MANAGER (DYING)	-1		

Source : Amin Jute Mills Ltd.

b. Chittagong Steel Mills Ltd.

Figure : 5



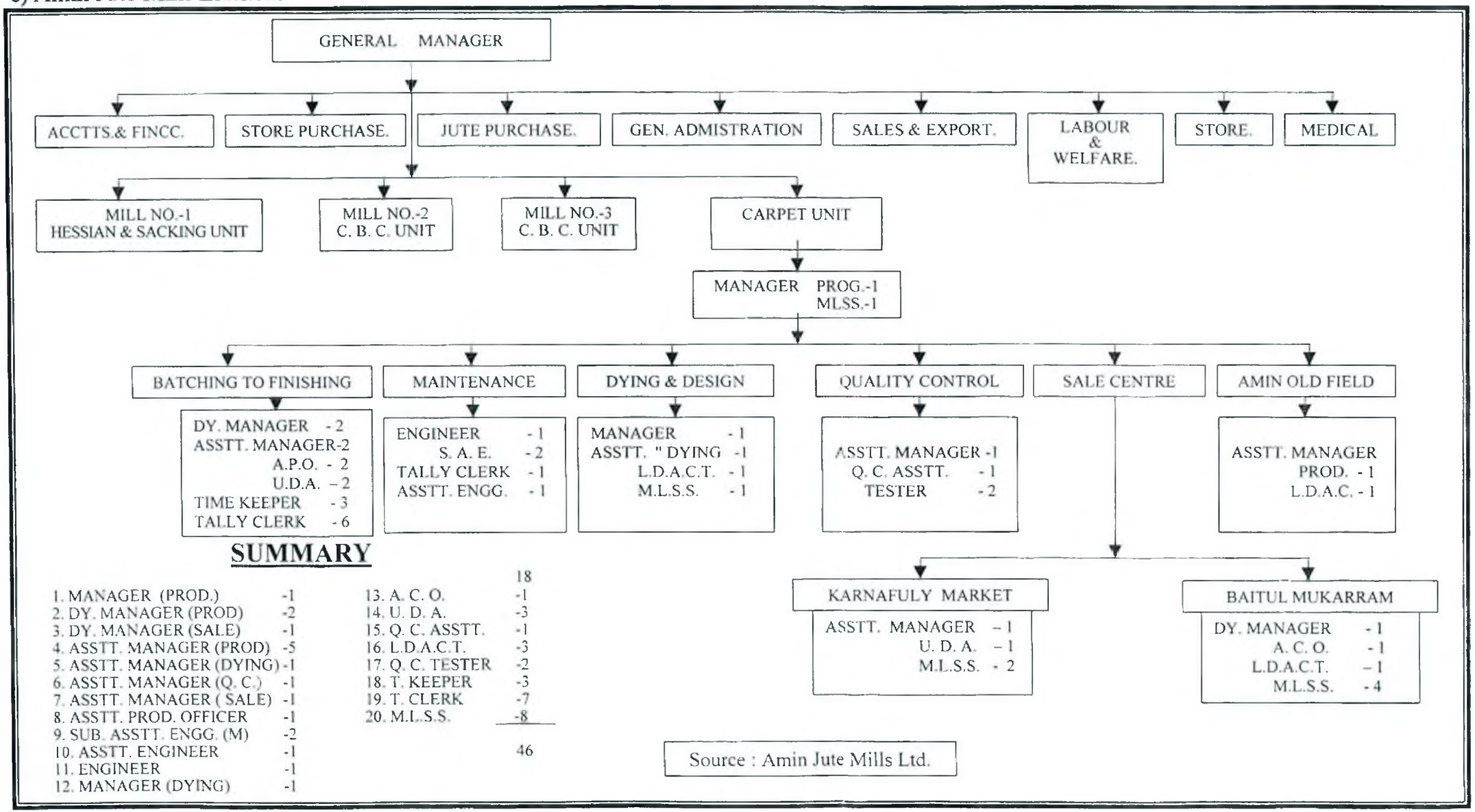
Total Manpower - 1898

APPROVED SETUP FOR CSM

Source : Chittatong Steel Mills Ltd.

Figure : 6

c) Amin Jute Mills Limited:



SUMMARY

1. MANAGER (PROD.)	-1		18
2. DY. MANAGER (PROD)	-2	13. A. C. O.	-1
3. DY. MANAGER (SALE)	-1	14. U. D. A.	-3
4. ASSTT. MANAGER (PROD)	-5	15. Q. C. ASSTT.	-1
5. ASSTT. MANAGER (DYING)	-1	16. L.D.A.C.T.	-3
6. ASSTT. MANAGER (Q. C.)	-1	17. Q. C. TESTER	-2
7. ASSTT. MANAGER (SALE)	-1	18. T. KEEPER	-3
8. ASSTT. PROD. OFFICER	-1	19. T. CLERK	-7
9. SUB. ASSTT. ENGG. (M)	-2	20. M.L.S.S.	-8
10. ASSTT. ENGINEER	-1		46
11. ENGINEER	-1		
12. MANAGER (DYING)	-1		

Source : Amin Jute Mills Ltd.

The above mentioned set up of the industries has shown that all the three industries have several units which are directed by several unit principals. It is clear that their division of works are well reputed as organizational set-up. For example Amin Jute Mills have a few important departmentslike Accounts and Finance, Store Purchase, Jute Purchase, Administration, Sales and Export, Store and Medical. Like wise, there is a 'Worker and Welfare' department whose duties include supervision and preservation of the workers interest. In Chittagong Steel Mills mention-able sections are Legal Affairs, Welfare and Common Service under the Department of Administration. This industry has 48 sections under 7 departments which have important duties and responsibilities. In the TSP Complex mentionable distinctive sections are Research and Quality Control, Planning Design and Development, and Training under the Department of Technical Service. There is no distinctive department on industrial waste management which is very essential. We shall discuss this topic elaborately in the next chapter.

3.2. Number of Personnel:

Table : 5

Name of Industries	Officers	Staff	Workers	Total
Amin Jute Mills Ltd.	172	408	3340	3920
Chittagong Steel Mills Ltd.	158	303	1360	1821
TSP Complex Ltd.	224	221	411	856

In these industries most of the workforce consists of approximately 77% workers and some officers directly concerned with production. Manpower is therefore an important aspect of factory environment. It may be mentioned that these type of industries have an average of 2199 workers, staff and officers. At present the number of workers, staff and officers are limited in number than that shown in the organizational setting. This is because industries have not further recruited any new employee. So several posts have become vacant gradually. These vacant positions do not create any problem in the industry as their production target is not increasing. According to industry specialists all public industries need to reduce manpower for excessive production cost.

CHAPTER-IV

FINDINGS OF RESEARCH ANALYSIS AND COMPARISON

4.1. Location of the Industries :

Table : 6

Name of Industries	Size of Boundary	Situated Elements
Amin Jute Mills Ltd.	Within 100 meters Radius of the industry	Roads, abandoned-land, ponds, industries, houses, etc.
	Within 500 meters	Slums.
Chittagong Steel Mills Ltd.	Within 100 meters Radius of the industry	Roads, land of navy, abandoned-land, ponds, food-grain godown, industries, bazaar, domestic area etc.
	Within 500 meters	Karnaphuli river.
TSP Complex Ltd.	Within 100 meters Radius of the industry	Roads, abandoned-land, agricultural-land, ponds, food-grain godown, industries, slums.
	Within 500 meters	Karnaphuli river

All the three industries have abandoned land and usable agricultural land, daily use ponds, shops and residential houses within 100 meters of their precincts. Chittagong Steel Mills and TSP Complex are situated within 500 meters of the country's large river Karnaphuli. There are also other industries located near all the three industries. Although all three industries are situated in the industrial area but they are not situated according to the appropriate plan. As for example industry and dense residential houses are located side by side. So according to aspects of environment their locations are not appropriate. According to a Gazette Notification of the 'Environment and Forest Ministry' of 'Bangladesh Government' in August, 1997 the following listed industries can not be situated in a residential area. According to vide 7 (2) Rule industries have been categorized into the four categories- Green, Orange-A, Orange-B, and Red depending upon their pollution loads and likely adverse impacts. (see: Appendix:III). Location of the industries should be situated, as much as possible in an industrial area or open space. According to this classification Amin Jute Mills is Orange–B, on the other hand Chittagong Steel Mills and TSP Complex are of the Red type. All the three industries are situated in the industrial area but due to increasing localization these have created a hazardous situation in the area.

4.2. Produced Goods :

All the three industries, Amin Jute Mills, Chittagong Steel Mills and TSP Complex produce goods in three phases. A few associated products such as 'Intermediate Products' are uses for 'Main Products'. As for example Amin

Jute Mills produce Carpet Backing Cloth (CBC) from raw jute which are used in the Carpet Factory for the back side use of carpet. Chittagong Steel Mills produce 'Sheet Bar', 'Slab' and 'Ingot' which are used in another unit of the same industry for production of main goods. Phosphoric acid and sulfuric acid of TSP Complex can be mentioned as reusable products.

In many cases wastes of one unit are used to produce goods in another unit. These type of goods are treated as by-products. Chittagong Steel Mills has no by-product. But in Amin Jute Mills and TSP Complex there are by-product. In Amin Jute Mills blankets are made from 'felt unit' and in TSP Complex 'Gypsum' is made from sulfur sludge. Once gypsum was un-usable but now it is a by-product under the production process.

a) Intermediate Products:

Table : 7

Name of Industries	Name of Goods
Amin Jute Mills Ltd.	Carpet Backing Cloth (CBC)
Chittagong Steel Mills Ltd.	Sheet bar Slab Ingot
TSP Complex Ltd.	Sulfuric acid Phosphoric acid

b) Main Products :

Table : 8

Name of Industries	Name of Goods
Amin Jute Mills Ltd.	Sacking Hessian Mate Tape and Carpet
Chittagong Steel Mills Ltd.	MS billet, MS rod, BP sheet, GP sheet, CGI sheet, Plate-thin and thick, MS angle.
TSP Complex Ltd.	TSP and SSP

c) By- Products

Table : 9

Name of Industries	Name of Goods
Amin Jute Mills Ltd.	Felt → Blanket
Chittagong Steel Mills Ltd.	Nil
TSP Complex Ltd.	Gypsum.

4.3. Used Chemicals :

Table : 10

Name of Industries	Name of uses Chemicals
Amin Jute Mills Ltd.	Sulfuric acid, acetic acid, copper sulfate, salt, sodium-carbonate and gas.
Chittagong Steel Mills Ltd.	Aluminum, zinc, alum, soda, lime stone, antimony, hydrochloric acid, sulfur, dolomite, lead, gas, etc.
TSP Complex Ltd.	Rock sulfur, rock phosphate, sulfuric and phosphoric acid, gas etc.

These industries use chemicals such as sulfuric acid, hydrochloric acid, phosphoric acid, acetic acid, gas, rock sulfur, rock phosphate, sodium carbonate, zinc, lime stone, aluminum, antimony, soda, common salt, lead etc.

Uses of the above mentioned chemicals are essential for any industry in production process but the question is how chemicals can be used for multiple purposes and also in the production process. From the obtained data we see that there has been no research in this field.

Although use of chemicals is obligatory, chemicals may have adverse effects on environment. Some measures of protection against adverse effects of chemicals are necessary. These measures are : reducing the

process loss of chemicals, set-up treatment plant for appropriate disposal of the wastes. However there are no initiatives to take necessary action with these activities.

4.4. Waste of the Industries :

These industries have both re-usable and non-usable type of wastes :

a) Re-usable waste :

Table : 11

Name of Industries	Name of Wastes
Amin Jute Mills Ltd.	Jute dust.
Chittagong Steel Mills Ltd.	Scrap
TSP Complex Ltd.	Sulfur sludge

In all the three industries some raw materials are lost in many ways which are treated as process loss. These materials although treated as wastes in one industry are used to produce goods in another industry. As for example 'jute dust' which is treated as a waste in many units of Amin Jute Mills is used in the 'felt unit' of the same industry for producing blankets. In Chittagong Steel Mills various sizes of scrap wastes are used to produce 'ingot', which is again melted to produce 'bar'. As usual in TSP Complex sulfur sludge which is once (before 10 years) treated as a found waste (non-usable) is converted to 'gypsum' fertilizer.

b) Non-usable Waste :

Table : 12

Name of Industries	Waste: Biodegradable	Waste: Non-biodegradable
Amin Jute Mills Ltd.	Jute dust (final)	Scrap, gas, chemicals
Chittagong Steel Mills Ltd.	Iron dust	Slag, zinc dross, gas, chemicals
TSP Complex Ltd.	Rock phosphate dust, rock sulfur dust	Scrap, phosphoric, hydrochloric and sulfuric acid, and gas

These industries do not have any re-cycling mechanism so the mention-able wastes are treated as final wastes. But some time these wastes are used in other industries as raw materials. As for example jute dust of Amin Jute Mills are used in other factories for making quilt – mattress. Non-usable wastes are 'biodegradable' and 'non-biodegradable'. Most of the 'biodegradable' wastes are dust which are mixed with soil or ground and have no bad effects and the remaining two industries also have these type of wastes.

Most of the 'non- biodegradable' wastes are chemicals, gas and other hard matter which are not mixed with soil. These type of wastes have bad effects on the soil. In these industries huge quantity of these type of wastes are produced. Melting Shop of Chittagong Steel Mills produce ingots by

melting pig stone, lime stone, scrap and other chemicals. In producing ingot some wastes are produced as a process loss which are called 'slag'. Most of the produced wastes of the industry are slag. But its specific quantity of wastes are not known. In the galvanizing shop of this industry a big amount of zinc, lead, ammonium chloride, hydrochloric, sulfuric, chromic and acetic acid, rock sulfuric antimony, glycerin and tin is used for galvanizing. As for example 1993-94 financial year 523 metric tons chemicals was used for 5041.72 metric tons G.P. sheet production. In this production process there was 223.844 metric tons of chemicals loss which was 42.8% of the total chemicals (Chittagong Steel Mills; 1993). These type of chemicals are wastes which are called 'zinc dross', because 80 percent of uses chemicals in it are zinc. It is known that some chemicals can be produced from zinc dross by re-cycling. This helps in reducing process loss. But in this industry there is no re-cycling unit, so all the zinc dross is treated as waste.

Amin Jute Mills and TSP Complex produce some scrap wastes from packaging, and discarded tools. The scrap is first dumped in the yard and then a small amount is sold.

4.5. Re-use and Recycling of Waste :

Extensive recycling activities as in the developed countries are practically non-existent in the concerned three industries. Limited recycling activities are present in the Amin Jute Mills which at first makes 'felt' from jute dust

of various units. In the 'felt unit' blankets are made. This is a product generated from the process of recycling.

The industries may produce goods through recycling of wastes. Process loss can be reduced within re-use of raw materials at production process. Re-usable zinc can be tapped from zinc dross that is produce waste of Chittagong Steel Mills. Nonetheless there is no technology for reducing loss of zinc in a large scale industry like Chittagong Steel Mills. We have already observed that there are re-uses of raw materials for reducing wastes in Britain. They collect various wastes for recycling systematically. However all the three industries have not deeply perceived re-use and recycling of wastes.

4.6. Disposal System of Waste:

Table : 13

Name of Industries	Ways of disposed
Amin Jute Mills Ltd.	Chemicals Waste: By drain to outer drain. Gas Waste: As smoke to air. Jute Dust: At first dumped in yard of industry, then some are sold.
Chittagong Steel Mills Ltd.	Chemicals Waste: By drain to river. Gas: to air Slag, zinc dust and iron on specific yards of the industry by dust trolly.
TSP Complex Ltd.	Acid: By drain to river Gas: By chimney to air Dust: In yard.

In all the three industries the disposal system is the same. Chemicals waste are disposed outside the industry area through a drainage system. In this stage the chemicals are diluted by mixing excessive water. As for example, it was known from an officer of a carpet factory of Amin Jute Mills that the carpet factory uses chemicals for dying. In it wastes are .05 percent (approximately). In the 'galvanizing shop' of the Chittagong Steel Mills wastes are .02 percent (out of zinc dross) and in TSP Complex sulfuric and phosphoric acid wastes are below .01 percent. Specific data on the percentage of bad effect of chemicals waste occurring after dilution of chemicals is not available.

Gas wastes are emitted to the air. Some gases are emitted due to leakage and some as a smoke. There is no alternative system in this regard. Slag, zinc, jute and iron dust are dumped in the respective yards of the concerned industries. Dumping of wastes in Amin Jute Mills is done by workers, in Chittagong Steel Mills and TSP Complex it is done by trolley and vehicles. Some workers also participate in the disposal process.

One important work is the treatment of various chemical elements before waste is disposed. For this purpose a waste treatment plant is needed. By treating the liquid wastes any industry can reduce the waste as well as its detrimental effects on the environment. But there are no treatment plants in all the three industries. Their argument for the absence of treatment plant is that it is expensive. They are also not very much concerned or conscious about its existence.

4.7. Distinctive Department on Waste Management:

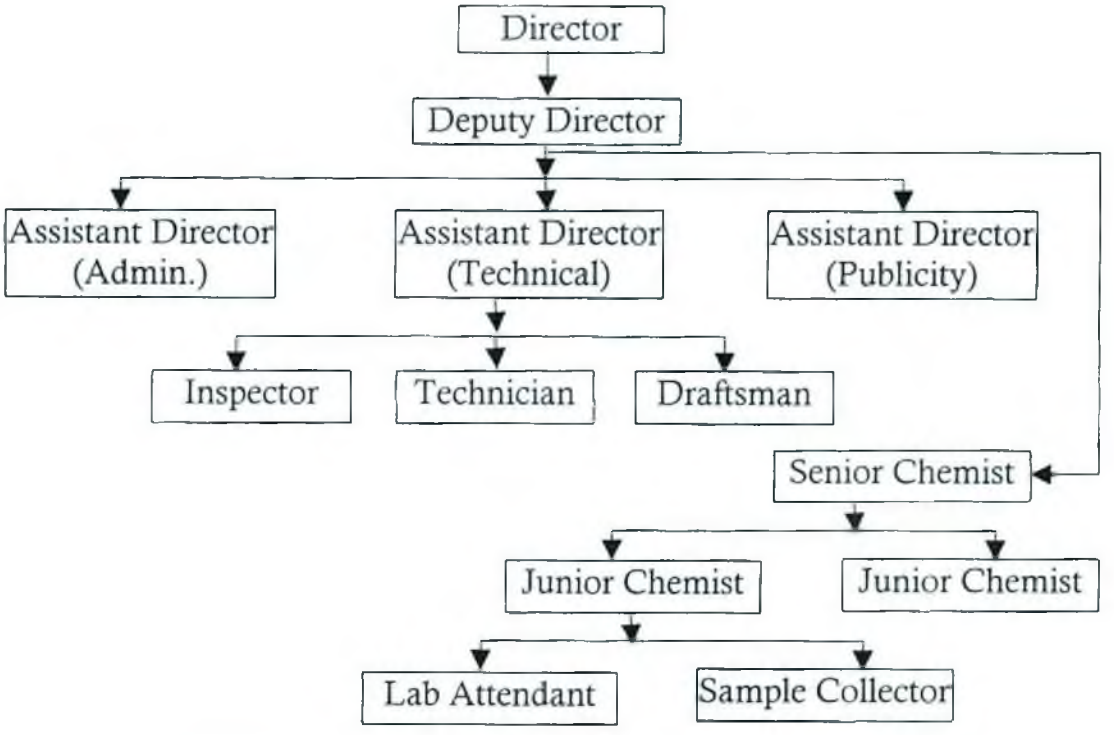
It is found that in all these industries there is a lot of waste but there is no separate department for waste management. Waste re-cycling, appropriate disposal system are necessary to save the environment from the bad effects of waste. From various interviews, it has been deduced that officers, staff as well as workers are not conscious about these matters. Concern workers, staff and officers of industries take responsibility and initiative for their own unit, but they do not take responsibility for industrial waste management. Every department has some specific duties and responsibilities, e.g. the Administration Department carries out the function of overall management, Accounts Department is involved with accounts, the Commercial Department is involved with purchase and sales. It is not possible for these departments to deal with problems of comprehensive waste management besides performing their departmental work. As observed in the third chapter, all three industries have several departmental sections but there is no distinctive department for Industrial Waste Management. When asked about this matter a top ranking officer opined "Where there is no way to comprehensively think about production how is it possible to think about Industrial Waste Management"? Other officers opined the need for developing consciousness and government association in undertaking essential steps.

4.8. Department of Environment Guidelines for Waste Management:

Several data have been collected from the 'Department of Environment' to know about industrial wastes, whether concerned industries know about waste and whether they follow the guidelines of the 'Department of Environment' or not.

Organizational Setting of the 'Department of Environment' :

Figure : 7



Source : Department of Environment; Chittagong.

According to above mentioned organizational setting activities of the 'Department of Environment' in Chittagong Division are not satisfactory

and well set-up. An officer of the 'Department of Environment' said that they have manpower shortage at present. Thus it is not possible to comprehend the activities and maintain a satisfactory condition in a broad range area like Chittagong Division.

Guidelines of the 'Department of Environment' :

1) Water, air and soil should not pollute the activities and processes of industries;
2) Certificate applicable for one year from the date of issue;
3) Certificate must be renewed at least thirty (30) days before the date of expiry;
4) This certificate is not exchangeable;
5) The certificate is compulsory at the time of gas connection;
6) Pre-approval is required for setting up of a washing plant in an industry;
7) Every industry must be associated with a representative of DoE by supplying concerned data from Chittagong Division;
8) The Department of Environment must be informed of any change/ modernization/ location change or shut down of an industry;
9) If any rule is broken, the certificate will be cancelled.

The above mentioned guidelines of the 'Department of Environment' are applicable for all industries. But the guidelines depend on the nature of the industry, as according to the measure of environmental pollution,

industries are classified as Green, Orange-A, Orange-B and Red.

The Department of Environment has conducted a few studies like - Report of Chemical Analysis on collected water of river, land surface and factory wastes from sample areas of Chittagong Division.

Now we can see what is the position of the three industries according to the 'Department of Environment' guideline. There are no specific guidelines from 'Department of Environment' under the 'Forest and Environment Ministry' for reducing of waste, disposal of waste and to save the environment from bad effects of waste. The officials of the industries informed that the 'Department of Environment' sometimes initiates some steps, but these only reflect the overall opinion that the environment is polluted in this industrial area". As for example; the 'Department of Environment' maintained that water of the Karnaphuli river was polluted due to the as chemical waste of industrial area which flowed into it, thereby reducing Fish wealth. The 'Department of Environment' deals with the matter in two ways: either they give an advertisement in newspapers or the industries are informed by the issuance of a letter.

But one of the main problem is that there is no way to know which industry is responsible and in what quantity for polluting the environment, because in an industrial area there are many industries. For this reason it is not possible to know the actual problem or situation. In this regard the TSP Complex informed by letter to the Department of Environment that the overall situation of Patenga Industrial Area is not applicable for them. Their argument is that if they are responsible for environment pollution,

then they should be informed the specific reason.

So we can say that the Department of Environment is issuing only Environment Clearance (although our concerned industries have no Environment Clearance, because clearance was not essential at one time). There is no inquiry for execution of the guidelines of the said department. Concerned industries have no accountability for pollution of the environment.

4.9. Bad Effects of Waste on Environment:

We have collected some information about produced wastes of these industries whether they have any bad effects specially on land, agricultural produce, water, air and human health. This information was collected from concerned managers, unit principals, workers and neighbors. The interviewees talked about the environment but they are not conscious about the bad effect of waste. Workers and staff did not give any specific opinion about the effects on land and agricultural production. In Chittagong Steel Mills, 4 (four) interviewees out of 23 (twenty three) have opined that although their industry does not dump any waste on outside land but waste is dumped in its own yard. Consequently land, vegetable, and plants in their area are effected. If some chemicals seep through to other lands then that land may also be effected. But there are no statistics as to how and to what measure the effect takes place. Two neighbors out of 30 (thirty) said that their agricultural-productions are reducing gradually

due to the effect of wastes.

In three industries 10 (ten) executives and officers out of 20 (twenty) said that their wastes did not effect water. Their argument was that no waste is disposed outside the ponds for agricultural use. The quantity of chemical wastes disposed in rivers are of a diluted condition. So this is not hazardous to the environment. Another 3 (three) officers out of 20 (twenty) opined that chemical wastes specially effects river water. Chemicals are drained in a diluted condition but when big amount of chemicals are disposed of then the hazards to the environment cannot be controlled. Another 7 (seven) officers could not give any satisfactory opinion. 18 (eighteen) neighbors informed that they are not aware about this matter. Another 12 (twelve) neighbors opinioned that chemicals wastes have bad effects on river water. They mentioned reduction of fish in rivers.

All interviewees commented about the bad effect of wastes on human health. Officers first commented that no toxic wastes are present in their industry so there was nothing harmful for human health. On the other hand a few officers commented that factory workers face some health problem. But when asked about the volume of bad effect then they replied that data was not available. Only three officers said that workers are attacked by tuberculosis, paralysis, etc. On the other hand workers did not know anything about the health condition of neighbors. But they said that they face health problems and suffered from cancer, paralysis, tuberculosis etc. On the other hand a few neighbors commented that they often feel ill, specially children and old people. They did not ascertain any specific

disease. But two people commented that children suffer from hooping cough, and the old suffer from tuberculosis.

4.10. Minimization of Bad Effects of Waste:

Officers, workers and neighbors were asked, what steps have been taken about minimizing the bad effects of waste and what steps should be taken. They opined that industries in a poor country like Bangladesh often do not have any possibility to take sufficient initiative to minimize the bad effects of waste. However they have taken all possible measures to overcome the problem. The workers said that steps taken by the authority is very limited. On the other hand neighbor's are of the opinion that they do not know about any steps taken to minimize the bad effects of waste. However the limited steps taken by the authority to minimize the bad effects of waste are:-

(1) Water is always treated so that chemicals waste do not pollute the environment. Waste chemicals are also diluted by mixing with much water.

(2) Some security based item like gloves, mask, shoes, heat-proof dress are given for the safety of the worker's health, but it is not used always.

(3) In only one of the three industries (TSP Complex) bonus is paid for taking nutritious food. The other industries provide some vitamins (Amin Jute Mills and Chittagong Steel Mills).

(4) Facilities are given for minimum treatment in these industries.

(5) The industries observe banner oriented Environment Day occasionally.

According to the view of the authorities of industries further more steps can be taken. These are:-

(1) Reduce the process loss of raw materials by recycling of waste and minimize bad effects on agricultural land, water, air and human health. For this various experiments should be undertaken.

(2) Need to grow consciousness in people about the environment.

(3) Need to grow consciousness in worker about the uses of pre-cautionary measures; there should be more supervision of the concerned authority.

(4) Need for regular treatment facilities for all.

(5) Need to provide bonus and nutritious food to workers for minimizing bad effects of wastes.

CHAPTER-V

CONCLUSION and OBSERVATIONS

It is clear that there is no specific conception about waste management in the concerned industries, specially re-cycling of waste, appropriate disposal system of waste and identification of bad effects on environment from the study. Managers, officers, workers and neighbors of industries are not conscious about what steps should be taken to minimize the bad effects. They have a negative attitude about waste and think it to be harmful. They do not have an aptitude for observing the magnitude of waste effects, how waste produces effects on the environment, on whom it produces these effects and the quantity of effect it produces. From amongst various reasons two reasons are mentioned: one is the haphazard situation of industries and the other is the absence of a separate department for waste management. On the other hand the activities of the Department of Environment are also limited. The Department of Environment does not think about recycling of wastes. In terms of disposal their main concern is to whether any disposal system is present in the layout plan. But the reality is that there is no inspection about the concerned matter. The Department examines some industrial wastes and some river water samples at the time of issuing Environment Clearance for the identification of bad effects of wastes and for taking measures to minimize the bad effects of waste. But the Department of Environment does not carry out any regular specific inquiry regarding recycling of waste, appropriate disposal system of waste and the essential steps to minimize the bad effects of waste. So the question

arises here is that how can this problem be solved? The present study can give us a few guide lines regarding these problems and options to support extensive research on industrial waste management.

I

As 'Industrial Waste Management' is associated with reducing process loss of raw materials at production process, re-use and re-cycling of wastes, appropriate disposal of wastes, identifying the bad effects of waste on environment and minimization of this problem, establishment of a distinctive waste management department at all middle and large scale industries is necessary. The waste management department should see how re-use and re-cycling of wastes are conducted and executed. Previously there used to be re-cycling of zinc-dross opportunity in Chittagong Steel Mills. It is also possible to re-use zinc-dross by re-cycling plants. If there is a distinctive waste management department it can conduct observation minutely. This department can also undertake a modern system of waste disposal. If re-cycling and disposal system of wastes is executed appropriately then it would be possible to reduce bad effects of wastes on the environment. So the Department of Waste Management is essential for industries.

II

Instead of speaking volumes about environment pollution a specific guideline, regular observation and monitoring system by the Department of Environment is imperative. Observation and monitoring for solid, liquid and gas wastes of industries is also essential. The Department of

Environment has only a region based overall study on the emission of liquid wastes of industries. But it is also important to study the bad effects of industrial wastes. So more analytical and comprehensive activities are needed in this regard. More manpower and modernization of the Department of Environment may well serve this purpose.

III

Industrial waste management requires modernization and technical development of management. The management pattern of industries is traditional and defective. Introduction of industrial waste management system calls for restructuring the total management system. This involves the accommodation of raw materials collection, production, marketing and appropriate management of waste. Technological development is necessary to increase production, reduce process loss, re-use wastes and proper treatment of wastes. This necessitates setting up of re-cycling plants, treatment plants etc.

IV

This study makes it clear that an in-depth research is required for setting up an Industrial Waste Management department. Waste management is concerned with reducing of wastes, re-process or re-cycling, scientific system of disposal and minimization of bad effects of wastes.

V

What is urgently needed is to create consciousness among officers, workers and neighbors of industries about 'Waste Management and Environment' through discussions, seminars, symposiums in industrial enterprises and

also at the national level. The study is aimed at calling the attention of all conscious and concerned citizens. Above all an inquiry about the appropriate execution of the proposed initiatives is essential.

Appendix - I

QUESTIONNAIRE

(For Industries)

(1) Position/category of the interviewee:

(2) Name and address of the industry:

(3) Location of industry:

(within 100 meters radius) North :-

South :-

East :-

West :-

(101-500 meters radius) N :-

S :-

E :-

W :-

(4) Explain the hierarchical setup of the Industry:

(5) Total no of personnel :-

Officers	Staff	Workers

(6) Product(s) :

(a) Main products:-

(b) Intermediate products:-

(7) By product(s) :-

(8) Types of waste :- (a) Re-usable :-

(b) Non-usable :-

(1) Bio-degradable :-

(2) Non-biodegradable :-

(9) Is there any re-cycling option : (If yes, explain)

(10) Name of chemicals which are used in :-

(a) Product(s) :-

(b) By-products :-

(11) Way(s) waste disposed of :-

(12) Is here any treatment plant : (If yes, explain)

(13) Total no of Waste Management personnel :-

Type (a) :-

(i) Qualification :- (ii) Experience :-

Type (b)

(i) Qualification :- (ii) Experience :-

Type (c)

(1) Qualification :- (ii) Experience :-

(14) In your opinion is any of these wastes hazardous to :-

(i) Land :-(a) :-

(b) :-

(c) :-

(ii) Agricultural produce :- (a) :-

(b) :-

(c) :-

(iii) Water :- (a) :-

(b) :-

(c) :-

(iv) Human health :-(a) :-

(b) :-

(c) :-

b) What protective measures have you undertaken to minimize the above mentioned hazards :

(i) Land :-(a)

(b)

(c)

(ii) Agricultural produce :-(a)

(b)

(c)

(iii) Water :-(a)

(b)

(c)

(iv) Human health :-(a)

(b)

(c)

(c) Protective measures taken to minimize health hazards to the workers involved:-

(i) No of worker(s) sick :-

Weekly	Monthly	Yearly

(ii) Types of sickness :-

(1)

(2)

(3)

(iii) Result of treatment :-

(1)

(2)

(3)

(d) Does the Industry follow the Department of Environment guidelines in this regard?

(e) Are these measures adequate?

If no ; what other measures should be taken?

(i)

(ii)

(iii)

(iv)

15) Is there any environmental assessment: (If yes, explain)

16) Do you think that a distinctive department for waste management in industry is essential? : (If yes, explain)

17) Please show the last report submitted to the Department of Environment?

18) Please comment on the activities of the Department of Environment?

Appendix - II

QUESTIONNAIRE

(For Department of Environment)

(1) Position/category of the interviewee:

(2) Name and address of the Department/Organization/Institution :

(3) Total area under the Department of Environment:

(4) Total no of personnel :-

I II III

(5) Explain the hierarchical setup of the Department of Environment.

(6) Total no of Waste Management personnel:

Type (a) :-

(i) Qualification :- (ii) Experience :-

Type (b)

(i) Qualification :- (ii) Experience :-

Type (c)

(1) Qualification :- (ii) Experience :-

(7) Number of industries under the supervision of Department of Environment?

(8) Types of waste :- (a) Re-usable :-

(b) Non-usable :-

(1) Bio-degradable :-

(2) Non-biodegradable :-

(9) Name of chemicals which are used in :-

(a) Product(s) :-

(b) By-products :-

(10) Way(s) waste disposed of :-

(11) In your opinion is any of these wastes hazardous to :-

(i) Land :-(a) :-

(b) :-

(c) :-

(ii) Agricultural produce: -(a) :-

(b) :-

(c) :-

(iii) Water :- (a) :-

(b) :-

(c) :-

(iv) Human health :-(a) :-

(b) :-

(c) :-

b) What protective measures would you undertake to minimize the above mentioned hazards :

(i) Land :-(a)

(b)

(c)

(ii) Agricultural produce :-(a)

(b)

(c)

(iii) Water :-(a)

(b)

(c)

(iv) Human health :-(a)

(b)

(c)

(c) Protective measures taken to minimize health hazards to the workers involved:-

(i) No of worker(s) Sick :-

Weekly Monthly Yearly

(ii) Types of sickness :-

(1)

(2)

(3)

(iii) Result of treatment :-

(1)

(2)

(3)

(d) Do you have any guideline for minimizing the bad effects of waste?

(e) Does the industry follow your department (DoE) guidelines?

(f) Are these measures adequate?

if no ; what other measures should be taken?

(i)

(ii)

(iii)

(iv)

12) What rules and regulations are followed about the industries location?

13) Is there any re-cycling option : (If yes, explain)

!4) Is there any treatment plant, if yes what is the monitoring system in this regard? (If yes, explain)

15) Is there any distinctive department on Waste Management? (If yes, explain)

16) Do you think that a distinctive department for waste management is necessary in industry : (If yes, explain)

17) Please show the last report which the industry submitted to the Department of Environment?

18) Please comment on the activities of Department of Environment?

(19) Please comment on the interrelationship between the personnel of the Department of Environment and industries about environment?

Appendix - III

Classification of Different Industrial Units or Projects Based on Impact & Location

[vide Rule 7 (2), Schedule 1, Environment Conservation Rules, 1997]

A. Green Category:

1. TV. Radio, etc, Assembly & Manufacture.
2. Watch Manufacture & Assembly
3. Telephone Assembly
4. Toy Manufacture Assembly
5. Book Binding
6. Rope, Mat, Floor Mat (Cotton, Jute & Synthetic)
7. Photography (except cinematography & x-ray)
8. Imitation Leather Product
9. Motor Cycle, Bicycle, Toy Bicycle Assembly
10. Scientific & Mathematical Instrument Assembly (except manufacture)
11. Musical Instrument
12. Sports Goods (except plastic products
13. Tea Packaging (except processing)
14. Powder Milk Re-packing (except manufacture)
15. Bamboo & Cane Products
16. Artificial Flower (except plastic)
17. Pen & Ball Pen
18. Jewelry (shop only except manufacture)
19. Candle

20. Medical & Surgical Goods(except manufacture)
21. Cork Product Manufacturing Plant (except metal product)
22. Laundry (except washing)

Note :

a) All Cottage Industries in industrial schedule except those listed above shall be outside Environmental Clearance requirement (Cottage Industry means industrial manufacture or service by full or part time work of family members and limited to investment ceiling of Tk. 500,000 only);

b) No industry listed above may be located in residential area.

c) As far as possible location of industrial unit in industrialized or designated industrial area or moderately open space is desirable;

d) Location of industrial unit likely to emit unacceptable limit of noise, smoke or bad odor in commercial area is not permissible.

B. Orange-A Category :

1. Cattle Farm (below 10 animals in city & below 20 in village area)
2. Poultry (up to 250 birds in city & 1000 in village area)
3. Whole Flour, Rice, Turmeric/Pepper Milling, Pulse Grinding/Milling (up to 20 horse power)
4. Weaving & Handloom
5. Shoe & Leather Goods Manufacture (up to capital to Tk. 500,000)
6. Saw Mill
7. Wood, Iron/Steel, Aluminum etc. Furniture (up to capital Tk. 500,000)

8. Printing Press.
9. Plastic & Rubber Goods (except PVC)
10. Restaurant
11. Carton/Box Manufacture/Printing & Packaging.
12. Cinema Hall.
13. Dry Cleaning.
14. Imitation Leather Goods Manufacture (up to capital of Tk. 500,000).
15. Sports Goods.
16. Salt Manufacture (up to capital of Tk. 1000,000)
17. Agriculture Machinery & Equipment.
18. Industrial Machinery & Equipment.
19. Jewelry Manufacture.
20. Pin, Gem Clip.
21. Spectacle Frame.
22. Comb.
23. Brass, Bronze, Utensil, Souvenir Manufacture.
24. Biscuit & Bread Manufacturing Plant (up to capital of Tk. 500,000)
25. Chocolate & Lozenge Manufacturing Plant (up to capital of Tk. 500,000)
26. Wooden, Boat Building.

C. Orange-B Category:

1. PVC Products
2. Synthetic Fiber (Raw Material)
3. Glass Factory

4. Life Saving Drug (applicable to formulation only)
5. Edible Oil
6. Coaltar
7. Jute Mill
8. Hotel, Multistory Commercial & Apartment Building
9. Foundry
10. Aluminum Product
11. Glue (except animal glue)
12. Brick/Tile
13. Lime
14. Plastic Product
15. Bottling Potable Water Soft Carbonated Drink Manufacture & Bottling
16. Galvanizing
17. Perfume, Cosmetics
18. Flour (large)
19. Carbon Rod
20. Stone Crushing, Cutting, Grinding
21. Fish, Meat, Food Processing
22. Printing & Writing Ink
23. Animal Feed
24. Ice Cream
25. Clinic & Pathology Laboratory
26. Clay, China clay/Crockery/Sanitary ware (ceramic)
27. Shrimp Processing

28. Water Treatment Plant
29. Metal Utensil/Spoon etc.
30. Sodium Silicate
31. Match
32. Starch & Glucose
33. Cattle Feed
34. Automatic Rice Mill
35. Motor Vehicle Assembly
36. Wooden Vessel Manufacture
37. Photography (X-Ray & cinematography film studio work)
38. Tea Processing
39. Powder Milk/Condensed Milk/Dairy.
40. Steel Re-rolling
41. Wood Treatment
42. Soap
43. Refrigerator Repair
44. Metal & Machine Repair Shop
45. Engineering Workshop (up to capital of Tk. 1,000,000)
46. Spinning Mill
47. Electrical Cable
48. Cold Storage
49. Tire Retreating
50. Motor Vehicle Repair Workshop (up to capital of Tk. 1,000,000)
51. Cattle Farm (above 10 animals in city & above 20 in village area)
52. Poultry (above 250 birds in city & 1000 in village area)

53. Whole Flour, Rice, Turmeric/Pepper Milling Pulse Milling/Grinding (above 20 horse power)
54. Shoe, Leather Goods Manufacture (above capital of Tk. 500,000)
55. Wood, Iron/Steel, Aluminum, etc. Furniture (above capital of Tk. 500,000)
56. Imitation Leather Goods Manufacture (above capital of Tk. 500,000)
57. Salt Manufacture (above capital of Tk. 100,000)
58. Biscuit & Bread Manufacturing Plant (above capital of Tk. 500,000)
59. Chocolate & Lozenge Manufacturing Plant (above capital of Tk. 500,000)
60. Clothing Sweater Manufacturing
61. Apparel Washing
62. Power Loom
63. Road construction/Reconstruction/Extension (feeder road, local street)
64. Bridge construction/Reconstruction/Extension (below 100 meter length)
65. Public Toilet
66. Ship Breaking
67. G I Wire
68. Battery Assembly
69. Dairy & Food.

Note :

a) No industry listed above may be located in residential area.

b) As far as possible location of industrial unit in industrialized, or designated industrial area, or moderately open space is desirable.

c) Location of industrial unit likely to emit unacceptable limit of noise, smoke, bad odor in commercial area is not permissible.

D. Red Category:

1. Leather Processing (tannery)
2. Formaldehyde
3. Urea Fertilizer
4. TSP Fertilizer
5. Chemical Paint, Polish, Varnish, Enamel.
6. Power Plant
7. All Mineral Projects (Coal, limestone, hard rock, natural gas, petroleum etc.)
8. Cement
9. Oil Refinery
10. Synthetic rubber
11. Paper & Pulp
12. Sugar
13. Distillery
14. Fabric Dyeing & Chemical Treatment
15. Caustic Soda Potash
16. Other Alkali
17. Iron & Steel Plant
18. Pharmaceutical Raw Materials Basic Medicine

19. Electroplating
20. Photo Film Paper & Chemical
21. Manufacture of Miscellaneous Products from Coal & Petroleum
22. Explosive
23. Acids & their salts (Organic Inorganic)
24. Nitrogen Compounds (Cyanide etc)
25. Plastic Raw Material Manufacture (PVC PP/ Steel Polystyrene etc)
26. Asbestos
27. Fiberglass
28. Insecticide Fungicide & Pesticide
29. Phosphorus & its Compounds
30. Chlorine, Fluorine, Bromine, Iodine & their compounds
31. Industrial gases (except nitrogen/Oxygen & carbon dioxide
32. Waste Insecticide
33. Other Chemicals
34. Arms
35. Nuclear Power
36. Liquor
37. Other Non-metallic Chemicals (not mentioned above)
38. Other Non-metals (not mentioned above)
39. Industrial Estate
40. Basic Industrial Chemicals
41. Non- ferrous Metal Elements
42. Detergent
43. Earth filling Industrial/ Domestic/ Commercial waste

44. Sewerage Treatment plant
45. Life saving Drug
46. Animal Glue
47. Rat killer
48. Re-factories
49. Industrial Gases (Oxygen Nitrogen & Carbon dioxide)
50. Battery
51. Hospital
52. Ship Building
53. Tobacco processing/ Cigarette / Biri Manufacture
54. Metal Body Vessel Building
55. Wooden Body Vessel Building
56. Refrigerator/ Air conditioner/Air cooler Manufacture
57. Tire & Tube
58. Board Mill
59. Carpet
60. Engineering Workshop above capital of Tk. 1000,000
61. Motor Vehicle Repair Workshop above capital of Tk.1,000,000
62. Water Treatment Plant
63. Sewerage Pipeline laying/ re-laying/ extension
64. Water, Electricity, Gas Distribution System construction/ re-construction /extension
65. Mineral Resources exploration/mining / distribution
66. Flood Control Dam, Polder, Dyke etc. construction/ re-construction/ extension

67. Road Construction/ Reconstruction/ Extension (regional national & international)
68. Bridge Construction / Reconstruction/ Extension (length 100 meters or over)
69. Muriate of Potash (manufacturing)

Note :

a) No industry listed above may be located in residential area.
b) As far as possible location of industrial unit in industrialized or designated industrial area or moderately open space is desirable.
c) Location of industrial unit likely to emit unacceptable limit of noise, smoke, bad odor is not permissible.
d) After obtaining Location Clearance based on IEE report, the EIA report including Time Frame and ETP diagram have to be submitted subsequently as per approved program outline.

Appendix - IV

Application for Environmental Clearance

[vide Rule-7 (5)

Director/ Deputy Director

Department of Environment

Dhaka Division/ Chittagong Division/ Khulna Division/ Rajshahi Division (Bogra)

Sir,

I hereby apply for Environmental Clearance with documents containing following information for our proposed /existing industrial unit or project.

1. Name of industrial unit or project:
   a) Address of industrial unit/location of project:
   b) Present office address:

2. a) Proposed industrial unit or project:
   Expected date of start construction:
   Expected date of finish of construction:
   Expected date of start of trial production of industrial unit, the same of project in other cases:
   b) Existing industrial unit or project::
   Date of start or trial production of industrial unit, the same of project in other cases:

3. Name of the manufactured product & quantity/ daily/ monthly/ annually:
4. a) Name of raw materials & quantity daily /monthly/annually:
   b) Origin or raw materials:

5. a) Daily use of water:
   b) Origin of water:

6. a) Name of fuel & quantity/daily/ monthly /annually:
   b) Origin of fuel:

7. a) Expected quantity of liquid waste daily:
   b) Waste discharge location:
   c) Expected quantity/gaseous effluent:
   d) Mode of gaseous effluent discharge:

8. Mouza map with Dag & Khatian:

9. Approval of Rajdhani Unnayan Kartripakkha/ Chittagong Unnayan Kartripakkha/Khulna Unnayan Kartripakka (if applicable):

10. a) Expected Time Frame including Diagram of Effluent Treatment Plan (ETP)
    b) Allotted fund:
    c) Land area:

11. Process Flow Diagram:

12. a) Location map of industrial unit or project :
    b) Layout Plan (including location of ETP):

13. a) IEE/EIA Report (if applicable):
    b) Environment Management Plan (if applicable):

14. Feasibility Report (if applicable):

Signature of Sponsor

Name :
Address :
Phone :
Date :

Declaration:

I hereby declare that, to the best of knowledge, the information given in the application is correct and nothing has been concealed or distorted.

Name of sponsor & signature

Must be signed in every page by manufacturer & sponsor.

Appendix -V

Procedure for Granting Environmental Clearance

(1) For granting of Environmental Clearance industrial units and projects shall be divided into four categories as follows depending upon impact on environment and location:

a) Green;

b) Orange-A;

c) Orange-B; and

d) Red.

(2) The lists of industries and projects mentioned in Sub-clause (1) above are given in Schedule 1;

(3) All existing industrial units and projects of all categories and proposed industrial units and projects of Green Category shall be granted Environmental Clearance:

(4) For proposed industrial units and projects of Orange A, Orange B and Red categories at first Location Clearance shall be given. It is also provided that, upon application by an industrial unit or project, if the Director General feels proper, he/ she may grant Environmental Clearance to the same directly without first giving Location Clearance.

(5) The sponsor of the industrial unit or project with payment of required fees described in Schedule 13 shall apply in Form 3 to the relevant Divisional officer for Environmental Clearance.

(6) The following papers must be submitted with the application mentioned in Sub-clause (5) above:

a) for Green Category:

i) General information on the industrial unit or project.

ii) Proper description of the manufactured product with raw materials: and

iii) No Objection Certificate (NOC) from the local authority.

b) for Orange-A Category:

i) General information on the industrial unit or project

ii) Adequate description of the manufactured product with raw materials.

iii) No Objection Certificate from the local authority

iv) Process Flow Diagram.

v) Layout Plan (showing Effluent Treatment Plant)

vi) Waste discharge arrangement.

vii) Outline of relocation or rehabilitation plan (where applicable)

viii) Other necessary information (where applicable)

c) for Orange-B category:

(i) Feasibility Report of the industrial unit / project (applicable only for proposed industrial unit or project)

ii) Initial Environmental Examination (IEE) Report of the industrial unit or project (applicable only for proposed industrial unit or project) including Process Flow Diagram, Layout Plan (showing location of Effluent Treatment Plant (ETP) diagram of ETP.

iii) Environmental Management plan (EMP) Report including Process Flow Diagram of the industrial unit or project Layout Plan (showing location of ETP) diagram of ETP with information on its function (applicable only for existing industrial unit or project)

iv) No Objection Certificate of the local authority

v) Pollution Effect Abatement Plan along with Emergency Plan for adverse environmental impact

vi) Outline of relocation or rehabilitation plan (where applicable)

vii) Other necessary information (where applicable)

d) for Red Category;

(i) Feasibility Report of the industrial unit or project (applicable only for proposed industrial unit Or or project)

ii) IEE Report including program outline of Environmental impact Assessment (EIA), Process Flow Diagram of the industrial unit or project, or EIA Report based on program outline previously approved by the Department including Layout Plan (showing location of ETP) of the industrial unit or project. Process Flow Time Frame Diagram

(applicable only for proposed industrial unit or project)

iii) Environmental Management Plan (EMP) report including Process Flow Diagram of the industrial unit or project, Layout Plan (showing location of (ETP), diagram of ETP with information on function (applicable only for existing industrial unit or project);

iv) No Objection Certificate of the local authority;

v) Pollution Effect Abatement Plan along with Emergency plan for adverse environmental impact,

vi) Outline of relocation or rehabilitation plan (where applicable);

vii) Other necessary information (where applicable).

(7) Upon receiving of application vide Sub-clause (5) above along with documents mentioned in Sub-clause (6) in case of Green Category industrial unit and project, Environmental Clearance will be granted to the relevant sponsor within 15 working days or the application will be turned down giving reasons;

(8) Upon receiving of application vide Sub-clause (5) along with documents mentioned in Sub-clause (6) Location Clearance shall be granted within 30 working days for proposed industrial unit and project of Orange-A Category and within 60 working days for proposed industrial unit and project of Orange-B Category and Red Category, or the application will be turned down giving reasons;

(9) Upon receiving of Location Clearance vide Sub-clause (8) above, the

sponsor :-

(i) Shall be able to undertake land development and infrastructure development program;

(ii) Shall be able to install machinery including ETP (applicable for industrial unit and project of Orange-A Category and Orange-B Category only).

(iii) Upon completion of works mentioned in (i) and (ii) above shall apply for Environmental Clearance informing of the same;

The applicant shall not be able to obtain gas connection without Environmental Clearance and shall not be able to start trial production in case of industrial unit and operation in other cases (applicable for industrial unit and project of Orange A Category Orange B Category only)

(iv) Based on program outline mentioned in IEE Report including Time Frame and ETP Diagram, prepare EIA Report and submit the same for approval of the Department within given time (applicable for industrial unit and project of Red Category):

(10) Upon receiving of application vide Sub- clause (9iii) above, Environmental Clearance shall be granted to the sponsor within 15 working days for industrial unit and project of Orange A Category and within and within 30 working days for industrial unit and project of Orange B Category or the application will be turned down giving reasons;

(11) Upon receiving of application vide Sub-clause (9 iv) above the EIA Report and the Time Frame including ETP Diagram shall be approved within 60 working days for industrial unit and project of Red Category, or the application will be turned down giving reasons;

(12) Upon receiving approval of EIA vide Sub- clause (11) the sponsor :-
(i) Shall be able to open letter of credit for importable machinery which will include ETP related machinery and
(ii) After installing ETP apply for Environmental Clearance;
shall not be able to obtain gas connection without Environmental Clearance and shall not be able to start, trial production in case of industrial unit, and operation in other cases;

(13) Upon receiving application vide Sub-clause (12ii) above Environmental Clearance shall be granted to the sponsor within 30 working days for industrial unit and project of Red Category or the application will be turned down giving reasons;

(14) Upon receiving application vide Sub-clause (5) above along with documents mentioned in Sub-clause (6), Environmental Clearance shall be granted to the sponsor within 30 working days for existing industrial unit and project of Orange A Category and within 60 working days for existing industrial unit and project of Orange B Category and Red Category or the application will be turned giving reasons.

Appendix -VI

List of Important Environmental Legislation

1. The Bangladesh Penal Code, 1860 (as amended from time to time)
2. Chittagong Hill Tracts Regulation, 1900
3. The Smoke Nuisances Act, 1905
4. The Explosive Substance Act, 1908 (modified up to may,1983).
5. The Destructive Insects and Pests Act, 1914
6. The Agricultural and Sanitary Improvement Act, 1920
7. The Boilers Act, 1923
8. The Vehicle Act,1927
9. The Forest Act, 1927
10. Water Hyacinth Act, 1936
11. The Agricultural Produce (Grading and Marking) Act, 1937
12. The Tanks Improvement Act,1939
13. The Acquisition of Waste Land Act, 1950
14. East Bengal Conservation and Protection of Fisheries Act, 1950 (amended in 1982)
15. The Embankment and Drainage Act,1952
16. The Town Improvement Act, 1953
17. The Public Safety Ordinance, 1953
18. The Culturable West Land (Utilization) Ordinance, 1959
19. The Chittagong Development Authority Ordinance, 1959
20. The Forest Industries Development Corporation Ordinance, 1959
21. The Bangladesh Penal Code, 1860 (as amended from time to time)
22. Water Supply & Sewerage Authority Ordinance 1963 (with amendment

of 1989)

23. The Factories Act, 1965
24. The Agricultural Pesticides Ordinance, 1971
25. The Bangladesh water and Power Development Board Order, 1972
26. Statute of the Indo- Bangladesh Joint Rivers Commission, 1972
27. The Bangladesh Fisheries Development Corporation Act, 1973
28. The Bangladesh Wild Life (Preservation) order, 1973
29. The Territorial Water and Marine Zones Act, 1974
30. The Chittagong Division Development Board Ordinance, 1976
31. The Paurashava Ordinance, 1977
32. The Environmental Pollution control Ordinance, 1977
33. The Chittagong Metropoliton Ordinance, 1978
34. Factories Act, 1965 and the Factory Rules, 1979
35. The Chittagong City Corporation Ordinance, 1982
36. The Chittagong District Development Board Ordinance, 1982
37. Local Government Ordinance, 1982 (Upazilla Parishad and Upazilla Administration Reorganization).
38. The Dhaka City Corporation Ordinance, 1983
39. The Motor Vehicle Ordinance, 1983
40. The Marine Fisheries Ordinance, 1983
41. Petroleum Act, 1984
42. Labor Laws (amended up to 1987)
43. The Forest (amended) Ordinance, 1989
44. Environment Policy, 1992
45. The Bangladesh Environment Conservation Act, 1995
46. The Environment Conservation Rules, 1997

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