Evaluation of Environmental Impact Assessment (EIA) Process and Its Role in Mitigating Industrial Pollution

By

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APPROVAL SHEET

Thesis of Robina Naz, Department of Environmental sciences University of Peshawar on "Evaluation of Environmental Impact Assessment (EIA) Process and Its Role in Mitigating Industrial Pollution" is hereby approved in partial full filaments of the requirement for the award of degree of Doctorate of Sciences in Environmental Sciences.

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All praises to **ALLAH**, the most merciful, kind and beneficent, and source of all knowledge, wisdom, within and beyond our comprehension. He is the only God who can help us in every field of life. All respect and possible tributes goes to our **Holy Prophet Muhammad (PBUH),** who is forever guidance and knowledge for all human beings on this earth.

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List of Abbreviations

Abbreviation	Detail
EIA	Environmental Impact Assessment
IEE	Initial Environmental Examination
Nox	Oxides of Nitrogen
Sox	Oxides of Sulphur
CO2	Carbon Dioxide
PEPA	Pakistan Environmental Protection Act
KP	Khyber Pukhtunkhwa
SDA	Sarhad Development Authority
Pak-NEQS	Pakistan National Environmental Quality Standards
PVC	Poly Vinyl Chloride
PCSIR	Pakistan Council of Scientific and Industrial Research
CO	Carbon monoxide
PEPC	Pakistan Environmental Protection Council
EPA	Environmental Protection Agency
PEPO	Pakistan Environmental Protection Ordinance
EPT	Environmental Protection Tribunal
TSS	Total Suspended Solids
TDS	Total Dissolved Solids
COD	Chemical Oxygen Demand
NOC	No Objection Certificate
BOD	Biological Oxygen Demand
SPCS	Sarhad Provincial Conservation Strategy
TON	Threshold Odor Unit
USA	United States of America

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ABSTRACT

This study was conducted in 2013-15 on three main industrial estates of Khyber Pukhtunkhwa (KPK). The purpose of the study was to analyze the current industrial set up, estimate pollution load/status i.e water, air and noise, and identify role of Environmental Impact Assessment (EIA) in pollution abetment. For this purpose the three industrial estates were analyzed for three main categories include steel mill, paper industry and marble industries. Two surface water bodies i.e. Kabul River and Haro River, the receiving water bodies were also analyzed for various physical and chemical parameters. Besides, three EIA reports were evaluated for its role in pollution abatement.

Till 2012 there were 640 industrial units operational. EIA/IEE was conducted for 203 industries only. out of this three industries, for which EIA was conducted were analyzed in detail. Among these Paper mill was observed as polluted most industry. Instead of EIA, no mitigation measures were observed in paper mill. The total annual pollution load, calculated for paper and marble industry was 691 thousands and 7814 Kg respectively. Similarly air pollution and noise level was also observed high in steel industry with no mitigation measures.

By comparing the various air and water parameters revealed that most of the industries were not complying with Pakistan National Environmental Quality Standards (Pak-NEQS) or the list is incomplete or deficient. For example, Steel industries were studied for water recycling. From recycling point of view, two parameters, are important but not mentioned in the list of Pak-NEQS i.e. odor and turbidity. If we make these parameters part of the NEQS and address it properly then the water used in the steel mills can be recycled. After experimentation, to solve the problem of coliform baxteria and odor, KMnO4 was suggested. Occupational health and safety is also not mentioned in the IEE/EIA Regulations 2000. Therefore the situation of occupational health and safety is very poor.

This revealed that EIA process is very deficit and has got no proactive or reactive role to combat environmental pollution. It is therefore recommended to revisit the Pak-NEQS and IEE/EIA Regulations for further improvement and make research and development process as part of the EIA process.

CHAPTER I INTRODUCTION

Environmental pollution is one of the major threats to the modern and urbanized society. The fundamental drivers of pollution are population growth, industrialization and globalization. In addition, there are primary and secondary drivers of pollution that are adversely affecting the environment. However, the sources of pollution are manufacturing industries and power generation (Anwar, 2008).

The primary and secondary drivers of pollution are production and consumption. The process of production starts with the manufacturing of goods and materials that are then consumed by the population of a society. The production driver is referred to as industrial goods, power generation, and transport system as well as agriculture and timber production. The secondary factors of pollution causing agents are individual consumers, residential consumers, commercial and social consumers (Ashfaque, 2000). The waste products failed to recycled causes major portion of pollution to the environment. Environmental pollution is also only detrimental to the human health and human population. According to World Health Organization (WHO) environmental pollution and impacts on health are visible now. Pollution of all levels is seriously damaging the health of human population. The onset of epidemics is one manifestation of environmental degradation (Jatinder and Chadha, 2006).

In most developing countries pollution level has been increased to the level, especially in the populated areas to its dangerous level. . In fact, it is the problem of developed countries more because the process of industrialization started in 19th century in developed countries. Industrialization started much late in the developing countries in this respect. The only difference is that in developed countries the sustainable systems of recycled waste and dumping the nonrecycled waste is quite efficient. Whereas, in developing countries the focus is on the development of industrial cities, and not on utilizing the industrial as well as domestic waste in productive manner. Therefore, the problem of pollution is quite obvious in under developing countries (Longley and Gallagher, 2004).

In poor countries of the world 80% of the polluted water is used for irrigation. Polluted water used for irrigation causes many health problems in people consuming them on daily basis. The adulteration of food products come late in this category when vegetables and other human-grown crops have become contaminated with polluted water (Zeka and Zanobetti, 2005).

Similarly, when lower middle classes form their own communities near the industrial areas to get employment in the industries create non-healthy environment for them as well as for the environment. They do not have sewerage system and no proper way of dumping waste. Industry, clustered and semi-clustered in “urban areas surrounded by densely populated, low in-come localities, continues to pollute the environment with impunity**.** Over the last three decades there has been increasing global concern over the public health impacts attributed to environmental pollution” (WHO, 2002). Many countries have taken the initiative to address the issue of environmental problem on governmental level. Human exposure to pollution is believed to be more intense now than at any other time in human existence. The peak of industrial growth and modernization has affected the environment gradually but in a more severe way. Now human existence has to fight for their survival on many grounds. Among them the

issue of environment pollutions seems to be more prevalent and pervasive in nature as compare to wars, global warming and, dearth of natural resources, and atomic radiations (Beg, 2000).

Pollution can be made by human activity and by natural forces as well. According to various research, it is evident that nature can also create pollution along with human intervention. The requirement of the time suggests the need for eradication of pollution from the grass root levels irrespective of developed and underdeveloped countries (GTZ-NWFP, 2000).

Private sector, due to lack of proper information and education is one of the main reason of the pollution. There is a need to tune our industrial activities with the adaptation of legislative technology coverage. Some changes that are occurring in nature are beyond human control irrespective of their modern technological inventions and scientific procedures. Sometime we blame nature for environmental pollution with the idea to justify our polluted acts such as volcano eruptions contribute huge amount of pollution load. Similarly, natural disasters in the form of Tsunami, Tornadoes, floods, and earth quakes are playing the significant role in devastating the natural environment as well as demolishing human population, their resources and infrastructure. Natural disasters not only pollute the environment but also cause heavy losses of economic nature also. But these cannot be presented as justification to keep man made pollution continue. (Mark, 2004).

Human intervention to natural forces has caused pollution on many levels. The major affect, however, could be seen in air, water and soil pollution. South of Poland, Ukraine, China, and Pakistan are facing air pollution. Polluted air contains one or more hazardous substance, or contaminant that poses negative impact on the general health of human population in these countries. The pollutants in air could be heavy metals, Carbon mono oxide, Benzene, ground level ozone, sulphur dioxide and nitrogen dioxide

In the same way, polluted water is hazardous to human health and well being. Approximately 2.4 million people do not have access to clean drinking water. The polluted water contains industrial effluents, sewage water, rain water and polluted by agriculture and household use pose serious damage to the water used for drinking. “Pakistani cities are facing tribulations of urban congestion, deteriorating air and water quality and major cities are facing crop failure, desertification, land degradation, clean drinking water, noise pollution, sanitation” (Anindita basak 2009).

Wide-scale industrialization in combination with population growth, and urbanization contributed to all segments of environmental pollution of air, water and soil. This was further aggravated by fluctuation in climatic conditions and put more pressure on environment in general and urban environment in particular (Banerjee and Srivastava, 2011).

To tune our developmental activities and address all the mentioned problems, the concept of environmental impact assessment was introduced. “EIA refers to the evaluation of the effects likely to arise from a major project (or other actions) significantly affecting the natural and manmade environment” (Nyirabakwiye,2008) Pakistan developed its industrial base very slowly; still its environmental impacts are visible in cities and surroundings of main industrial Estates (Akif et al, 2011). Inspite of good legal basis and detail guidelines, various research studies revealed that EIA in Pakistan is

still under developmental stages (Riffat and Daulat, 2006). The various problems include "inadequate capacity of EIA approval authorities, deficiencies in screening and scoping, poor EIA quality, inadequate public participation and weak monitoring" (Nadeem and Hameed, 2008).

In 1947 Pakistan had only 11 industrial units. Industrialization was accelerated as a result of 1st five years plan prepared in 1955. At that time no attention was paid to environmental aspect of the country. In this way solid waste, air emission, industrial effluents, domestic sewage and other waste water were thrown into environment with no prior treatment (Shinwari, 1994). In comparison to other part of Pakistan the process on industrialization was slow in Khyber Pukhtunkhwa (KP) province. Pakistan Industrial Development Corporation worked on industrialization in KP during 1955-1960. After 1960 the responsibility was handed over to Sarhad Development Authority (SDA). SDA established 12 industrial Estates in KP provinces. (Asia 2012).

No doubt, industrialization has got positive impacts in the form of goods, services and jobopportunities, but despite of its positive impacts it has adversely affected the surrounding environment. Presently 50% of all industries fall in textile and food sector. Remaining 50% include mineral processing, paper, chemical and wood. All these industries are producing wastes of various types in the ambient environment and nearby sink without any prior treatment (Zahidullah and Nafees. 2010).

Industries are important for economic growth with negative impacts on the environment if suitable mitigation measures are not adopted at earlier stage (Ullah *et al*, 2013). It has been reported that various industries discharge their effluents directly in the river Kabul (Tariq et al, 2006). The compatibility of industrial development with environment demand for the study of various environmental segments (Theofanoudi et al, 2008).

Waste water samples and water of River Kabul at a few locations were found to be high in COD, BOD and Fecal coliform rendering it unfit for irrigation and human consumption (Nafees, 2004) Effluents from Khazana Sugar Mills, Colony Sarhad Textile Mills, Adamajee Paper and Board Mills and from different tanneries are the main sources of organic pollution in the River Kabul Reduction in fish population in Kabul River could be referred to the increased organic pollution contributed by industries**.** For example Textile Industry discharges various pollutants in concentration that are above the permissible limits laid down in Pakistan National Environmental Quality Standards (Pak-NEQS). The textile effluents contain toxic metals, high oxygen demanding wastes and sulfide. (Akif et al, 2011)

Therefore, to cope with the growing trend in environmental pollutions an assessment tool was introduced in the form of Environmental Impact Assessment (EIA) during early ninety (Needhidasan, 2013). From the very start there is a regular development in EIA process and methodology. The objective was to accelerate the EIA process, identify and adopt preventive measures to safeguard environment **(**Perdicoulis & Glasson**,** 2006**)**. Environmental Impact Assessment (EIA) depends on the institutional framework along with implementable rules regulations **(**Paliwal, 2006**).**

EIA has the inherited potential to help in achieving sustainable planning and development. This is how it is useful in safeguarding our surrounding environment. The focus of EIA is not only mitigation measures but also highlighting construction, rehabilitation and conservation of the degraded part of the ecosystem. To achieve all these, EIA needs further improvement to be used as a tool for sustainable planning (Pope et al, 2013).

EIA aims to analyze a particular development policy for its negative and positive impacts. The objectives identified in a policy are tuned in such a way to facilitate decision makers and other relevant forums. One thing is clear that EIA is not responsible to conclude and recommend but provide guidelines for the same.EIA sometimes works as a communication tool among the technical experts and the decision makers and provide relevant information for final decision on a project, (Lee, & Kirkpatrick 2006).

Pakistan started its journey of Environmental Impact Assessment (EIA) in 1983 by promulgating Environmental Protection Ordinance 1983. This paved the way for approval of Pakistan Environmental Protection Act 1997 and EIA. EIA process was further strengthened, with the approval of EIA Regulations 2000. The aim of these efforts was to focus developmental activities, especially industries and mitigate environmental pollution (Nafees et al., 2015).

As recommended by United National Conference in 1992 EIA is required to be used as a tool for the analysis of various developmental activities. For this consensus of the concerned governmental department is important (European Commission. 2002).

This study is an attempt to review present EIA practices and mitigation measures adopted for pollution mitigation in various industries with the objective to find out ways and means to make the EIA process efficient for minimization/ reducing pollution load contributed by industrial Estates.

Problem Statement and Research Questions

The main objective attached with EIA/IEE was to reduce pollution load. Various studies conducted during 1977-2010 revealed that no decrease in pollution has been observed (Nafees, 2010). Not only this, EIA received a lot of criticism in terms of mismanagement and its ineffectiveness in pollution control (Nafees, 2004). Now EIA is just a formality and limited to report writing only. Besides, EIA/IEE is still a hard cake and not an unwanted activity for industrialist (Nadeem *et al*., 2008). It is, therefore, required to review the present ongoing EIA process for deficiencies if any and suggest improvement.

Study Area

This study cover three main industrial Estates of Khyber Pukhtunkhwa i.e. Hattar, Hayatabad and Gadoon industrial Estates, comprising of various sectors like ghee, steel, poultry feed, marbles, chemicals, match, food Industries etc.

CHAPTER II LITERATURE REVIEW

Environmental pollution has become one of the major global problems of present day scenario. Every country either developed or underdeveloped is working on devising preventive measures to deal with the issue of environmental degradation worldwide (Anindita Basak 2009) published by Dorling Kindersley, India Pvt. Ltd.

In Pakistan air pollution is a burning issue for the environmental agencies. Inspite of the low energy consumption in comparison to international standards air pollution in Pakistan is alarming. Biomass burning is problematic due to the high level of particulate matter as well as carbon monoxide and other harmful gases. The level of particulate matter (PM) in main Pakistani cities is almost 2 to 3.6 times higher than WHO standards. (Khwaja et al 2012)

In Pakistan, the problem of pollution is much more serious due to lack of awareness, advocacy campaigns and minimum resources to initiate projects on small scale. To understand the seriousness of the matter, public as well as private institutions are conducting research to analyze water, soil and air contaminants and how to mitigate the root cause of this matter. During the past few decades many researchers have appeared on the scene of studying water, soil and air pollution in detail. To deal with the global issue of environmental pollution, the government of Pakistan has formulated an action plan to tackle the issue of pollution in its major cities. The action plans refers to as Environment Impact Assessment (EIA). The major function of this platform is to pinpoint such actions that are adverse to the sanctity of environmental protection. Therefore, it is mandatory for industrial sector of the country to abide by the rules and regulations of EIA. EIA primarily follow the international standards set for the protection of environment on all four major levels: water, air, soil, and noise pollution (Barker, 1999).

The Environmental protection agency needs to comply with the international standards for environment protection. Many research reports have explored the efficiency of EIA plan of action. Pakistan, as low-income generating country needs considerable amount of financial funding to create projects sustainable for the protection of environment as well as for the well being of human population (Bekhechi, 2002).

The quality of drinking water is deteriorating due to the contaminants present in it. The reason behind excessive cause of water pollution is direct discharge of waste in the rivers, exposure of industrial affluent to the drinking water. To decrease the problem of water pollution government of Pakistan has devised many action plans.

Recently, a research study has been conducted to examine the levels of mercury and arsenic from industrial waste that is damaging the drinking water in polluted as well as non-polluted areas of the city. Mercury and arsenic are two metals that are harmful for human consumption. Therefore, the purpose of

the study was to detect the presence of both these metals in the water. The area of lower Dir district has been taken as the controlled variable in the study.

As far as soil pollution is concerned it is a problem of many developing and poor countries worldwide. Countries like Africa, Asia and Latin America tends to use the waste water without treating it any further for many purposes. In the Middle East low income countries like Tunisia and Jordan treated waste water is used (Faruqui et al., 2004). In Pakistan and Dakar regions, most of the farmers prefer to use waste water over fresh water even if it is readily available for irrigating their crops and vegetables. The reason behind this approach is earning more profits by using sewage water. In this way, many farmers grow crops three times a year as compare to farmers using fresh water. Moreover, farmers use wastewater because it is available in large quantities as compare to rain or fresh water supply.

Therefore, In Pakistan (Clemett, et al., 2006), farmers using wastewater earned approximately US$300 per year more than those using freshwater. Furthermore, wastewater not only generates profits for farmers but also provide urban and sub-urban agricultural communities with employment and income for traders who buy their vegetables. However, waste waters are degenerated with trace elements like lead, copper, boron, cobalt, arsenic, chromium, zinc, molybdenum, and manganese. Many of them are not necessary for human consumption. Some of them become toxins to plants, animals and human being.

Another research has been conducted to analyze the condition of surface as well as ground water in Peshawar region. The main purpose is to monitor the condition of various fresh water resources along with soil and air in Peshawar valley with the idea to know about temporal effect of various discharges in the valley.

The government of KPK has taken serious measures to improve the environmental conditions of the province as well as of Peshawar city. The department of Environment protection has devised 'National Environment Quality Standards' in order to control the environment pollution to the maximum extent. There are four basic provisions of the NEQS that need to be in compliance with the existing framework of industrial sector.

According to the NEQS standards owners of industries, textile mills, power generation, and tanneries are bound to follow these standards. In case, they fail to follow these rules they will be given heavy penalty. These four standards are as follows:

- "Prohibits discharge or emission of any effluent or waste or air pollutant or noise in excess of the NEQS, or the established ambient standards for air, water or land" (Govt of Pakistan -1997).

- "Prohibition of hazardous wastes on the areas of human population" (Govt of Pakistan 1997).

- “Prohibits the handling of hazardous substance expect under license or in accordance with provision of any local law or international agreement” (Govt of Pakistan -1997).

- “Prohibits operation of motor vehicles for each air pollutant or noise is being emitted in excess of the NEQS or the established ambient standard” (Govt of Pakistan -1997).

All the related information regarding environmental reformation can be studied on the official website of KPK government. On the similar lines, the institution of Environmental Impact Assessment has been developed. The Environmental Impact Assessment is an orderly organized study that should be included in a developmental activity at early stage of planning. It is at the stage of diagnosing the environmental problems and causes, in order to devise the strategies to improve the environmental condition of the province. The EIA is the process to analyze all the adverse as well as positive impacts on the environment caused by any developmental activity started on the government as well as private level. Upon studying all the effects, the responsibility of the EIA officials is to prepare sufficient measures to mitigate the degenerating effects of pollution from the environment. The major contribution of EIA is its proper utilization of the resources, minimizing the capital costs, providing well reviewed decision making process for long lasting development. The role of EIA is to ensure the environmental safety while taking mitigation measures to improve the devastating condition in specific areas.

In addition, the main focus of EIA unit is to make sure that the implementation of Section 12 of the Act 1997 is being done. The Section states, "No proponent of a project shall commence construction or operation unless he has filed with the Government Agency, where the project is likely to cause adverse environmental effects an Environmental Impact Assessment, and has obtained from the Government Agency approval in respect thereof” (Government of Pakistan 2000)." The EIA department of KP entails full time Director General, Deputy Director, Assistant directors, lab analysts and Monitoring Inspectors.

The government has taken another initiative for the implementation of environment friendly projects as well as taking measures to keep the environment safe from water, air and soil pollution. This is called Initial Environmental Examination IEE that is used as assessment technique just like EIA. The only difference between EIA and IEE is their scope of work. IEE tackles the environmental issues on a smaller scale. Whereas, EIA is responsible for projects designed to improve the environment on provincial level (Khan and Iqbal, 2001).

Another important polluting agent is the air. The air used for breathing could be damaging for health when it gets contaminated with hazardous gases and metals. In an urbanized and industrialized countries air pollution is increasing rapidly. Air pollution is one of the major environmental problems Pakistan is facing since the beginning of the industrialization. The propellers of air pollution are evident in their nature. the use of inefficient energy, increase in growth of vehicles manufacturing and export, growth in industrial processes without proper treatment of air emissions from the plants, burning of plastic and solid waste in open air and use of substances that are devastating for the sanity of ozone

layer are some of the major reasons of increase in air pollution in Pakistan. The issues regarding air pollution has been analyzed within the framework of Pressure, State, Impact and Response (PSIR).

The increase in the demand of energy, fuel consumption from increasing number of vehicles that emit high intensity of coal, oil and energy consumption by the various industries are the major factors to air pollution. The quality of air has been examined by analyzing the emission levels of air pollutants and ambient air quality. Astonishingly, the increase in the intensity of sulphur dioxide in the air quality of industry, transport and power has increased 23 folds from the last two decades. In the same fashion, the increase in carbon dioxide is greater that is four times more than sulphur dioxide in air. The increase is alarming in its nature and requires immediate measures to overcome the problem of air pollution. Unfortunately, Pakistan's per capita green house gas emissions are quite low according to global average (Poon et al, 2006). Moreover, the data regarding ambient air quality show the level of carbon monoxide in Karachi and Lahore are higher than the recommended levels of World Health Organization. The study reveals that the average levels of carbon monoxide are higher in major cities of Pakistan including Peshawar, Rawalpindi, Lahore and Karachi that have high amount of CO levels. The impacts of polluted air on health of human population are beyond measures. The factors including deforestation, soil erosion, low productivity cause loss of 1.71 billion dollars in the early 1990s. The loss attributed to air pollution, in terms of health emergencies, amount to 500 million dollars a year.

In order to improve the air pollution in major cities of Pakistan, government has established an organization that formulates policies in favor of environmental protection and safety. The name of the organization is National Environmental protection agency (EPA). It works according to the Pakistan Environmental Protection Act 1997 that covers air, water, soil and noise pollution.

Steel mills in Pakistan are also contributing to air pollution as they produce metal dusts, gaseous emissions, and slag. All these polluting agents are causing air pollution by affecting the quality of air. The research conducted by the Pakistan Environmental Protection Agency concludes that smoke produced during the process of charging the furnace causes significant value of air pollution. Twelve kilograms per ton of product is produced during burning of furnace and air getting discharged from it. The dust components of metals are zinc, cadmium, and lead. They vary in composition and its contents from scrap to scrap quality (Agha et al, 1995).

In the process of burning scrap by using electric induction poses severe health hazards to the workers in particular and to the whole environment of human population in general. The extremely high temperature gases create many health issues for the workers. These gases include NO_2, SO_2, and CO in the form of thick black smoke. To maintain the environmental pollution at its minimum level, National Environmental Quality Standards have been applied to ensure that steel mills do not use any scrap that causes pollution (Sepúlveda, et al., 2010).

The first research study is carried out on the water quality of water bodies and rivers in Pakistan by Pakistan Council of Research in Water Resources. The research sampling included 21 cities, 6 rivers and 10 reservoirs and lakes. The findings of the research reveal the prevalence of bacterial existence in the

water of these samples. The bacteria present in all the water samples are called coliform bacteria. In 17 cities bacterial contamination is found to be 50%, while in other remaining cities the presence of bacteria is 100% which means water is not suitable for human consumption. In addition, the inorganic contamination of metals is also present at high risk. The water samples are replete in sulfur, sulfates, iron and fluorides (PEPC, 2001).

Bangash et al (2006) conducted a study on the effluent of some selected industries of Hayatabad Industrial Estate Peshawar and analyzed the parameters like PH, Conductivity, temperature, suspended solids, hardness, alkalinity, chlorides, sulfites etc and found that some parameters are beyond the permissible limits.

Tariq et al (2006) carried out a study on various industrial effluents of Hayatabad Industrial Estate (HIE), Peshawar. He analyzed different parameters like pH, electrical conductivity, total dissolved salts, total suspended solids, biological oxygen demand and heavy metal contents (Cd, Cr, Cu, Fe, Mn, Ni, Pb, Zn).for this purpose 12 samples were collected from industries like marble, matches, steel, aluminum, pharmaceutical, beverages, ghee industries, one from the main drain and some from tube well and dug wells of that area. The analysis result shows that these industries have extreme negative impact on the ground water resources and possible mitigation measures should be followed to address these issues.

Rajaram & Das (2008) conducted his research on water pollution by industrial effluents in India in his paper the researchers has tried to sketch industrial effluent discharge scenarios under the enforced government conditions and proposed possible mitigations and strategies for fruitful regulatory regime in India. The authors find out that as India steps towards stricter regulation of industrial discharges for the control of water pollution, it would require great endeavors to reduce the risk to public health from toxic pollutants that are expected to be released into the ecosystems otherwise it would cause irreparable and long term ecological harm. It is recommended that ecosystem standard should be fixed for the discharges.

Milovanovic, (2007) worked on the water quality assessment and determination of pollution source along the Vardar river in Southeastern Europe .this study was extracted from the longterm data (1979–2003) collected on a monthly basis of nitrate, nitrite, ammonium, total phosphorous, BOD_5, Cd, Cr, Zn, Pb and water discharge from 22 sampling spots along the Axios/Vardar River . It was concluded that heavy metal pollution from smelter and fertilizer plants in Veles, Ferro-alloys plant in Jegunovce, the disposal of their solid waste near the river bed and also by the industrial wastewater discharge deriving from the industries located in the watershed has greatly effected the quality of the river water. The domestic wastewaters is also discharged directly into Axios/Vardar.

Tsai et al. (2009) worked on the noise mapping in urban environments of Taiwan in which they assess the spatial properties of the urban areas noise withb data collection from 345 monitoring stations with different time intervals. The data was evaluated and visualized by geographic information systems which shows the highest and lowest average noise levels as 69.6 dB(A) and 59.3 dB(A) respectively .These value were compared with the standard valuesshow violations that is usually occur on summer evenings (23 dB(A)). Moreover the research concluded that over 90% of the population is exposed to noise pollution. It is suggested that oise maps can be useful for investigating noise in urban environments

Ho et al (2013) worked on the Comparison of CO_2 capture economics for iron and steel mills and conclude that iron and steel industry which emits almost 5% of the total world CO_2 emissions are one of the largest energy consuming manufacturing industries in the world. In his study, at existing direct atmospheric CO_2 emission points he presented a high level scoping assessment of the opportunities for implementing CO_2 capture. Implementing CO_2 capture. he compared the estimated costs of CO_2 capturing through different process .he further concluded from his study that CO_2 can also be captured at the source such as blast furnace reduction vessel. Moreover methods were also used to capture CO_2 before further combustion and welding

Joseck et al (2008) worked on the potential energy and green house gas emission effects of hydrogen production from coke oven gas In the steel mills of US, in which he analyzed the energy and emission effects of hydrogen production from coke oven gas on a well-to-wheels basis and compared these effects with those of other hydrogen production options along with other conventional gasoline and diesel options. The magnitude of hydrogen production from COG was then estimated .This analysis showed that energy can be achieved by this production this production pathway and also resulted in a decrease in the greenhouse gas emission.

Gall et al (2015) conducted as study on Exposure to particulate matter and ozone of outdoor origin in Singapore, in which they estimated the averaged population exposure concentrations for $PM_{2.5}$, PM_{10}, and O_3 . He applied a model and data that was based on age and gender demographics, intra-urban regional variability, and mini environmental effects with age- and gender with time-activity budgets. This study addressed the pollutant exposure only to outdoor air pollutants. The outdoor concentrations for $PM_{2.5}$, PM_{10}, and O_3 ambient exposure concentrations are 59%, 52%, and 47%, respectively.

Zheng and Kahn (2013) conducted a study on Understanding China's urban pollution dynamics ,he concluded from his study that the ongoing china's urban economic growth has increased the population's per capita income sharply, reduced the level of poverty but caused major environmental problems. The consequences of china urban policy were investigated for the causes and consequences of China's urban pollution challenges. The causes of l pollution levels and greenhouse gas production were studied with relation urban population and industrial growth impacts.

Amin et al (2013) worked on the Industrial effluents mixed water that was used for irrigation in vegetable growing area was analyzed for its heavy metal contents using Atomic Absorption Spectrophotometry. Sixteen water samples from various industrial outlets were collected and analyzed for different physical and chemical parameters such as temperature, pH, total dissolved solids electrical conductivity, and heavy metals, in the year 2011. The results showed Cu to be in the range of 0.102-0.260, Fe 0.191-0.330, Pb 0.117-0.330 ,Co 0.021-0.195, , Cr 0.024-0.121, Mn 0.053-0.234, Zn 0.090-0.165 and Ni as 0.019-0.074 ppm. The overall metal concentration in the studied samples was in the following order: Fe>Pb>Cu>Mn>Co>Zn>Cr>Ni ($p < 0.05$). PH was in the range of 3.1-8.7 and electrical conductivity was 325 to 1515 ms/cm. As all values were above the permissible pollution limits, it was recommended that industrial effluents need a continuous monitoring and proper management before they are discharged into the water bodies.

Rathi (2002) worked on the "Promotion of cleaner production for industrial pollution abatement in Gujarat (India)" and found that common facilities should be created for the management of industrial waste keeping in view the resource constraint, public understanding and awareness and the judicial intervention along with the common facilities. Many preventive measures were also followed to achieve the goal of cleaner production in industries and a plan was also initiated by the Government of Gujarat for the promotion of cleaner production in the state.

Qu & Fan (2010) worked on the status of water quality and technology development for water pollution control in China .the present overview of the current state of water pollution was summarized along with the recent progress and the future development of water pollution control technology, in China. China has tried for significant improvement in water environmental protection over the last decades but the waste water analysis reveals that water pollution in China is still not properly controlled resulted in an increase nitrogen and phosphorus concentration in few water bodies that has ultimately caused eutrophication problems. It is suggested that China should perform research on management, pollution control and treatment through major technology initiatives.

Vinish (2005) worked on water pollution in three different parts of the world like Malaysia, Poland and Columbia**.** The paper finds out that what policies are followed by these countries for the reduction of water pollution in these countries. This study concluded that by active enforcement of law the license fee, standards, charge and subsidies bare the factors that played a vital role in the overall improvement in environment compliance.

Rosemary (**2005)** analyzed how concepts of place effects are relevant in understanding the public's experience of air pollution. Using qualitative and quantitative data from a case study of four neighborhoods in north London, the analysis shows how this experience is mediated by multiple aspects of place, which may be seen as overlain. These multiple aspects also provide routes to inequalities in the experience of air pollution. Working with these understandings of the relevance of place could provide ways to mitigate the experience of pollution, and to address environmental health inequalities.

Wang et al (2001) conducted a study on the industrial sectors in Shandong province for this purpose he divided the whole industrial sector into three main societies , he found that the economic scale and the pollution emission have an important position in the province .For this purpose ridge regression method was incorporated for the construction of industrial waste model. It was found that clothing and leather industry mainly contribute to industrial waste water and solid waste.

Zahid et al (2013) worked on the the water quality of the River Kabul near Peshawar in Pakistan. Many sites were sampled upstream and downstream and samples were also taken in 2009. Various physio-chemical parameters were analyzed and it was found that the pollution level in river is rising from upstream (at city entrance) to downstream (at city exit) due to discharge of domestic waste water effluents, agricultural activities, and solid waste dumping directly into the river.

Hussain et al (2003) worked on the industrial waste water treatment and found Pakistan as a big textile industry that manufactures 26,000 jeans per day. Simultaneously, it produces 1,628 m^3 /day textile wastewater, 1,968 m3 /day laundry wastewater and 225 m3 /day domestic sewage water. The overall BOD load of this wastewater is 2,533 kg/day. The treatment of this high amount of effluent has been a difficult task. This problem was solved by the installation of wastewater treatment plant which was designed by Corporate Engineering Greenwood Mills, USA and Dontare LtD., UK. The activated sludge process was used during treatment. Naturally occurring micro organisms cultivated for the purpose in containers like tanks and lagoons, were used for this process. Different polymers are used for flocculation. The daily evaluation of parameters like BOD, COD, TDS, TSS and pH showed that these are adjusted to the standards fixed by W.H.O. thus the wastewater treatment plant was very much effective for the removal of all pollutants.

3.1 Air Pollution

Sivacoumar et al (2000) conducted a study on Jamshedpur, the steel city of India situated in the eastern part of India. The area was badly affected by air pollution caused by various industries in the vicinity. Oxides of Nitrogen were found the most objectionable pollutant. The total contribution of NOx

from industry was 53% followed by transportation with 40%. Domestic sources were the minimum with 7% contribution.

Anthony & Chin (1995) conducted a study on air and noise pollution in the urbs and concluded air pollution as a big threat to humans.. He suggested various preventive measures such as electro static precipitator (EPS), cyclone and wet scrubber. He also recommended the enforcement of air quality guidelines standards worldwide. Therefore the remedies that can be used to control air pollution as stated above have been amply justified.

Steel mills and pollution

Falkenmark,. (1990). His work is on Global Water Issues Confronting humanity states. According to him steel industry is important industry. To streamline its impacts, a multi disciplinary approach should be adopted to look after the various impacts from mining till final products preparation. At all stages steel industry has got impacts on water resources and need proper attention. According to him Industrial pollution is a worldwide problem. On the one hand it pollutes ecosystem, on the other side ground water is used for industrial purposes and created pressure on ground water resources as observed in Pakistan .

Asia Umar Khan worked on the specific causes of sick industrial units of Hayatabad Industrial Estate, Khyber Pukhtunkhwa and their remedial measures. Data was collected through questionnaires from 36 industrialists of sick industrial units. In addition to this, interviews were conducted with officials of Sarhad Development Authority, Small and Medium Enterprises Development Association and Industrialists Association Hayatabad Industrial Estate. The results showed that lack of entrepreneurial skills, unskilled labor, unavailability of raw materials, weak promotional activities and misuse of financial resources are the specific causes of sick industrial units of Hayatabad Industrial Estate, Peshawar.

Khan et al (2009) have worked on industrial development in Pakistan including the province of Khyber Pukhtunkhwa. He recommended installation of more industry in the country with the idea to promote economic development in the country. He suggested that the import should be minimized to the maximum. For this purpose the government is required to provide incentive to the investors.

IEE/EIA of Industries

EIA in Pakistan creates analysis, number of the EIA reports as well as secondary data through the semi-structured interviews with experts of govt. authorities. It also encompasses concerned officials of the EPA that stands for Environmental Protection Agencies. It is also going to reveal a short description about legal legislation, administrative set-up as well as guidelines for EIA.

At first, EIA was introduced by the promulgation of the PEPO. The ordinance disclosed that all proponents will execute the task of filing the statement which is related with the environmental

impacts. However, this ordinance was replaced with the PEPA in 1997. After consulting with the shareholders, NGO's as well as industrialists, it was prepared. PEPA disclosed that project proponents of the private sectors and public sectors are needed to prepare IEE. Actually, it encompasses Initial environmental reviews to determine that proposed project can lead to the adverse environmental impacts.

EIA is needed to be presented to concerned EPA in order to start the construction work. And there is hardly any legal requirement of the plans, programs for the SEA. It also bears provisions in order to impose fines regarding the non compliance with the section twelve as well as many other clauses of Act. The fine is extended to around $11905 and includes additional fines which are determined $ 1190. These fines are higher comparing with other fines. However, EPA is determined to fix a decision regarding fate of the EIA and it may take around 4 months. If no objection is made within specified period the application is considered approved-up to an extent which does not contravene with provisions of that Act and section-twenty two is encouraging the appeal against the provisional EPA. Members of the EPT are the fact finding members. And for this reason, 4-tribunals were made in entire province and headed by three persons. Two of them are the technical members and the other one is the legal members. Implemented agencies of Pakistan were formulated to facilitate the project proponents in 1997. The package encompasses guidelines needed for preparation as well as review of the environmental reports, Critical areas, public consultation, and development sector etc. The package encompasses sectoral guidelines on different types of development projects like major roads as well as industrial aspects. (EPA Peshawar)

Unfortunately, entire guidelines are not practiced properly as availability is insufficient in order to ensure good practice. Those guidelines are based on specified guidelines of ADB as well as World Bank. And these were formulated in order to view local circumstances. In 2000, IEE regulations were promulgated and these also contained compulsory requirements for monitoring. All of those guidelines and regulations are quite comprehensive with the regulations of other countries like Bangladesh, Egypt, Sri-Lanka etc. Separate ministries of Pakistan have created federal as well as provincial levels. Prime minister of Pakistan chairs EPC at the federal level and it is consisted of forty members. Some members are non-financial members and they represent a wide range of sectors of community and the council was established with a view to ensure proper implementation of the NEQSs. However, initial process of EIA is vested in PakEPA.

All the provisional agencies were made in 1987. And the Pak-EPA delegated its power to provincial EPA's. All of the provincial-EPA has directorate of the EIA and they are responsible for EIA process. At federal level, the Pak-EPA is competent authority in order to process EIAs of the projects like military projects, projects with the trans-province impacts. Responsibilities which are related with the EIA encompass monitoring, implementation as well as post decisions.
Building the institutional-capacity is determined with a view to increase the efficacy of the EIA. Concerned officials disclosed that EIA directorates are faced with severe shortage of workers. Administrative set up of Pakistan is lacking in the institutional capacity. There are around 8 members who are dedicated in order to run the EIA processing and they belong to different professional

background. They are the dedicated staffs who monitor the impact of the EIA processing. Only two inspectors are recruited at the district level. They also appointed only one district officer and field inspector for every district. Four members of the environmental tribunals remain as non-functional and the reason behind is the failure to appoint members. Environmental impacts regarding the development-projects are closely related with the govt. agencies and interagency-coordination is badly needed for the effective and efficient EIA system. Consultants disclosed that informal coordination may exist among proponents. It is also important to mention that electricity, water and gas are needed in order to start the construction work of the development projects.

Tang et al,(2005) carried out a study on Public participation and environmental impact assessment in mainland China and Taiwan to answer the questions that what role can public participation play in environmental management? Environmental Impact Assessment (EIA) has been practiced in many countries widely. However, its effectiveness varies on the basis of incorporation of transparency and public participation in its process. The role of public participation in environmental management was analyzed in this study by examining the operation of EIAs in two polities, Mainland China and Taiwan. In both situations, the effectiveness of EIA was very much limited by the lack of transparency and public participation during the initial years when it was first introduced.

Jay et al, (2007) conducted study of the environmental impact assessment process explaining the widespread experience of environmental impact assessment (EIA) as preventive environmental management tool for achieving its purpose. Which was measured in terms of EIA 'effectiveness', deviating from the issues of procedural implementation, to the more effective goals of EIA and its role in decision-making contexts, indicating relatively weak degree of influence on planning decisions that is being exerted by EIA. This article elaborate the political purposes of EIA which, it is argued, provide a negligible, yet strong, basis for EIA improvements and reform, so as to contribute to more sustainable patterns of development planning.

Boateng & Amedofu, (2004) Carried out his research on the industrial noise pollution and its effects on the hearing capabilities of workers. In this study he carried out noise measurements, audiometric evaluation and assessment of medical history and concluded that corn mills and saw mills exceed 85dBA, printing industry 85dBA. 23%, 20% and 7.9% of workers in corn mills saw mills and the printing industry respectively have evidence of noise-induced hearing loss (NIHL). A correlation was found between noise exposure level and duration of exposure in corn mills and saw mills but not in the printers. Hearing - impairment was also observed among some of the workers that were exposed to hazardous noise.

Objectives of the Study

The aim of the study is to find out ways and means to make EIA process simple and efficient. The following are the main objectives of the proposed study :

1- To study the present conditions of industrial setup in the KP province (Hayatabad industrial Estate, Hattar Industrial Estate and Gadoon industrial Estate)

2- Exploring the pollution prevention and control technologies used in various units of steel mills and those industries that have been passed through the process of IEE/EIA.

3- To analyze the industrial emissions of the aforementioned industries.

4- To analyze the water quality of the receiving water bodies, streams and Rivers.

5- To review EIA Regulation 2000 for proper environmental management plans and pollution prevention measures.

CHAPTER III ENVIRONMENTAL STATEMENT OF THE STUDY AREA

3.1 Background information

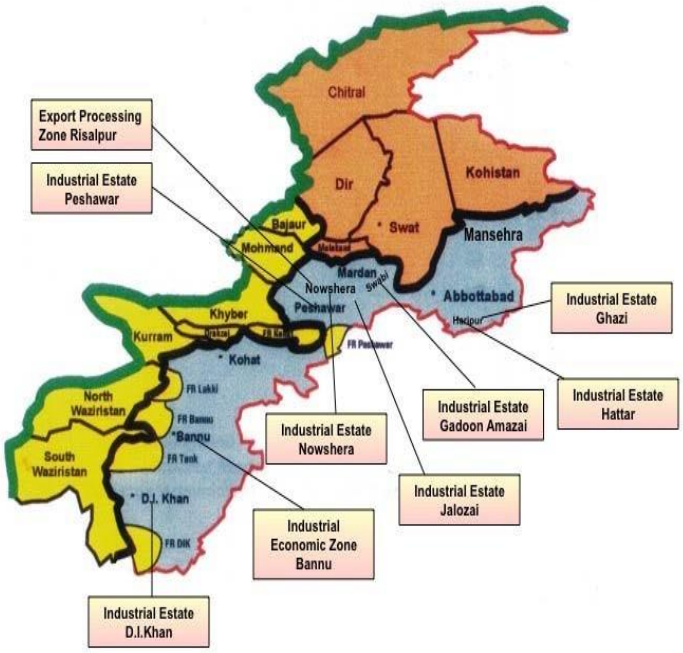
Industry is one of the major economic activities in the KPK province. This province has a very small industrial base but during the last few years, new industries have been established. In 1947 we have only 11 industries in our province but now the number of industries in KPK exceed thousand (Nafees, 2010). A total of 14 industrial estates, 3 big and 11 small were established in KPK. Among these Hayatabad, Hattar and Gadoon industrial estate are the biggest (Nafees and Ghulam 1992).

The major objectives of these industrial estates were to develop the less developed regions, to provide employment opportunities for the local utilize un-productive or less productive land and develop infrastructure for transportation and accessibility to the market and other urban center of the province.

At that time the concept of environment was not counted. The main focuses of establishment of industrial estates were economic development. Pakistan in general and Khyber Pakhtunkhwa in particular is very weak in industrial development. Khyber Pakhtunkhwa start the journey of industrial development from 11 industries in 1947 (Govt, 1996). With passage of time there was increase in industrial units. During the 1960-70 new industries have been established, a bit at a slow pace. Today the province has nearly 1,848 industrial units employing 75908 people. The Sarhad Development Authority (SDA) had managed several large projects and industrial estates in the province, with large concentrations in and around Peshawar, Charsadda, Nowshera, Gadoon Amazai, Haripur and DI-Khan (Fig. 31.). Moreover, there are several small industrial estates in different parts of the province, set up and are administered by the NWFP Small Industrial Board (SDA official web page, 2008). While government incentives have attracted some industries, most of the industrial estates have yet to be fully developed, still posing negative impacts on environment (Obaidullah and Rizwan 2008).

To institutionalize Environmental Impact Assessment and Environmental Monitoring, Pakistan starts its journey in 1983 by promulgating environmental ordinance. After the establishment of Environmental Protection Council federal and provincial Environmental Protection Agencies (EPA) ware established during 1990-92 (Riffat and Daulat.. 2006). Environmental Act was approved in 1993, which was revised in 1997. EIA procedures in NWFP started in 1992 and were made compulsory for all developmental activities by 2000 at government level. Environmental Impact Assessment (EIA) and Initial Environmental Examination (IEE) procedures have not yet been regulated and properly institutionalized (Nafees and Ghulam, 1992). Even on the industrial estates, there is no requirement or obligation to install waste treatment, recycling or safe disposal facilities. Industrial pollution in KPK may not be great, but severe pollution has been observed locally around industrial units and estates. Untreated wastes are discharged and dumped on land, into water bodies such as the Kabul, Indus and Swat Rivers, degrading the aquatic and terrestrial ecosystems of the province (Hayat, 1992 and Wajid et al 2008).

Fig. 3.1: Major Industrial Estates of Khyber PakhtunKhwa



Map Source: SDA Govt of KPK Peshawar

This study was conducted on three main industrial estates, Hayatabad, Gadoon and Hattar industrial estates of Khyber Pakhtunkhwa and is herein discussed in detail with the objective to highlight its environmental aspects.

Hayatabad Industrial Estate

Hayatabad Industrial Estate is situated on the western side of Hayatabad Housing Scheme. It is decorated with important basic facilities such as electricity, gas, telephone, roads network and water supply **(**Zahidullah, 2009**).** It is located on the main Jamrud Road Peshawar having 230 plots with plot size of one or more than one acre.

As per SDA record, the industrial estate provides employment to about 11 thousands peoples. The total investment done by the government in this estate is Rs. 3650.160 millions. The estates have got their own grid station of 132 KV. Other facilities include rest house, community center, labor residence and hotels.

Hayatabad industrial estate is a combination of small and large scale industries. In large industry include Ghee and oil, Marble, Tiles, Chemicals, steel rerolling, chip board, food industry, ceramics, Pharmaceutical, Match steel etc.

3.2.2 Hattar Industrial Estate

Hattar is a small city with 44 union councils. It is administrative subdivision of the Haripur district, Khyber Pakhtunkhwa Pakistan. The surround of Hattar is green and fertile enriched with varieties of fruits and vegetables.

Hattar Industrial Estate is located near Kot Najibullah, Distt: Haripur. Total land is about 1443 acres, divided into 331 plots of various sizes. **T**he total initial investment was Rs. 28636.42 millions, The estate has provided employment opportunities to 65 thousand people. The estate is equipped with road network, drainage and water supply system and 132 K.V grid station (SDA 2012)

There are quite a number of villages around the Hattar Industrial Estate. Of these significant ones are Raniwah, Pind Gujran, Shadi, Kamil Pur, and Hattar. There are schools up to primary level and secondary level in the villages. Basic health facilities are inadequate in these villages. A specialized eye hospital-'Christian Hospital' is present at Taxila.

Major Industries are Ghee, Marble, Tiles, Chemicals, Pharmaceutical, steel, food, Match Textile engineering etc.

3.2.3 Gadoon Industrial Estate

Gadoon Industrial Estate is located near Topi, District Swabi, Total number of plots are 547. The minimum plot size is also one acre. The estate is bordered Baisak in north, Topi village in the south. In the east and west are Maini and Gandaf (Khan et al.2009). The total acquired land is 116 acres with the total investment of Rs. 49014.861 millions. The estate has got the capacity to provide employment to 15345 numbers of people. All the infra structures like WAPDA grid station, PESCO office, sui gas, post office, police station ,bank, hospital etc are present. (SDA 2012). Major Industries are Ghee, Marble, Tiles, Chemicals, Pharmaceutical, Match Textile, Steel, Paper, Electronic Goods PVC etc. (Haidar, 1990-1992) .

Main Environmental Problems in the three industrial estates of KPK

Air Pollution: An important polluting agent is the air. The air used for breathing could be damaging for health when it gets contaminated with hazardous gases and metals. In an urbanized and industrialized countries air pollution is increasing rapidly. Air pollution is one of the major environmental problems Pakistan is facing since the beginning of the industrialization. As a result of steel industries, chipboard, plastic and various other units, air pollution is common in all the three industrial estates of KPK, Steel mills in Pakistan are also contributing to air pollution as they produce metal dusts, gaseous emissions, and slag. All these polluting agents are causing air pollution by affecting the quality of air. (Agha et al, 1995).

In steel melting industries, the method of electric induction is applied more frequently. The quality of scrap is mainly responsible for the black smoke generated from the electric induction method. The maximum amount of air pollution is caused when temperature is low in the furnace and scrap is degraded in oil (Ahmed, 1992)

Wastewater Pollution Status Industrial Estates of KPK

All industrial estates situated in KPK are under the administration of SDA, while provincial EPA has to look after environmental aspects. Three large scale industrial estates, include Hayatabad Industrial estate Peshawar (HIEP), Gadoon Amazai Industrial Estate (GAIE), and Hattar Industrial Estate (HIE) Majority of EIA or IEE submitted to EPA for various industries are situated in these industrial estates/Area. Various studies conducted on this show high level of pollution which are high from Pakistan National Environmental Quality Standards (Pak-NEQS). Study conducted for Hattar Industrial Estates shows that the level of five day biological Demand (BOD5), Chemical Oxygen demand (COD) total Dissolved Solids and among heavy metals Copper (Sial, 2006) of waste water was high form Pak-NEQS. According to Haider (1996) studied three major Industrial Estates (Hayatabad, Gadoon and Hattar). The concentration of various heavy metals (Pb, Cd, Cr, Zn, Fe, Cu, and Ni) and TSS and TDS were found above the level provided in Pak-NEQS. Similarly study conducted for Gadoon Industrial estate shows that the BOD5, TSS, SS and TDS where found high when compared with Pak-NEQS (Bashir, et al 2002). Department of Environmental Sciences and IUCN conducted a comprehensive study in 1992-93 to evaluate Kabul River for pollution load. It was found that the Hayatabad Industrial Estates and Amangrah Industrial area has got negative impacts on Kabul River which is disturbing the ecology of the river (DEPM-IUCN, 1994). This study was further supported form study conducted by Husna during 1996 (Nafees et al 2002, and Nafees 2004,). These studies revealed that industries like paper mill, textile mill, tanneries, sugar mill and ghee mill have negative impacts on Kabul River and its tributaries.

Impacts on Ecological Resources

The monitoring status of various studied shows that waste effluent samples collected from different industrial estates at different times witnessed that BOD and COD were high which is mainly due to the presence of oxidizable wastes (organic). These effluent have adverse impacts on fish because it affecting the dissolved oxygen (DO) negatively. The normal level identified for fish is 5mg/l, if fish are to be

thrived (Hodges 1992). Masheer (Barbus putitura) is toward decline in Swat River and Kabul River attributed to over fishing (Nafees et al., 2011) and pollution load (Rasul et al 2003). In Kabul River Shairmai is toward decline, mainly attributed to industrial effluents from Hayatabad Industrial estate and Amangrah Industrial Area, Nowshera (IUCN and DEP, 1993). To look after these species so neither it is mentioned in the base line information of nor mentioned of any mitigation measure in any IEE or EIA report. The concentration of Sulfide was also noted well above permissible level as 0.002 mg/l is considered toxic for fish and 0.0015 mg/l is harmful to spawning (Kumar 1992). Most of the samples analyzed, have very high concentration of suspended solids and dissolved solids. It's possible effects on fish population and fish food may lead to bio-accumulation and will contaminate food cycle (Ashraf et al 2003).

The laboratory results show that SS load, BOD5, and COD were high in Kabul River. The range of SS was from 250 to 580 mg/l before joining of Hayatabad Industrial waste, which increase to 450 to1030 after joining the industrial effluents. The COD of the river was observed in the range of 12 –18 with a increase of 14 – 22 mg/l downstream. Similarly the BOD5 was found 2-6 mg/l upstream of the industrial estate and 5-8 mg/l downstream, which has got negative impacts on Kabul River Fauna. The questionnaire survey showed that 61 respondent out of 70 said that fisheries are affected. The three branches of Kabul River, Adezai, Naguman and Shalam were surveyed and fishing was practiced with the help of local export. Tofan-Jal (a big net used for fishing) was practiced in Shalam River and after 2 km distance only four fishes were found. While according to the experts it should have been 50-70 numbers before 1970. Besides, huts situated on the bank of Adezai was surveyed and was found that 80% fish is received from Turbala dam and various fishponds situated in Punjab province. The main reason for the decrease in fish population, as pointed out by various respondents was industrial pollution.

Impact on Humans

By the development of these industries, land use pattern in the surrounding area are substantially changed. This may be particularly due to urbanization, which accompanies the sitting of industrial estates. There was increase in property value. Similarly clean drinking waster supply and electricity were also provided to the people and people showed their satisfaction in this regards In case of solid waste disposal and sewage disposal, there was no proper arrangement for the collection and disposal of solid waste in the study area. Due to this there is always a danger of water and food contamination. This may affect the health of the people living in this area. Similarly the municipal sewage joined the industrial effluent and ultimately discharged into the Kabul River which creates pollution and damage to the aquatic life.

Economic benefits

The establishment of Industrial estate created job opportunities and other related employment opportunities for the local people. This indicates long term benefits for the People of the area. Due to the industrial development land price in the vicinity area have increased.

The other economic benefits include increased earning by creation of jobs. At the same times the increase level product in the area is increased which is a benefits to the locals as well as to the whole nation.

Occupational Safety & Public Health

Hazards to employees and nearby residents can originate from accidents such as fire, from hazardous materials and communicable disease. In case of colony Sarhad textile mill the worker are exposed to dust and many of them have chest problem. In PVC pipe factory the workers are exposed to lead dust. Similarly great threats exist in the paper mills due to Chlorine, as in 1975 an accident had occurred in the Chlorine plant of Adam Jee paper mill due to which large number of vegetation and worker were affected. A continuous leakage was observed from pipes in various industries. This can appeared dangerous as fire hazard also exist in Ghee mill due to Hydrogen and Oxygen plant. In these industries the workers have no occupational safety devices or other mitigation measures.

About one third 38% of the respondents said that diseases in the project area have positive correlation to these industries. Therefore more health facilities should be provided in the study area, as 63% of the respondents claims that no health facilities are available to them (Nafees and Ghulam 1992).

Major area of deficiency in EIA Process

The very first problem is use of proper methodology. For example Networking is suitable if we want to identify impacts on fish population, as mentioned above. In most case simple chick list is used which can not quantify impact on health in the surrounding area. The best methodology will be the matrixes or over-lay. To make EIA efficient mostly expert opinion is used which is, some time misleading.

The second weak area is composition of base line data. In most of the EIA reports were found deficient. Such is study conducted by Yaqoob (2002) shows that out of the total 28 fish species 11 are also found in NWFP, in which 5 are rare and need special attention. Another study reveal that two important species Shermai and Masheer were found toward decline (Ahmad 2002 and IUCNDEPM 1994). But both the NEQS and the EMP were found silent on this. Because it is not properly reflected in the base line information.

The third problem area is the process of EIA review. Initially it was reviewed by neutral people identified by the EPA official. The EPA has to receive response from the reviewer within 45 days for IEE and 90 days for EIA. In case of delay form the reviewer it is considered as delay on behalf of EPA in which the EPA is bound to response within the stipulated time, failing which the proponent will get the NOC automatically. For review the proponent is depositing review fee but there is no payment option for the reviewer. If the reviewer wants to visit the proposed site, will be on his own expenditure. Recently the EPA has developed review mechanism inside their office to fulfill the review formalities and give No

Objection Certificate (NOC) quickly. In this way the EIA/IEE reports are not reviewed properly, which later on cannot be implemented properly to look after environmental considerations.

The fourth problem is in monitoring. Since 1992 EPA has given the option of self-monitoring, in which each industry has got the right to analyzed their waste water and report the same to EPA, which is always within the permissible limits. In this way the mitigation measures are not adopted properly. This is damaging proper reporting and Environmental Auditing step of EIA/IEE.

The fifth problem is the evaluating the wastewater impacts by simply comparing with Pak-NEQS which is for all sort of water resources (small river, big river, lack and ocean) and for all seasons (low flow and high flow). In this way even with a small industrial base has got negative impacts on surface water quality. In this way a counter analysis to check the situation in the receiving water bodies is not practicing.

CHAPTER IV MATERIALS AND METHODS

This study is based on two types of data, primary and secondary. Primary data was collected in the field while secondary data was collected from different departments such as Sarhad development authority and Environmental protection Agency, for collection of secondary data two approaches were used i-e visits to concern department and internet search.

5.1 To study the present industrial set up i-

Preliminary visits to industrial estates ii-

Visits to SDA and EPA

5.2 Exploring pollution prevention status: It was difficult to visit each industry therefore the main industry was short listed i.e. steel and marble industries. Each industry was thoroughly visited and was explored for pollution prevention technologies and strategies.

5.3 Water quality:

In the present study, the main focus is to analyze the water quality of those rivers who are receiving the effluents from the three main industrial estates in KPK province. The target locations for the study are Hattar Industrial Estate, Gadoon Industrial Estate and Hayatabad Industrial Estate. The main objective of the study is to evaluate the process used for the prevention of pollution designed and implemented by the EIA body of KP province. On the same grounds, the research presents the analysis of water bodies of the rivers of KPK province.

i. **Water bodies:** The sampling method has been done by taking various specimens from water bodies of Budhni nullah, Shahalam Bridge, Akbarpura Bridge, All these water bodies are part of Peshawar region. Beside them samples from Dengi nullah Hattar, Jarikas Hattar (Pic No 1), Dhunal nullah Hattar, and Haro River were also collected.. Along with them, the samples from various marble drains have been collected. The four locations of marble drains have been identified and taken as sample.

ii. **Industries:** The other part of sampling constitutes water samples from various industries. The major sectors targeted in sampling procedure are steel mills, s, oil and ghee manufacturers, chemical industry, paper mills, textile mill, and food factory, match box industry, Soft Drink Company, marble industries as well as dying unit. All these industries have direct impact on the water of the selected regions during manufacturing of their goods. Therefore, samples taken from these industries become secondary water samples in the study. The specimens of samples of waste water from various industries of the industrial estate are sent to laboratory for further detailed examination and analysis of parameters present in them. The parameters to study are pH, electrical conductivity, temperature, total suspended solids, total dissolved solids, biological oxygen demand and chemical oxygen demand.

5.4 Review of EIA reports

To strengthen the research, the evaluation of Environment Impact Assessment tool has also been studied in detail alongside the mainstream research analysis. For this purpose EIA reports were studied thoroughly and were reviewed, workshops were arranged and experts opinion were taken.

The other half of the research is based on qualitative research designs involving interviews, and surveys with the target population. The officials of Sarhad Development Authority (SDA) have been taken as survey participants for in depth interview technique in survey research.

5.5 Interview with SDA

Interview was conducted from the director, Assistant directors and other employees of the SDA in which the process of grant of lease and permission regarding the establishment of industry was find out. During the interview it was found that SDA grant approval for establishment of industry provided that prior NOC from EPA has been taken, this has a positive role towards the improvement of environment. Data regarding the number of industries and open and closed units were collected from SDA, for this purpose questions were framed prior to the interview, that were open type of questionnaires. A total of

15 questionnaires were asked from different employees of the SDA regarding the procedure of allotment of plot, lease and its renewal, contribution toward the environment and other obligatory process that have a positive impact on the environment.

5.6 Field Visits

Five visits were made to each three industrial estates i-e Hayatabad, Hattar and Gadoon IE so as to collect information and ground realities about the industries and industrial set up in these three estates of KPK and to confirm the open and closed units.

5. 7 Sampling i. Identification of Sample points

Prior to sample collection the whole area of study i.e. Hayatabad, Hattar and Gadoon industrial estate was visited twice. During these visits major sampling points were selected. The criteria adopted for site selection was, that sample should cover maximum area, must be accessible and representative

ii. Collection and storage

A systematic composite soil samples from different industries and water bodies were collected from selected sites. For this purpose the months of January, February, March, April may and June 2011 and 2012 were selected. Industries were sampled twice as it was not allowed by the industrialist to collect samples from their out drain.

In each water body three or four points were selected for sample collection. These samples were then brought to laboratory for analysis of various parameters. River Kabul was sampled at Budhni, Shahalam, Akbarpura bridge. River Haro was sampled at Dhengi nullah, Jarikas, Dhunal (Pic N0.2)and on Peshawar road near bridge. Each sample, after collection was properly labeled along with name and site of the river. Samples were stored in sterilized Plastic bottles.

iii. **Water sampling from industries**:

Water sampling is possible in a rational manner through development of an analytical strategy for the same. Samples should be taken from various representative spots which can truly represent the level of water contamination. Water samples should be carried to the laboratories through portable equipment and delivered as quickly as possible for testing. Samples from B&B Oil & Ghee mill, Deewan Salman fiber unit, Chiniot Enterprises Pvt. Ltd, Hafeez Iqbal Oil & Ghee Industries Pvt. Ltd., pine match complex chemical industries, paramount paper Neelam paper, tops food, Amin paper were collected and analyzed in the laboratory for parameters like PH, Temperature, TSS, TDS, COD, BOD, Nickel oil and grease. **iv. Sampling from water bodies:**

Seasonal samplings from the receiving water bodies of the corresponding estate. The receiving water body of I.E Hattar is river Haro and the nullah join it are Jarikas, Jabbi nullah (Sara-e-gadai), Dengi nullah, Dhunal nullah. Jabbi and Dhunal mix at 5 km apart from Jarikas while at

Mundhar all the three joins and the point is also called *sabz peer* which then finally drop into river Haro.All these carry pollution load from Hattar industrial estate but only dhunal,jarikas and dengi nullah were analyzed for pollution load

The receiving water body of I.E Hayatabad is River Kabul; samples were collected in winter as well as in summer from Budhni bridge, Shalam and Akbarpura bridge.

While the receiving water body of I.E Gadoon was a *khwar* which was found dry in summer while in winter it has a very low content of water that hardly joins any river.

Samples from different industries in each estate were also collected and all these samples were analyzed for parameters like BOD, COD, TSS, TDS, Temperature, pH, conductivity, oil and grease etc

v. **Water analysis:** The samples were analyzed for the following water quality parameters for comparison with Pak-NEQS.

Parameters

a. PH: Soil pH was also measured in the field as well as in the laboratory using pH meter model Jenway-350, Japan.

b. Temperature: Temperature was measured by Celsius thermometer on the spot and was recorded.

c. Electrical Conductivity and Dissolve Contents: Electrical conductivity and dissolved contents were measured with the help of portable conductivity meter; model Jenway-470, Japan in the field as well as in the laboratory.

Conductivity meter was calibrated according to the manufactures instruction using KCl reference solution. Electrical conductivity of 0.01 M KCl reference solution and sample was measured at the same temperature. Before each reading the meter was rinsed three to four times with de-ionized water.

d. Total suspended solids (TSS): the portion of solids that usually remains on the filter paper after filtration is called total suspended solids it consist of silt, clay, fine particles of organic and inorganic matter, a type of pollution because if the concentration of total suspended solid is high in water it may negatively affect growth and reproduction of aquatic life. For the analysis of TSS, an already known amount of sample was filtered through the pre weighed filter paper.

Filter paper was then dried at 103-105°C. TSS was determined by using following formula (Anon, 1992). TSS mg/l= Final weight – initial weight x 100

Amount of sample taken

e. Total dissolved solids (TDS): The measure of total inorganic salts and other substances that are dissolved in water are called Total dissolved solids (TDS). TDS was determined by using Electrical Conductivity (EC) meter.

f. Biological oxygen demand (BOD): Weight of oxygen consumed per unit volume of water during a specific duration of time at a definite temperature is called Biological oxygen demand (BOD) and was calculated following the procedure of Hamer (1986).

The waste sample was incubated for 5 days at 20^0C in the incubator. The decrease in dissolved oxygen concentration during the said incubation period gives a measure of the biochemical oxygen demand.

g. Chemical oxygen Demand (COD): it was determined through Open reflex titrimetric method

COD, mg/L = (Vb-Vs)*f*8000
V

Vb; vol of ferrous ammonium sulphate used for blank. Vs;
vol of ferrous ammonium sulphate used for sample
F; factor.
V; Vol of sample.

5.8 Measurement of Air Emission of industries

For monitoring air pollution, air sampling is done. For air monitoring, samples of air are collected from various places in the given region under study. While samples are taken, selection of spots to collect samples is to be done very carefully. Portable equipment helps in transfer of material to the labs. Air monitoring of Alam Match, Umar Glass, Royal PVC,(Pic No 3) Sarhad board and chemicals, Olympia paper and board mills, frontier tech wood and Lahore steel mill (Pic No 4) was taken through apparatus PG-250 and the results were compared with the Pak NEQS.

5.9 Review of IEE/EIA Regulations as well as PEPA Act 1997

Pakistan Environmental Protection Agency has notified the Environment Impact Assessment and Initial Environment Examination Regulations 2000 details of filing, reviewing as well as approving or rejecting the process of IEE and EIA reports. IEE and EIA Regulations 2000 constitutes of two schedules. The one

involved the projects needs to be submitted for IEE, while the other schedule is for the projects needs to be submitted for EIA report. All the guidelines for project submission, and report writing has been mentioned by the Federal Ministry of Environment. The purpose of the guidelines is to inform all the stakeholders regarding submission of IEE and EIA reports by the government. The Environment Protection Agency of Khyber Pukhtunkhwa province works with Sarhar provincial conservation strategy (C) wing of International union for conservation of nature and natural resource. The program has developed EIA Proforma-Checklists used Guidelines for small level projects in the province. The major focal point of these Assessment Checklists is to locate the environmental flaw and to devise possible action plan to mitigate it. These guidelines are essential for starting the project for environment safety as public or private partnership with the government.

The EIA Regulations were studied and meetings with different officers of EPA, professors of university and industrialists were made to know their idea about the existing Regulations and suggestions for improvement were noted from them. Workshops were arranged. Six reports were analyzes and thoroughly studied, workshop was carried out and expert opinions were taken.

Review of EIA Reports

Three EIA reports were reviewed for quality (Table 3.1). For this purpose a report was presented before panel of experts and Master level students of environmental Sciences. Their views and observations were recorded in a checklist for comparing with the rate given by Environmental Protection Agency.

Table 3.1: List of EIA report reviewed

S No	Report Name
1	Consumer line steel re-rolling mill
2	Khan brothers steel
3	Salman steel re rolling mill

5.10 Data Analysis and Report Writing

For tabular data analysis Microsoft excel was used, while for report writing Microsoft word was used. For arrangement of Picture and presentation Microsoft PowerPoint was used.

CHAPTER V

RESULTS AND DISCUSSION

PART A

5.1 Present Industrial set up

There are 826 industrial units in the province of Khyber Pukhtunkhwa which employ 57290 employees. These industries are the life line of a large population of the province and also for the economy of Pakistan. It is a general perception that the industries in Pakistan is toward decrease.

As per Sarhad Development Authority (SDA), out of the total, 286 industrial units have been closed in three major industrial estates i.e. Hayatabad, Hattar and Gadoon industrial. Till 2012 , a handsome number of, 540 industrial units were found functional (Table. 5.1) . Fig. 5.1 revealed that there was increase in operational units during 2007-12. In Gadoon the situation was not encouraging. Where, the percentage of closed industries reached up to 60%. In 2012 an increasing trend was observed. In Hattar industrial estate, number of closed industries was comparatively less but an increasing trend was observed after 2012.

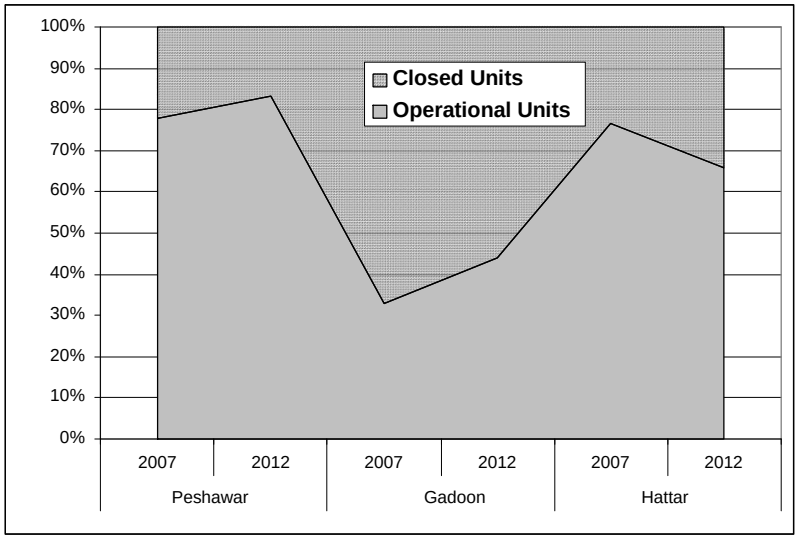


Fig 5.1: Number of open and closed units in 3 main industrial estates of KPK

The industrial estates are for the purpose to share resources with each other and over come on resource deficiency. As observed in different industrial estates, still facing problems like lack of resources and numerous other issues such as lack of financing, infrastructure and power supply.

As clear from Fig. 5.1, large numbers of industries have been closed down. The study of the industrial estates of Peshawar revealed that only 212 of the 255 industries in the Peshawar Industrial Estate were open while the rest were closed. In the Hattar Industrial Estate, 230 out of 349 industries were operational whereas the situation of the Gadoon Industrial Estate of Swabi was comparatively worst where only 98 out of a total of 222 industries are open with the rest closed down. (Table 5.1)

Table 5.1: Status of operational and closed units in three industrial estates of KPK

Industrial Estate	**Peshawar**		**Gadoon**		**Hattar**	
Number of Industries	2007	2012	2007	2012	2007	2012
Operational Units	190	212	48	98	118	230
Closed Units	54	43	98	124	36	119
Totals	244	255	146	222	154	349

The following are various points that can be relate to decrease in industrialization. These points should be part of the EIA/IEE reports. A particular project is not evaluated properly and lead to closer of an economic activity.

i. **Government policies and mandate:** There is an overlap in different government policies and mandate of different organization. These include Sarhad Development Authority responsible for allotment of plots, Water and Power Development Authority (WAPDA) responsible for electricity, Environmental Protection Agency (EPA) responsible for EIA/IEE processing, Chamber of Commerce responsible for financing and so on. In this way a proponent has to go through various formalities. As observed, in many case the proponent was not aware of taking NOC from EPA. When they came to SDA for issuance of lease for the plot, the SDA then demand clearance from EPA . In such situation the proponent has to initiate another file. In this way EIA/IEE is considered as a separate bureaucratic hurdle

ii. **Distance from the Seaport**, was considered as a disadvantage in access to the equipment and raw material: Most of the industries are far away from their resources points for example most of the marble is carried from Buner to other parts of Khyber pakhtunkhwa so the marble industries installed in Buner have the advantage over the marble industries installed in Peshawar in terms of raw material.

iii. **Law and order situation**: The law and order situation of KP is uncertain for the last few years and varies from time to time. Therefore most of the industrialists hesitate to do investment in this province.

iv. **Human resource development and Non-availability of skilled labor**: Usually the type of labor having specific skill is hard to find. First the industrialist would train the workers by spending a lot of time and money on them. The availability of skilled development may not lead to closure of an industry, but if a labor get a skill and become jobless, is a problem for both owner and labor.

v. **Lack of proper infrastructure**: No proper infrastructure is present in most areas of the KP so as to bring the raw materials smoothly.

vi. **Smuggling of foreign goods:** no mitigations were observed to control the smuggling of goods even from Pakistan to the neighboring country, Afghanistan. This effect the market price of item and ultimately affects the industry negatively.

vii. **Monopoly of the Govt. officers (Bureaucracy)**: The officers in EPA have their own consultants for the preparation of the IEE/EIA reports whose reports are processed as well as approved easily while the reports made through other consultants are analysed much critically analyzed and hurdles are made for them.

viii. **Improper selection of the product**: 50% success of the industries depends on the proper selection of products, proper evaluation of the market. This point was totally missing in the various EIA/IEE reports.

ix. **Mushroom-growth of one type of industry members**: For example the situation of flour mills and marble industries owners are with attempt to be in the surrounding of main cities, while these types of industries should be scattered to fulfill the local demand and decrease the transportation charges of the raw-material.

x. **Industries based on less value-added products**: For example plastic products are not durable but prepared in bulk. This is how the price of raw-material increase and that of the final product decrease due to heavy competition. In a long run it also contributing toward solid waste problem.

xi. **Too many taxes:** Government has imposed different types of taxes, and is a big discouragement for the industrialist.

xii. **Shortage of electric power:** The situation of water and power in Pakistan is going worse day to day affecting the industries very badly.

Although, a large numbers of industrial units are closed, still industrial development is on the way by adding new industrial units. In Hayatabad industrial estate, Peshawar and Hattar Industrial estate, Haripur 66 and 12 industrial units are under construction (Table 5.2). **Table 5.2: Number of under construction units in KP**

Industrial estates	**Peshawar**		**Gadoon**		**Hattar**	
Year	2007	2012	2007	2012	2007	2012
Under Construction Unit	66	62	Nil	19	12	87

5.2 Environmental Aspects

It is a matter of fact that industry has got impacts on environments that need proper attention. For this purpose Pakistan in general and Khyber Pukhtunkhwa government in particular has initiated various programs. These include legislative coverage; exist in the form of environmental protection act 1997, EIA/IEE regulation 2000, monitoring rules 2002, and setting up of environmental tribune. To tuned industrial effluents and emissions, it is responsibility of Environmental protection Agency to monitor these various industries. If the emissions exceed a safe limit, the EPA informed the concerned industry for non compliance. EPA has got the authority to challenge the owner of such industry in environmental tribunal. The idea behind these arrangements is to overcome on pollution problem as highlighted below.

To know about the present pollution status and the efficacy of EIA regulations, three major pollutions were studied, i.e. Water, Air and Noise. Each is herein discussed in detail.

5.3 Water pollution

Parameters are measured in terms of concentration (mg/l). Physio - chemical analytical results summarized in Table 5.3, revealed that most of the parameters are within the permissible limits or slightly above the permissible limits define in the Pakistan National Environmental Quality Standards (Pak-NEQS). For example four industries in Hayatabad Industrial Estate were analyzed for total pollution load. It was found that the annual contributing 36.8 thousands Kg/year to 111.9 million Kg/year. A total of 25.7 million kg per year of pollution load to the River Kabul (Table 5.3).

Table 5.3 reveals that the annual organic load (COD) by these various industries was above1 lac kg/year of COD while total suspended solid was above 70 thousand kg/year is added to the river Kabul by these

few industries of Hayatabad industrial estate. So here the point to be thought is that what will be the pollution of the total 255 industries that are present in Hayatabad industrial estate, this means that our environment is toward decline at a very rapid speed. In EIA an individual industry is considered while a holistic approach is required.

Similarly there are 29 marble units in Hayatabad industrial estate. Wastes from the Marble Industries normally carry loads of suspended and dissolved solids, which are harmful to both aquatic and human life. Marble is mostly composed of carbonates of calcium and Magnesium, which has impact on the soil .Most of the waste is discharged and used for irrigation purposes and has got negative effects on aquatic, wildlife and agricultural activities. Effluent samples were collected from some of the marble industries in the Industrial Estates of KP Hayatabad Peshawar and were chemically analyzed for the parameters like TSS, TDS, BOD and COD. These values were compared with the National Environment Quality Standards, (NEQS) and it was found that some of the values are much high and not complying the Pak-NEQS.

Table 5.3 Physio chemical characteristic of industrial effluent of selected industries, Hayatabad Industrial Estate Peshawar (mg/l)

S.No	Industry	PL COD kg /day	PL COD kg/year	TSS Kg/day	TSS kg /yr
1	Alam match	58.75	9400	126	20160
2	Mohsin Match	39	6240	61.2	9792
3	Bilour match	56	8960	58.8	9408
4	Paper mill	400	64000	147	23520
5	Ghee mill	103.2	16512	18.92	3027
6	Omer glass	23.25	3720	31	4960
	Total	**680**	**108832**	**442.92**	**70867**

To know about the mitigation measures, 5 marble units were analyzed. It was found that 2 out of five (MU I& 2) have not the standard size of settling tanks that is recommended by Environmental Protection Agency (EPA). The EPA has recommended a standard settling tank of 10W* 12L * 06D = 720 cubic feet equivalent to 20.4 M3. Each one of the size of 10 x 12 x 06 feet) also in 3 industries no water recycling system was present. While marble unit 3 & 5 has not taken NOC from EPA. It is concluded that these

units are having less pollution load with those having NOC. Data about the cleanliness and maintenance were inquired (Table 5.4). The under size settling tanks had got impact on water quality. Other parameters including BOD and COD were found within permissible limits except total dissolve solids (TDS) and TSS.

Table 5.4: cleanliness and maintenance of settling tanks

	UNIT 1	**UNIT 2**	**UNIT3**	**UNIT4**	**UNIT5**
Cleaning	Once a week	Once in 10 days	Once a week	Once in 15 days	Twice a month
Maintenance	Once a month	After finishing of stock	Once in season	When required	When required

Moreover, the TSS of all five industries was exceeding the NEQS level as evident from table 5.5. The NEQS limit for TSS is 200 mg/l and that of TDS is 3500mg/l. on analysis of effluents of marble industries it was found that the TSS were exceeding the permissible limits in all the five industries.

Table 5.5: Average Effluent Analysis of Marble Industries Hayatabad

Unit no	**TSS (mg/l)**	**TDS (mg/l)**
1	7738	340
2	6089	1612
3	289692.5	120
4	2350	300
5	6051	405
NEQS* Limits	**200**	**3500**
Remarks	**Violation**	**Complied**

Table 5.6 shows that only five units of marbles are contributing a total of 8678.586 tons per year pollution load and is resulting sedimentation of the receiving rivers at a very rapid speed.

Table 5.6: Average Pollution load (PL tons/Yr) of Selected Marble Units for Total Dissolved solids (TDS) and Total Suspended Solids (TSS)

S. No		MU1	MU2	MU3	MU4	MU5	Total
1	**TSS mg/l**	7738.0	6089.0	2896.2	2350.0	6051.0	25124.2
2	**PL Tons/ yr**	2406.8	1893.9	901.1	730.9	1882.1	7814.8
3	**TDS mg/l**	340.0	1612.0	120.0	300.0	405.0	2777.0
4	**PL Tons/ yr**	105.8	501.4	37.3	93.31	125.9	863.8
5	**PL(Sum of Row 2 and 4) Tons/yr**	2512.6	2395.3	938.3	824.23	2008.1	8678.6

Marble industry Hayatabad common drain: Physico chemical analysis revealed that most of other parameters (Table 5.7) were within permissible limits defined in Pak-NEQS.As most of the water is used for irrigation so the results were compared with FAO standards devised for irrigation water. It was found that carbonates were exceeding the limits. These type of standards and comparisons are totally missing in IEE/EIA Regulations as well as in reports submitted to EPA.

Table 5.7: Analysis of Marble Industries Hayatabad Common Drain (10 Marble Units)

S#	Water Parameter	Symbol	Unit	Range in Irrigation water (FAO)	Test Value 1st sample	Test Value 2nd sample	Test Value 3rd sample
1	Electric Conductivity	EC_w	dS/m	0-3	0.5	0.455	**0.55**
2	Total Dissolve Solids	TDS	mg/l	0-2000	254	225	**240**
3	Calcium	Ca^{++}	mg/l	0-20	3.21	3.61	**3.31**

Table 5.7 cont….

S#	Water Parameter	Symbol	Unit	Range in Irrigation water (FAO)	Test Value 1st sample	Test Value 2nd sample	Test Value 3rd sample
4	Magnesium	Mg^{++}	mg/l	0-5	2.5	2.8	**2.3**

5	Carbonate	CO_3^{--}	mg/l	0-1	2.27	2.54	**2.44**
6	Bi Carbonate	HCO_3^-	mg/l	0-10	1.1	1.04	**1.3**
7	Chloride	Cl^-	mg/l	0-30	0.95	0.8	**0.9**
8	Sulphate	SO_4^{--}	mg/l	0-20	0.21	0.2	**0.2**
9	Nitrate	NO_3	mg/l	0-10	1.6	1.2	**1.4**
10	Ammonia	NH_4	mg/l	0-5	0.81	0.75	**0.70**
11	Phosphate	PO_4	mg/l	0-2	1.22	1.32	**1.12**
12	Acidity	pH	(1-14)	6.0-8.5	7.9	7.7	**7.6**
13	Chemical oxygen demand	COD	mg/l	90	86	30	**40**
14	Total suspended solid	TSS	mg/l	-	54	254	**200**
15	**Hardness**	**-**	**mg/l**	**--**	**227**		

Hattar Industrial Estate

As mentioned in section 5.1, there are 220 industrial estates divided into seven main categories:

1. Textile,
2. Marble Tiles,
3. Heavy Electrical Engineering,
4. Chemicals,
5. Ghee & Cooking Oil,
6. Food and
7. Steel.

Seven different industrial units were selected randomly for detail analysis. On comparison with Pak-NEQS almost all industrial effluents were found exceeding safe limits (Table 5.8). These result shows that industries of Hattar also have a negative impact on the environment and the days are not so far that we would suffer a lot due to these environmental issues.

Table 5.8: pollution load of Hattar industrial Estate

S.No	Industry	PL COD kg /day	PL COD kg/year	TSS kg /day	TSS kg/year
1	Paper paramount	203.32	32480	187	29920
2	Pepsi cola	164.79	26367	106.32	17011.2
3	Deewan salman	364	58240	336	53760
4	Super latif ghee	172	27520	12.79	2046
5	Neelam Paper	800	128000	217	34720
6	Complex chemicals	239	38240	90	14400
7	Qarshi industries	157	25120	5.66	905.6
	Total	2100.11	335967	954.45	152762

These seven industries of Hattar industrial estate are contributing a total of 335967 kg per year of pollution load in terms of COD while152762 kg/year in terms of TSS to the River Haro. Among the various industries, two industries i.e. “Complex Chemicals and “Pepsi” were high in COD level.

Gadoon Industrial Estate

The study of Gadoon Industrial Estate revealed that majority of parameters was within permissible limits. Only COD was violating Pak-NEQS. Records of six selected industries were found high in terms of COD (Table 5.9).

Pollution load from Gadoon Industrial estate join a season drain. In this way the impact is more severe. These six industries of Gadoon industrial estate is contributing a total of 329992.3 COD while 152344 TSS kg per year while of pollution load to the water body (Table 5.9).

Table: 5.9: Pollution load of Gadoon Industrial Estate

S.No	Industry	PL COD kg /day	PL COD kg/year	PL TSS kg /day	PL TSS kg/year
1	Textile	1200	192000	300	48000

2	Utman Ghee	40	6400	36	5760
3	Amrat cola	295.8	47328	31101	49776
4	Sardar dyes	93.25	14920.3	57	9120
5	Shehzad ghee	40.7	6512	51.7	8272
6	Dynae pak	392.7	62832	196.35	31416
	Total	**2062.45**	**329992.3**	**31742**	**152344**

Impacts on Receiving Water Bodies

The tributaries of two water bodies namely river Kabul and River Haro were analyzed for the pollution rate.

River Kabul: sample were collected from three points of river Kabul i.e Budhni bridge,Shah Alam and Akbarpura village and was analyzed for PH, conductivity, TSS,TDS,BOD and COD. All the parameters were in permissible limits except for COD and TSS. Pollution load were calculated on the basis of flow rate and is recorded in the table 5.10

Samples from these three tributaries of river Kabul were taken thrice each and after taking the mean, its pollution load was calculated thus the river Kabul is receiving Above 15 million kg pollution load per year of COD as well as the same for TSS, from these three tributaries. And this pollution loads is as a result of those industries whose discharge is finally reached to river Kabul directly or indirectly.

Table 5.10: pollution load of river Kabul

S.No	AREA	PL COD kg /day	PL COD kg/year	TSS kg /day	TSS Kg/year
1	Budhni	216684	34669440	240760	38,521,600
2	Shah Alam	249808.5	39969360	299770	47963200
3	Akbarpura	516456	82632960	459072	73451520
	Total	**982948.5**	**157271760**	**999602**	**159936320**

River Haro: River Kabul: samples were collected from three points of river Haro i.e Dingi nullah, Jarikas and Dhunal Nullah and was analyzed for PH, conductivity, TSS, TDS, BOD and COD. All the parameters were in permissible limits except for COD and TSS. Pollution load were calculated on the basis of flow rate and is recorded in the table 5.11\ **Table 5.11: pollution load of river Haro**

1	Dingi nullah	154261	24681760	548032.5	87685200
2	Jarikas nullah	156887.5	25102000	683375	109340000
3	Dhunal nullah	156546	25047360	623508	99761280
5	Main Haro River	282,462	45193984	247154	39544736
	Total	**750156**	**120025104**	**2102069**	**336331216**

Samples from these three tributaries of river Haro were taken thrice each and after taking the mean, its pollution load was calculated thus the river Haro is receiving a total of 120025104 (COD) & 336331216 (TSS) kg pollution load per year from these three nullahs (drains).

Air pollution: Air analysis of eight industries in Hayatabad was carried out. Data was taken and was compared with the NEQS for air emissions. It was noted that all the parameters were within the permissible limits of the NEQS (Table 5.12). The reason is that the NEQS for air emission are too relaxed and it is easy for an industry to comply the standards set by Environmental Protection Agency. If the reported value is increased by 100% (Fig5.2), it will still be lower than the Pak-NEQs value. For SO_2, WHO Air Quality Guidelines (2005) stipulate 20 µg/m3 for 24 hours and the Pak-NEQS value is 120 µg/m3 for 24 hours (Ministry of Environment, 2010). If the observed highest value is doubled (100% increase) and compared with the abovementioned standards, it appears less than the available national and international air-quality standards (NEQS). In such a situation, no mitigation measures are required (Nafees et al, 2013).

Table 5.12: Air analysis of Hayatabad industrial estate

Parameters	**Alam Match factory**	**Umar Glass**	**Royal PVC (Generator)**	**Sarhad Board And Chemicals**	**Paper And Board Mill**	**Frontier tech wood**	**Frontier foundry**	**Lahore steel**	**NEQS Limits**
Ambient Temp (°C)	28	26	27	35	37	34	37	37	**40**

CO (mg/Nm^3)	15	313	92.5	320	250	312	0	0	**800**
CO_2	23.57	76.6	31.42	51.07	51.07	ND	24.35	0	**NA**
NO	0.00	26.25	289.2	225.6	122.4	ND	0	0	**3000**
NO_2	0.00	40.25	0	143.9	47.43	3.00	0	0	**3000**
SO_2	0.00	N.A	650.7	0	0.0		0	0	**1700**

The values of NO before construction was 1.07 ug/m^3 , which become almost double (2.07) during construction. Still it was below the level set in Pak-NEQS (Fig. 5.2). The double arrowed straight line in the graph (fig5.2) is the standards which is very hard to be crossed even if the NO emission are increased up to 100 percent . This Study carried out by Nafees et al (2013) conclude that the NEQS should be reviewed and make it strong enough to prevent the environment from deterioration.

Government Legislation and the Role of Agencies

The Environmental Protection Agency of Peshawar gets violation reports of the Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA). The IEE and EIA play a major role in implementing the Environmental Protection Act of 1997.

Till 2015 a total of 138 IEE and 41 EIA reports compliance has been received by EPA Peshawar.

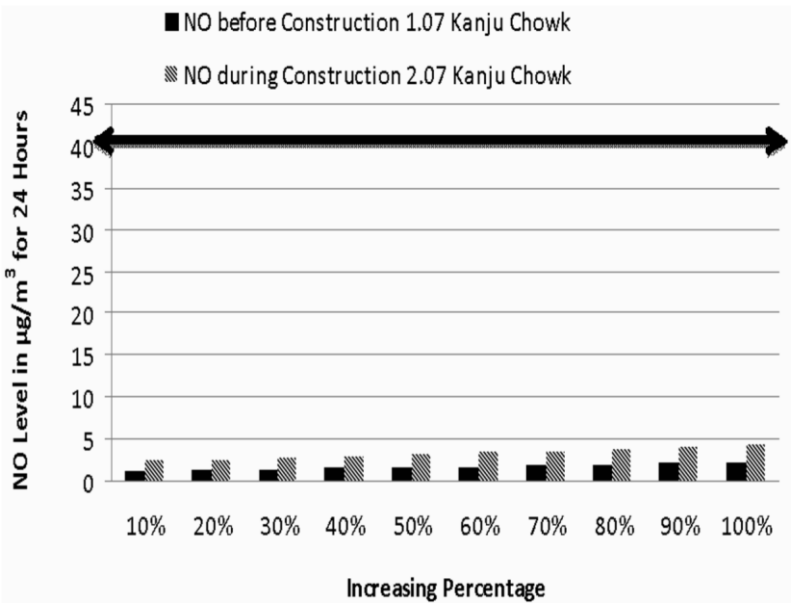
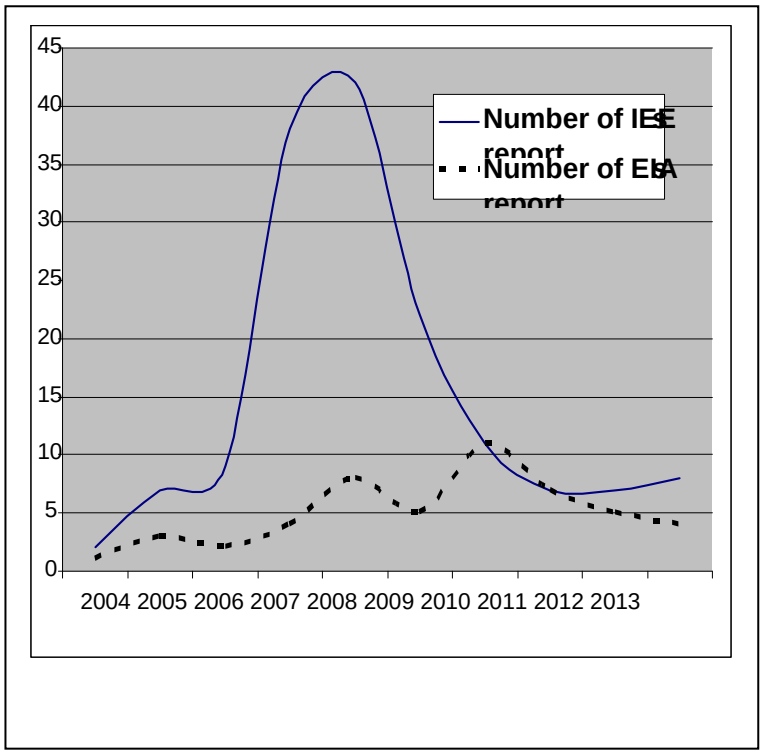


Figure 5.2: NO emission and its comparison with the standard

S Nf tl2013

Majority of the cases ha not been investigated properly. Industries are monitored by the EPA (KP) and if they are found in violation of the PEPA 1997, are wither issued warning notices or are prosecuted in environmental tribunal. In spite of all this legislation, only one proponent was fined Rs.5000 PKR in 2004, a large number of industrial units were charged a sum of Rs.90000 only in 2005, at the average of Rs.4091 only per industrial unit only. The performance of the EPA (KP) was dismal in the early years but later on it has made progress and worked hard to implement PEPA 1997. This became visible when over the years larger amounts of fines started being charged from violators in more recent tears.



Year wise submission of reports to EPA Peshawar: According to the record of EPA Peshawar the number of IEE/EIA reports submitted ha been summarized in table 5.13**.** The table shows that each year IEE/EIA reports are submitted to the EPA and this is a mandatory process for all the developmental activities .the number of IEE Reports submitted is greater comparatively to EIA. The reason may be the weak financial status of this province as a mega project would require more financial resources or may be the lack of interest of the investors.

Proper submission of IEE/EIA has been started in 2004, till 2013
53 IEE AND 50 EIA has been submitted 2009 both IEE and EIA were towards increase .After 2009 a visible decline has been recorded. In 2013 both came to the minimum, this trend talking about the interest of the investors

to invest in KPK. (Fig 5.3)

Fig 5.3 year wise submission of IEE/EIA reports to

Review of EIA Reports: EIA reports submitted to EPA is subjected to a review process.Till 2005 there was external review ,in this process reports were reviewed by two experts selected from the approved list of expert panel.As per IEE/EIA Regulations, EPA is bound to respond within 90 days, in case of delay the report is considered as approved. The experts could not comply this time bar, therefore internal review was started. For this a separate panel of experts has been constituted. The proponent is usually asked to submit IEE/EIA report to EPA. After 1530 days time the proponent along with consultant is called for presentation, if presentation is satisfactory the proponent is granted no objection certificate

(NOC). If not the proponent is asked for review. Generally the reviewers have to fill a form (fig 5.4)by ratting different aspects of the IEE/EIA reports, by giving a value from A to D. "A" is excellent and acceptable while "D" is poor and rejected . To evaluate a report the EPA use a checklist. A particular report is given to two reviewers. Each reviewer has the right to give his/her suggestion to the EPA for acceptance or rejection. For this ranking from A to D is used. A is excellent and accepted and D is poor and rejected (Fig.5.4). In this section an attempt has been made to review an EIA on EPA format as detail out below (Table5.14).

Report 1st: EIA of consumer line steel re-rolling mill: comparatively this is a recent EIA study carried for re-rolling industry. In this industry steel bars (pic No 5) are prepared for construction purposes. The mill consists of a kiln and rolling equipment. A briquette of iron is heated up in a Killen and shaped in a rolling equipments in to a long bar. As per schedule xxx of EIA regulation 2000 detail EIA was obligatory for such mills.

EIA was conducted in 2010 and was submitted to Environmental Protection Agency in May2010. The industry was supposed to be installed in Hayatabad Industrial Estate Peshawar (HIEP). As similar mills were already there in HIEP, therefore, it was easy to study one particular industry for identification of environmental problems and its mitigations.

The various gaseous emission studied include oxides of nitrogen (NO_x) Sulfar (SOx) and Carbon (CO_x). Carbon emissions were found the highest but no mitigation measures were identified. For the reason that Pakistan is not member of annex-1 countries and exempted from Copenhagen declaration 2002. Other parameters were

Environmental Review Rating Checklist

Name of Project: **Executing Agency: Name of Consultants:**

S. No	Review Component	Rating	Remarks
1	IEE/EIA Report Presentation Format		
2	Description of Project Activities and Identification of Affected Areas		
3	Description of Existing Environmental Situation (Baseline Information)		
4	Identification of Potential Impacts and Significant Impacts for Mitigation		
5	Description/Study of Alternatives Option		
6	Proposed Mitigation measure in the IEE Report		
7	Stakeholder/Public Consultations by the proponent in the project area		
8	Description of EMP and its practicability		
9	General Comments/Observation		
10	Overall Rating of the IEE Report		

Key for Assessment Rating: A: Generally well described and acceptable
B: Satisfactory and acceptable
C. Satisfactory, with some inadequacies, which may be completed
D. Incomplete & unacceptable

Fig: 5.4: Specimen of Check list used for review of EIA

within permissible limit. In this way, air emission related problems were identifies but no mitigations measures were suggested.

Noise and heat level were above the permissible limits. There were some suggestion related to occupational safety but no mitigation measures were identified. This section were further taken for research (case study - I).

As the mill was supposed to be installed in the industrial estate therefore there was no discussion on the local ecology. Although the air emission has got impacts on the surrounding habitats.

Water is used for cooling purpose only. As per EIA report, about $30M^3$ water is required per day. This has got negative impacts on the ground water table and can impact the availability of water in the long run. As the water quality parameters are not mentioned in the EIA-regulation-2000. Therefore its study and identification of mitigation measures were not obligatory. Besides, the water parameters were within permissible limits. Therefore only a settling tank was suggested for re-circulation. Water related aspects were studed in detail (Part-B Case Study-II). And suitable mitigation measures were identified.

Report 2nd : Khan brother steel re rolling mill: This was an Environmental impact Assessment report by the name of Khan brother. The Mill is located at Plot no. 23, Phase I, Hattar Industrial Estate, Haripur. This study was conducted in 2009.this was a steel rerolling mill. Steel bars will be the final product. The capacity of the plant was 70 - 80 tons/day. and its process was almost similar to that of consumerline discussed earlier.

The various gaseous emission that is related with the steel mill include oxides of nitrogen (NO_x) Sulfur (SOx) and Carbon (CO_x), but no such data was given in EIA report.

Noise and heat level were the parameters usually above the permissible limits in the steel industry. No measured values were found in the report .Moreover no suggestions for occupational safety except for the ear plugs were mentioned for the various pollution to be faced by the workers in various section of the mills.

As the mill was supposed to be installed in the industrial estate therefore there was no discussion on the local ecology.

Large quantity of water is used for cooling purpose in the industry but was not mentioned.It was claimed that “The steel re-rolling operations do not affect the quality and level of groundwater. No analysis for water parameters was present in the report nor any mitigation suggested.

Report 3rd Salman steel re-rolling mill : This was also an environmental impact assessment report of a steel mill in the industrial estate Hattar. As the 2nd and 3rd report were written by the same consultants and are almost similar.

IEE/EIA Report Presentation Format: This section is about the content and arrangement of information. A reviewer has to look into the format of a report, maps, annexes etc. The EIA report seems complete and was termed as "A". the report of Consumer line steel re-rolling mill can be divided into three main parts i.e. main report, table and annexes. The main report is divided into five chapters, a) Introduction, b) description of project, c) description of environment, d) potential environmental impacts and e) mitigation measures and environmental management plan and institutional requirements. Chapter-I is "introduction" and talking about the project, the consultant firm, major objectives, approaches and methodology and study team. It seems that this section is well written and clear to understand. Similarly other chapters are also complete and were termed as "A".

Report 2nd: The EIA report seems incomplete and was termed as "B" by the EPA while "C" when evaluated during this study. The report of khan steel re rolling mill can be divided into three main parts i.e. main report, table and annexes. The main report is divided into seven chapters, a) 1; description of objectives of proposals 2-legislative and institutional frame work 3description of the project 4-description of the environment 5-evaluation of potential environmental impact, 6- Environmental management plan 7-public consultation.

There was a little problem in the format of the report that is why it was given "B" moreover certain relevant details and analysis and measurements are also missing.

Report 3rd : As mentioned earlier, the third report was carbon copy of report second ,that's why it was also marked as "B".

Description of Project Activities and Identification of Affected Areas: For this there is a separate chapter "description of Project". The project has been described well but the affected area has been ignored with the justification that the industry is going to be installed in an industrial estate. This is not a good justification to ignore such important item. This responsibility may be put on the Sarhad Development Authority or Environmental Protection Agency or may be all the industries operational over there. Anyhow this missing was found and cannot be termed as "A" or "B". This is why we give a rank of "C".

Report 2nd and 3rd : The project has been described in a very good way but the affected area has also been ignored . This is why we give a rank of "C".

Description of Existing Environmental Situation (Baseline Information):

Report 1st: Baseline information has been given in the chapter "**Description of Environment**" In this section Hayatabad Industrial Estate has been discussed in detail. A detail account on environment has been given under the title "Description of Environment". In original EIA report it is termed as "A". The various contents such as land use, soil, hydrology, ground water table, climate, biodiversity, live stock and other fauna, socio-economic and existing infrastructure revealed that this section is also well written and clear. Most of the data given here are secondary. For some headings secondary data was found missing such as climate and forestry. Therefore, the grade goes from our side is "B"

Report 2nd : The Existing (baseline) condition of the biophysical and socio-economic environment, trends and anticipated future environmental conditions, Environmentally sensitive areas of special or unique value, Topography and geology, soil, climate, temperature, dust storms, earth quake, water, biodiversity, forestry, wild life and culture etc of the area has been described in detail. The grade given by EPA and in this neutral review is "B"

Identification of Potential Impacts and Significant Impacts for Mitigation: For all such project EPA has published detail guidelines. Therefore, only those parameters are obligatory to be studied, mentioned in EPA guidelines. For steel mill water related parameters are not mentioned. Still there was discussion on water related parameters. The project has no impact on surface water but had got impacts on ground water table. As per EIA-regulation 2000 it is not obligatory to adopt ground water related mitigation measures.

Report 2nd : All the impacts has been found in detail but no impact study has been carried out on the ground water table. So both the reports having common missing has been marked as "B" instead of "A".

Description/Study of Alternatives Option: No such alternative presented in report 2nd and 3rd so both the reports are marked as "D"

Proposed Mitigation measure in the Report:

Report 1st : for gaseous emission no mitigation measures have been highlighted. Mitigation for water recycling has been given but was not obligatory. To decrease the impacts of noise level some occupational safety measures have been given. Temperature related measures were required but not obligatory. But it was highlighted in the report.

Report 2nd : As no gaseous emission has been identified nor analyzed therefore no mitigation measures are presented for various gaseous emissions like NOx, Cox SOx etc, regular monitoring has been presented as a mitigation measure but it is not the solution. Moreover no mitigation measures are there for temperature.

So the grades go from "B" To "D" for both report 1st and 2nd. As per our analysis the grade of report 1st was reduced to "C" and the 2nd and 3rd to "D"

Stakeholder/Public Consultations by the proponent in the project area:

Report 1st: This was found the weak most area. Main stakeholders such as EPA, SDA, and Chamber of commerce were consulted with the aim to collect secondary data. Labor unions, school and colleges in the area, surrounding industries were not consulted. On the day of public hearing only a few workers collected from the surrounding industry. Therefore it was terms as 'D'

Report 2nd: only an advertisement was given in the news paper that if anyone having any complaint against the establishment of the said industry, they should contact .but this is not sufficient as mentioned for report 1st . Similarly the public hearing was also weak. So this was also marked as "D".

Description of EMP and its practicability: For report 1st EMP were available and were complete and was marked as "A", for 2nd and 3rd there was no EMP and was marked as "D"

Report 2nd: This area was weak with respect of the air emission and was marked as "B"

General Comments/Observation: Over All Rating: the overall rating from the reviewers was "A" as per our calculation the rating was "B" for report 1st and was "C" for report 2nd.

Table 5.14: Checklist for rating EIA/IEE studies in Khyber Pukhtunkhwa

No. of		Industry					
		1		**2**		**3**	
	Criteria	**G**	**O**	**G**	**O**	**G**	**O**
1	**IEE/EIA Report Presentation Format**	A	B	B	C	B	C
2	**Description of Project Activities and Identification of Affected Areas**	A	C	A	C	A	C
3	**Description of Existing Environmental Situation (Baseline Information)**	A	B	B	B	B	B
4	**Identification of Potential Impacts and Significant Impacts for Mitigation**	A	B	A	B	A	B
5	**Description/Study of Alternatives Option**	B	D	B	D	B	D
6	**Proposed Mitigation measure in the Report**	B	C	B	D	B	D
7	**Stakeholder/Public Consultations by the proponent in the project area**	B	D	B	D	B	D
8	**Description of EMP and its practicability**	A	A	B	D	B	D

9	**General Comments/Observation**						
10	**Over All Rating**	A	B	B	D	B	D

Note: "G" is used for Given Rating and "O" for Observed rating

CHAPTER V RESULTS AND DISCUSSION

PART B

(Case Studies)

In this section two case studies have been discussed. These two studies have been conducted with the objective to evaluate Pollution load and identify suitable mitigation measures. An attempt has been made address those areas which are generally not considered in EIA/IEE studies. For example, in study 1 water recycling related problems have been discussed. In steel Mill the focus area is air pollution,(pic No 6) therefore, water is not highlighted. This paper is important for those areas where water is deficient. For example water availability is different in Hayatabad Industrial Estate from that of Hattar Industrial Estate. In Peshawar region it can be skipped, but cannot ignore in Hattar Industrial estate.

Similarly occupational health and safety is very important but always ignored in EIA/IEE reports. In this study an attempt has been made to highlight the combine effect of noise and temperature. If we address such problems in EIA/IEE we can make the industrial environment healthy for the worker as well as for the surrounding community.

1. STUDY OF STEEL RE-ROLLING MILL FOR MITIGATION MEASURES WITH SPECIAL REFERENCE TO WATER RECYCLING (Nafees, M*., Zahid, Z[1] and Naz, R[2])

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Abstract

Steel Re-Rolling Mill (SRM) is a simple industry consists of heating and re-rolling of billet. A heating kiln is used for the maintenance of specific temperature (1000 to 1200 °C) to mould billets/ingots into various desired shapes. After getting the desired shape, heavy amount of water ranging from 32 to 39 m3 per day is used for cooling. This water is discarded on daily basis or after few weeks time. This huge amount of water creates pressure on ground water resources as well as contributing to pollution load. These

aspects of steel re-rolling mill are not clearly defined in the Pakistan Environmental Impact Assessment/ Initial Environmental Examination (EIA/IEE) rules and regulations, 2000. To study the possibility of water re-cycling as mitigation measure in steel re-rolling mill was analyzed for one year. It was found that wastewater of rerolling mill, used for cooling purpose, can be recycled after minor treatment. By the frequent reuse of the same water the possibility of biological contamination may occur. The water can be used for longer period of time after proper disinfection. To confirm its usage/re-use Potassium permanganate $KMnO_4$ was used as disinfectant. $KMnO_4$ treatment was given to the wastewater samples collected from storage tank with concentration of 3 mg/L, 5 mg/L and 10 mg/L. It was found that combination of 3-5 mg/L was more effective to keep the water odorless and free from coliform bacteria. After repeated use, it was suggested to discard/discharged wastewater of steel re-rolling mill only once in a year during high flow season (July-August). In this way the wastewater will be diluted to the extent that it may have no/or minimum negative impacts on the receiving the water body as well as saving the ground water resources. It is therefore, suggested required to start work on individual industry and develop specific EIA and monitoring guidelines.

Key words: Disinfection, KMnO4, Coliform Bacteria, Threshold odor Number (TON), Water Recycling, EIA, bNational Environmental Quality Standards (NEQS)

Introduction

Industrial pollution is a worldwide problem. On the one hand it pollutes ecosystem, on the other side ground water is used for industrial purposes and created pressure on ground water resources as observed in Pakistan (Falkenmark, 1990). At present the water table depth is about 45 meter and a regular decrease has been noticed due to which there is decrease in tube-wells at house hold level. Heavy industrial use may also affect domestic water supply in the long run (Pak-EPA, 2004). Besides, when industrial effluents join irrigated water, it can damage crops also (Iqbal, et al., 2010). Therefore, it is important to take initiatives for recycling and re-use of water along with water saving.

Like other developing countries, in Pakistan industrial development was quite slow during early fifties. Khyber Pakhtunkhwa had a small industrial basis consisted of 11 industrial units only. During late seventies and early eighties new industries have been established with a very slow rate. In 1996 there were 1848 Industrial units (Government of Pakistan, 1996 and The Daily Nation, 2003). Nowadays the province has nearly 1151 industrial units. Out of total only 431 (37.47%) are operational (Sarhad Development Authority, 2006). In the beginning these units were haphazardly distributed, situated in and around the major cities and towns. In the first (1955-1960) and the second five years plan (1960 to 1965) establishment of separate industrial estates were approved. Later on, in the third five year plan (1965- 1970) formal procedure was adopted for its proper implementation (Khan, 1976). Out of fourteen (14) industrial estates, 3 are large and eleven are small in magnitude (Government of Khyber Pakhtunkhwa, 2007). Hayatabad Peshawar, Hattar and Gadoon Amazai (Swabi) are large industrial estates, while small industrial estates include Peshawar Phase-II, Kohat Road Peshawar, Mardan Phase-I, Mardan Phase-II, Kalabat-Haripure, Abbottabad, Charsadda, Mansehra, Nowshera, Bannu, and DI Khan.

Rapid Industrialization, on one side has got positive impacts in terms of goods, services and job opportunities, but on the other side it has posed negative impacts on environment in terms of use of resources and increase in pollution. To look after environmental aspects, Environmental Impact Assessment (EIA) and Initial Environmental Examination (IEE) procedures have been adopted worldwide since 1970 (Paula, 2011). Pakistan had legislative coverage in the form of Environmental Protection Act, 1997 and IEE/EIA rules and regulation 2000.

At present these rules regulations are in its initial stage of implementation, although with the approval of Environmental Protection Act 1997 EIA has been mandatory since 1997 (Government of Pakistan, 2000). Steel mill is in Schedule II for which full EIA study is required. It is a general practice that the impacts are evaluated by comparing it with Pakistan National Environmental Quality Standards (Pak-NEQS). If the resulted waste water or air emission comply the Pak-NEQS, the industry is considered as environment friendly and NOC has been granted. (Pic No 7)

Environmental Protection Agency has offered the provision for self monitoring under "Self monitoring and Reporting Rules 2001. According to this, an industry is required to submit monitoring report periodically.

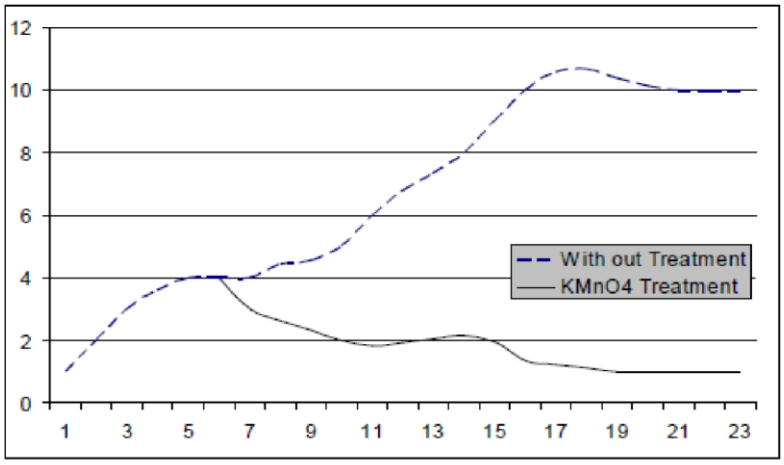

Fig 5.3 Graph showing trend in thresholg odor Number (TON) with and without $KMnO_4$ treatment (5mg/l)

Two categories have been defined, placed under

schedule I and II respectively. Schedule- I is for industrial effluent and schedule II is for gaseous emission. Schedule-I is further classified in to A, B, C and Special industries. Industries listed under A, B and C have to submit their monitoring report monthly, quarterly and biannually respectively. Industries not mentioned in any of the above categories are termed as special industries. The case is decided by EPA after proper evaluation. Steel re-rolling mill is not mentioned under any category. Although "Steel Mill" is mentioned under category a serial No. 9, but it is interpreted as large scale steel mill. Logically steel re-rolling may be placed under "special Industries" need special and modified rules. But Steel Re-

Rolling mill is interpreted as exempted from reporting its effluent periodically (**Government of Khyber Pakhtunkhwa, 2001**).

Schedule-II, which is for gaseous emission, is classified into three categories, A, B and C. Again, steel re-rolling mill is not mentioned but at serial No. 10 "coal and oil fired Boiler, oven, furnaces and Kiln" are mentioned. Therefore, steel re-rolling can be placed here and have to submit its gaseous emission monitoring report monthly. Gas fired boiler, oven, furnace and kiln are placed under category "B" and have to submit its gaseous emission report quarterly.

For this parameters to be analyzed are mentioned under schedule-III, where water related parameters are given for "Steel Mill" include, Effluents flow, Temperature, pH, Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), Biological Oxygen Demand (BOD5), oil and grease, phenolioc compound. For all these parameters an upper limit has been defined in Pak-National Environmental Quality Standards (Pak NEQS) except effluent flow. As mentioned earlier, steel re-rolling mill is not coming under this category "steel Mill" directly and is interpreted as exempted from reporting its industrial effluent monitoring. Besides, coliform bacteria, Threshold Odor Number (TON) are not mentioned (**Government of Khyber Pakhtunkhwa, 2001**).

Studies conducted during 2007-08 revealed that EIA process was quite weak **(Nadeem and Hameed, 2008**). In 2011 it was pointed out that public participation was considered as major contributor in its effectiveness and was suggested to make EIA effective public participation is none of the solutions (**Nadeem and Fischer, 2011**). EIA is considered as systematic study to identify impacts and mitigation measure by selecting suitable measures. Use of applied science is important for identification of suitable mitigation measure. (**Cashmore, 2004**). Up till now untreated wastes are discharged and dumped in and around the ground and water bodies are degrading the aquatic and terrestrial ecosystems of the province (**Nafees, 2004 and Zahidullah, 2009**). Besides, Hayatabad Industrial estate using ground water and continuous dependency may lead to water shortage in the vicinity as well as contribute to pollution load (**Sarwar, 2011**). Present studies revealed that water table in

Peshawar Valley is toward decline (**Pak-EPA, 2004)**. There are various mitigation measures, like re-use, recycling, end-of pipe treatment, cleaner production etc (**Gehin, et al., 2008**). But no such studied conducted on in Pakistan to evaluate a Steel Re-Rolling Mill for any of the mentioned options. Pakistan is facing water scarcity and need to save this important resource (Steenbergen, and Oliemans, 1997).

Industrial activities used huge amount of groundwater and it causes water scarcity on the one hand and cause surface water pollution on the other hand (**Hussain, et al., 1992**). Major rivers of Pakistan in general and of Khyber Pukhtunkhwa in particular are contaminated and not safe for drinking (**Nafees, 2004**).

Water recycling is a technical and most complicated method (**Jeffrey, et al., 1999**). Before devising a recycling method a pre assessment in terms of quantity and quality is essential. In which waste water

quality is of prime importance (**Ahmad, and Dessouky, 2008**). As waste water is stored in storage tank, therefore, various hurdles can appear in the form of bad smell, color and turbidity. This forced the industrialist to use fresh water (**Liu, 2010**).To cope with such situation, usually disinfections are used. The common disinfections used for raw water treatment includes Chlorination, and UV-treatment. But these are expensive and are justifiable for potable water only.

Other popular disinfectants include the use of potassium per manganate (KMnO4) and lime. These can be used in isolation or in combination, depending on water quality. KMnO4 is a colored compound and may be required in excess with a long retention time (Magalhaes and Neves, 2003). A suitable range for raw-water treatment is 5-10 mg/L (**Richardson et al, 1995**). Besides, in high concentration it is toxic. Therefore, a low dose of 10 or less is preferred (**USEPA, 1999 and Nwadiaro, et.al, 2010**).To increase its effectiveness other compounds are added as supplement for enhancement. These include Cu, Ag and lime. But there is always a trade off in terms of retention time and cost (Gerba, et al., 1989).

Steel mill is a common industry in Khyber Pukhtunkhwa. It is a simple industry, consists of two major steps i.e. heating and re-rolling where water is used for cooling. In total there are 103 steel related industrial units out of which 52 units are situated in Peshawar. Out of 52 units, 42 are accommodated in Hayatabad Industrial Estate. The average production of a steel re-rolling mill is 0.5 million tons/year (Government of Khyber Pukhtunkhwa, 2007). On the average 5% of the raw material is wasted during production and is re-cycled inside the plant. On the average a SRM consume 38 – 40 M^3 water, which is used for cooling. In theory this water will be reused as it will remain in circulation and develop foul smell and color. Due to International Journal of Recent Scientific Research, presence of odor the water is considered as source of skin and other diseases and is usually discarded as waste water. In this study an attempt has been made to overcome on the problems of odor and coliform bacteria and make this used water recyclable for a longer period of time with the idea to reduce pressure on ground water resources and avoid/ reduce surface water pollution.

Methodology

To assess water quality for recycling three composite samples were collected per month in a calendar year. Each composite sample consisted of four grab samples collected with one hour interval. Samples was analyzed for Temperature, Odor, pH, E.C, TSS, TDS, Turbidity, BOD, COD, Iron, Cupper and coliform bacteria by following standard method.

These parameters, except odor are mentioned in Pak-NEQS and the list was used for comparison. The same samples were subjected KMnO4 treatment for identification of proper dose. Various doses of 3mg/L, 5mg/L, 10mg/L and 15mg/L were applied and were monitored for coliform and Threshold Odor Number (TON). For coliform bacteria (cfu/100 ml) a simple filtration and incubation method was used (Romprea, et. al., 2002).

Results and Discussion

Water use: The daily water usage ranged from 31.94 M^3 to 44.39 M^3 (31940L to 44390L) per day in different seasons of the year with the annual average of 5900 M^3 (Table 5.15). A fraction ranged from 0.5 to 1.0% consumed per day in the form of evaporation. This amount of water (0.5 to 1.0%) equivalent to 200 to 400 L will have to be added daily to the storage tank.

Table 5.15 Detail of Average Daily Water Used in Steel Re-Rolling Mill during 12 Hours Shift

Period	Total Records	Min (M3/day)	Max (M3/day)	Average (M3/day)
Jan-March	9	28.22	34.25	**31.23**
April- Jun	9	37.23	48.34	**42.78**
Jul – Sept	9	32.78	42.89	**37.83**
Oct-Dec	9	31.56	39.82	**35.69**
Average	**36**	**32.44**	**41.325**	**36.8825**

Underground water is the major source in Hayatabad Industrial Estate. At present there are three steel re-rolling mills in Hayatabad industrial estate and consume 110.8 M^3 (36.9 * 3 M) water per day. The wastewater consisting of iron-scale will mainly be treated in settling tanks through the process of sedimentation. The scale will settle in sedimentation tanks that will be cleaned out and sold to the contractor. If a Steel Re-rolling mill is based on freshwater with no storage and recycling facilities, will consume 5900m^3 annually.

Continuous extraction of water can lead to ground water resource degradation and need to be reduced at the source. It is, therefore, desired to circulate the cooling again and again and avoid ground water depletion. By repeated circulation for cooling, with the passage of time water gets contaminated with dirt and also produces bad smell and the water is released as waste water after a few weeks.

Characteristics of used /wastewater

The average values of different parameters (Table 5.18), based on six month record shows that majority of parameters were within the permissible limits when compared with Pakistan National Environmental Quality Standards (Pak-NEQS). Besides, it is also not part of the routine monitoring program mentioned in the EIA/IEE regulation 2000. In this way it is not obligatory on the industry to arrange treatment for this type of wastewater. The direct discharge may have no negative impact on the receiving the water

body (Kabul River) but its recycling can decrease pressure on ground water resources on one hand and can decrease pollution load of the receiving water body on the other hand along with saving electricity.

Temperature ranges from 35 to 43 ^{o}C with the average of 39.43 ^{o}C. This range is not a problem in winter but can encourage the bacterial growth in the storage tank. In summer the atmospheric temperature remains above 40 ^{o}C (Government of Khyber Pukhtunkhwa, 2011). Therefore, the cooling capacity of the stored water will be minimum and extra-cooling system may be required. Which is usually achieved by i) mixing fresh water, ii) increase the capacity of storage tank by increasing the surface area instead of increasing the depth or iii) pass water from cascade and tray tower (**Manan, 2004**). The direct release may have no impact on the aquatic life as the receiving water body (Kabul River) is at a distance of more than 25 Km. Therefore, cannot increase surface temperature of Kabul Rive to such an extent that may have negative impacts.

The high temperature can affect the availability of dissolved oxygen of the used/wastewater. In the presence of 15-20 mg/L BOD and 45-95 mg/L COD, along with temperature of 42-48 ^{o}C will encourage bacteriological activity in the form of decomposition. Due to lack of oxygen anaerobic conditions will prevail to produce bad smell which is a big hurdle in recycling.

From re-cycling point of view, two parameters, which is not mentioned in the list of Pak-NEQS were objectionable i.e. odor and turbidity. US-EPA had set a limit of 3 Threshold Odor Number (TON) for drinking water (Peavy, et al., 1985, Lin, et. al., 2002). Threshold Odor Number (TON) of steel mill was ranged from 7 to 13 with an average of 9.57 (Table 5.16). This has got physiological impression and on the basis of bad-smell the water is considered as polluted (**Lin, et. al., 2002**).

Although, a slight treatment in the form of disinfection can remove bad smell and the water can be made recyclable (Paris, and Schlapp, 2010). As some water (0.5 to 1.0%) daily consumed during cooling system and fresh water is added daily. Dilution is one possible solution to remove odor but for removal of odor with 9.5 TON (Table 5.16) need 297.5 m^3 fresh water. Therefore, the daily addition of 0.5 to 1.0% water equivalent to 0.175 m^3 to 0.35 m^3 cannot solve the odor problem.

Turbidity is the second parameter which determines whether the water is polluted or not which is, caused by suspended and colloidal material. It is not necessary that turbid water is dangerous (Pavanelli, and Bigi, 2005).Therefore, a slight treatment in the form of sedimentation and coagulation can solve the problem. As observed in re-rolling mill, the storage used water get an overnight retention time, which is enough time to allow the suspended load settled and make the water less objectionable.

Table 5.16 Growth of Coli-form Bacteria without any Treatment

Day	**Fresh water**			**Waste water**			**blank (de-ionised water)**		
	Min	Max	Average	Min	Max	Average	Min	Max	Average
Before incubation	4	8	4.8	400	870	664.3	0	2	.8

After 48 hours incubation	8	20	14.4	1100	4500	3214,3	1	4	2.1
Increase	4	12	8	700	3630	2165.1	1	2	1.5

Table 5.17 Response of Coli-form Bacteria toward Different Doses of $KMnO_4$

Conc Duration	**3mg/l**			**5mg/l**			**10mg/l**			**15mg/l**		
	Min	Max	Average	Min	Max	Average	Min	Max	Aver	Min	Max	Aver
1st day	30	90	60	20	50	38.6	10	40	28.6	5	20	14.3
After 5 days	10	20	13.6	6	16	10	2	6	3.7	1	3	1.9
After 10 days	4	10	7	1	6	3.5	0	2	1	0	1	0.5

The third important parameter is coliform bacteria. It is a general perception and is also observed that the stagnant water is considered as source of pathogens and un-safe (Richardson, 1995). It was found that waste water has got 400 to 900 cfu/100 ml coliform bacteria. After 48 hours incubation at 25°C a bulk increase of 2-5 times was recorded. The minimum increase of 1100 (almost double) to 4500 (about 5 times) was recorded (Table 5.17). This high increasing trend not only contributing to the odor but also is a potential source of disease.

To remove the hazard of biological contamination and odor, different doses of KMnO4 were applied (Table 5.17). With the increasing dose there was decrease in coliform bacteria as well as in TON. As KMnO4 is toxic in greater quantity therefore, a minimum dose is always recommended (Reynolds, 1989).

With the help of 3 mg/L a decreasing trend was observed up to 10 days. 5mg/L completely destroy all sort of pathogen after 3 hours retention time while 2 mg/L shows its effect in 5 hours.

As KMnO4 remained dissolved for weeks and months, therefore, a minimum does (2-5 mg/L) is preferred to make wastewater safe and odor free. The required amount of KMnO4 comes out as 175 gram/35 m^3 @ rate of 5 mg/L. KMnO4 worked as strong biocide in acidic media (low pH) and worked as oxidizing agent at pH above 7. During repeated recycling the pH remain at higher sides, which decrease its effectiveness toward coliform bacteria. In this way bacteria are killed by oxidizing effect of KMnO4. Therefore, a dose of 5 mg/L was identified as suitable. In this concentration the odor remains below 2

TON (Fig-5.3). By analyzing table 5.17 the killing effect is slow which is due to incomplete mixing. Contents were within the permissible limits and may have no effect on environment.

Odor, Turbidity and coliform bacteria are parameters that are not mentioned in EIA rules regulation 2000 and making the steel re-rolling water objectionable and

Conclusion

According to the present rules regulation, industries are placed under main sectors of different nature in terms of environmental impacts. Parameters like pH; TDS, Iron and Cu appeared as hurdle in its re-cycling. It can create water scarcity in Peshawar. It is therefore, recommended to create separate guideline for each industry by including status of water use in EIA as well as in routine monitoring program. The overall discussions show that the used/wastewater of steel rerolling is recyclable. For coliform bacteria and odor Problems KMnO4 treatment is suggested. KMnO4 may be added at once in the concentration of 5mg/L or on daily basis in small doses of 1-2 mg/L. The best option is to start with 3 mg/L and after monitoring KMnO4 level at regular interval to add further KMnO4. To increase the effectiveness of KMnO4 a uniform mixing is therefore, one of suggestion. For uniform mixing the water storage must have two separate chambers. The first chamber will serve as mixing and sedimentation tank and will be cleaned periodically while the second Chamber store water for re-cycling.

2. STUDY OF OCCUPATIONAL HEALTH SAFETY IN STEEL RE-ROLLING

MILL WITH REFERENCE TO HIGH NOISE LEVEL AND TEMPERATURE (Mohammad Nafees[1], Bushra Khan[**†],Robina Naz) Abstract

This study was conducted to assess the exposure to noise and temperature in a steel re- rolling mill. The measured noise and temperature values were then compared with international standards set by Occupational Safety and Health Administration (OSHA). Our results indicate that temperature level was high at two places of the mill i.e. furnace and re-rolling mill sections with the average value of 67 °C and 39°C respectively, which exceeds OSHA limit of 25-30 °C for comfortable working temperature. The average noise level at furnace section was satisfactory but that at the re-rolling mill was found to be 102 dB, whereas OSHA has set the limit to be 92 dB for 6 hours work shift. A pair-wise t-test indicated that the noise level at all factory zones was significantly different than that of administration section with a p-value < 0.0001. The re-rolling noise level was found to be extremely significant, followed by furnace and unloading section. Likewise the indoor factory heat level is also significant from outside air temperature. The interview survey revealed that the workers exposed to these chronic conditions in the factory are suffering from post work irritability, headache, fatigue, eye infection and heat exhaustion. It was therefore, recommended that the Pakistan Environmental Protection Agency (PEPA) should strictly implement and follow-up on the occupational safety laws, adopt shift rotation and ensure reduction in the length of exposure of each worker i.e. 1.5 to 2 hours instead of 6 hours work in these working conditions.

Key-Words: Noise, Occupational health & Safety, Shift rotation, Steel Mill Temperature, Shift rotation, Steel-Mill

Introduction

Occupational health and safety has been the subject of interest worldwide. To protect labor from industrial hazards, various safety guidelines have been set up worldwide. The famous one is Occupational Safety and Health Administration (OSHA). For body protection, appropriate clothing, glasses, boots etc are suggested. Similarly various devices such as ear plug and ear muff are used against unavoidable noise (**Friend , and Kohn, 2007)**. The loss of hearing is a common complaint about the exposed workers. Besides hearing loss, workers may exhibit sleep disturbance, annoyance, mental strain and cardiovascular disease (Ta-Yuan, et. al., 2003, Virkkunen et .al., 2005 and Passchier et. al., 2000)

As a standard safety procedure, working for 8 hours under normal noise levels of 85 dB is safe. The duration of occupational exposure should be reduced if the noise level exceeds the normal levels. For instance, at an exposure level of 88 dB, noise, the suggested guideline exposed duration is 4 hours. If that level reaches to 91 dB, the exposure time is reduced to 2 hours only (US Department of Health and Human Services, 1998)

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.Elevated temperature is another significant source of occupational health hazard which is often ignored. Workers in many industries are continuously exposed to high degrees of temperature which could impact their well-being and health. The increased in level of temperature has got negative effect on health and worker's efficiency (Narlawar et.al., 2006). In some industries (like textile mill)(pic No 8) , the workers don't face the twin problems of noise and elevated temperature. But in industries like steel mill, both noise and high-temperature pose occupational health risks. Their combined effect harms human body. The health risk of the exposed worker to the combined effect of heat and noise would be expected to be greater than exposure to any of these two attribute alone.

Response to heat of a human body varies from person to person. Normal body temperature is 37^{o}C. Ambient air temperature range from 20-26^{o}C is the most comfortable for a human being. Discomfort starts at above 36^{o}C. The body responses in the form of sweating, that leads to dehydration and regular intake of water is desirable (Weijiang, 2007).

The twin problems of chronic noise and heat exposure put workers in steel mill at health risk. There is also an element of discomfort and effect on workers' overall well being involved. Although working continuously under elevated levels of heat and noise is underestimated by the owners and regulatory agencies; it is undesirable, unsafe as well as hazardous. There is strong evidence on how exposure to noise and heat could affect human health. A health risk study conducted by Melamed and Bruhis (1996) found that "under conditions of chronic noise exposure at the end of the work shift the workers exhibited high levels of accumulated fatigue and post work irritability. Attenuating the noise reaching the eardrum by 30 to 33 dB, by fitting the same workers with earmuffs for a period of 7 working days, resulted in a significant improvement in both psychological and physiological stress reactions" (Melamed S, and Bruhis S. 1996).

Although the Pakistan Environmental Protection Agency (PEPA) has become more effective due to recent decentralization from the federal government, the issue of occupational health and safety is often not well entertained. The strong hold of the industry in the country often leads to occupational health safety violations hence putting workers at risk. It is therefore a matter of serious environmental concern. The current study was, therefore, conducted to evaluate the exposure to noise and temperature conditions of the workers in a steel rerolling factory and record workers safety concerns so that suggestions could be made to the PEPA. Steel rolling mill was selected because it apparently does not contribute to any major environmental concern (e.g. chemical effluents or air emissions). That is probably one of the reasons why it is often ignored for its safety violations. Most of the workers in this factory belong to low income families for whom earning bread for their family is important at any cost.

Methods

Temperature and Noise measurements: Temperature was measure in degree Celsius (^{0}C) by using a Hygrotherm (Thermo/ Hydgro meter), Model No. TH03-China, with a temperature recording capability of 10 ^{0}C to 60 ^{0}C. Noise in dB was recorded using a sound level meter model Cole ParmerUSA, SL-4001. For both, temperature and noise level measurement, the factory was divided into six zones/sections (Figure 5.5).

For noise meter two modes were used i.e. Normal mode and Maximum hold mode. The former characteristic is simulated as "Human Ear Listing" response while the later mode stored the maximum value that occurs occasionally.

For workers health risk assessment from occupational noise and heat. In total there were 95 workers working in different zone of the mill, out of which 50% workers were interviewed through a structured questionnaire. The workers were selected through random sampling in each zone of the factory. The mill owners and management team members were also interviewed.

Data Analysis

Data was analyzed using statistical analysis software. A paired t-test was performed for both the summer and winter ambient air pairing with factory temp data. The mill noise at various zones was also compared with each other using a paired t-test. Linear regression analysis of the data was also done and correlation coefficient R^2 value was determined. For temperature and heat data zone of the steel mill were visited numerous times for data collection. Readings were taken at 10 minute interval (for 8 hours) in duplicates at collection, six zones were identified in the steel mill. These zones included; the administration section, unloading section, furnace section, steel re-rolling mill section, storage section and loading section. All these locations are sketched in Figure. 5.6. Selected locations in each

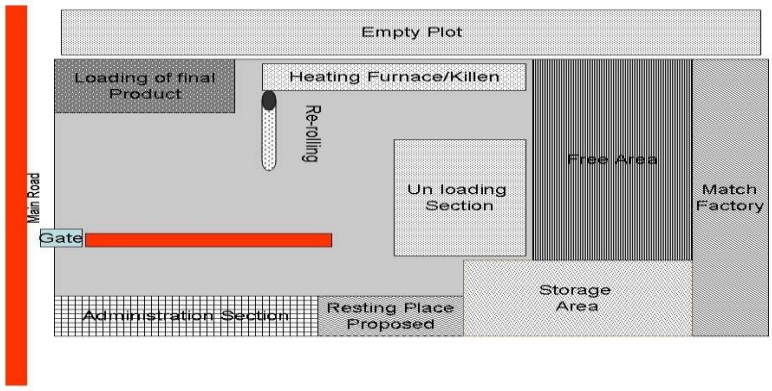

Figure5.6: Layout of various zones in the Steel re-rolling mill

each zone separately. Each reading was recorded for 2 minutes duration. Noise was recorded at an

approximate distance of 7.5 meters from the source.

A number of meetings were conducted with various stake holders of the factory, including the owner, administrative staff and exposed workers. They were interviewed through a structured questionnaire. Interviews were conducted with the administration and other staff of the industry.

A questionnaire was also prepared to collect data regarding the adverse impacts of working in elevated temperature and noise conditions. The aim of those meetings and interviews was to record their concerns and viewpoints on the overall occupational safety as well as health hazard to the workers due to elevated noise and heat exposure.

Results and Discussion Noise Exposure Levels in the Mill

The average noise level in the mill ranged from 67.22 – 102.00 dB (with the lowest in the administration section and highest in the re-rolling section (Table 5.18). The administration section is comparatively comfortable with an average noise level of 67.22±4.45 dB. On normal mode noise level fluctuated between 58.20 - 71.10 dB. In the administration section the maximum hold reached up to 89.70 dB only for a short period of time. Overall working in the administration section was safe in terms of safety standards, as the noise level is within the tolerable limits (Table. 5.6).

Table 5.18: Showing the recorded Noise level (dB) at different sections in the steel mill

Different Mill Sections	**Detection Mode**	**Maximum**	**Minimum**	**Average**	**Standard Deviation**
Administration	Maximum Hold	89.70	72.10	**80.9.**	6.11
	Normal Mod	71.10	58.20	**64.65**	4.45
Unloading	Maximum Hold	95.60	86.90	**91.25**	2.63
	Normal Mod	82.30	69.60	**75.95**	3.70
Furnace	Maximum Hold	98.30	85.30	**91.8**	4.33
	Normal Mod	84.10	71.00	**77.55**	3.42
Re-rolling mill	Maximum Hold	110.3	90.10	**100.2**	8.67
	Normal Mod	99.30	92.60	**95.95**	2.14
Storage	Maximum Hold	90.10	81.60	**85.85**	2.46
	Normal Mod	81.40	71.20	**76.3**	3.45

Loading	Maximum Hold	96.50	85.20	**90.85**	3.97
	Normal Mod	71.10	71.10	**71,1**	3.35

This was considered as yardstick in order to statistically compare with the noise in other zones. Pairwise comparison was done, and the mean, standard error, and p-value were calculated by conducting a pair-wise t-test. The following pairs of data were compared; Admin-unloading, admin-loading, admin- storage, admin-furnace and admin- re-rolling (Table 5.19). Results of the statistical analysis show that all the difference in each comparison is statistically significant at 95% confidence interval and at p value α= 0.05. But a closer look at the data indicates that some differences are extremely significant, for instance the admin- re-rolling is very significant with a p value= $1.9E^{-09}$, predicting that the noise level at re-rolling zone is very high than the normal. Likewise the unloading and furnace section are also very significant (Table 5.19).

Table 5.19: Statistical Analysis of the Noise and Temperature Levels measured in various zones of the factory

	Admin	**storage**	**loading**	**furnace**	**Unloading**	**Re-rolling**
Mean	67.21	74.23	76.76	75.85	75.77	95.21
Standard Error	19.76	11.88	11.21	11.69	13.70	4.57
t Stat		7.53	4.53	6.56	7.08	22.01
P-value at 95 % CI		8.5E-4	4.0E-4	2.0E-5	1.1E-5	1.9E-10

The second comfortable zone is the storage section. In this section the ingot and fuel are stored temporarily. Reading taken at maximum hold ranged between 81.60- 90.10 dB with an average of 87.42±2.46 dB. While reading taken at normal mode ranged from 71.20-81.40 dB with an average of 74.23±3.45 (Table 5.18). This zone is noisy in comparison with the administration section and standard working hours of OSHA. Loading and unloading is an occasional activity of the mill. Therefore, workers in these sections have enough intervals to take rest.

The furnace area is one of the busiest and noisiest places in the mill. The maximum hold reading recorded here range from 85.30 to 98.30 dB with an average of 94.95±4.33 dB. The maximum hold is occasional and affecting the workers temporally. Normal mode results range from 84.10 to 71.00 dB with an average of 75.85 ± 3.42 dB. This range seems comparatively comfortable but as temperature in this section is high and can affect worker negatively, as discussed in the subsequent section. Re-rolling section is the busiest section. The noise level started at 90.10 dB and reached up to 110.30 dB at maximum hold mode. At normal mode the noise level ranged from 92.30 to 99.30 dB with an average of 95.22±2.14 dB (figure. 5.5). As the ingot[2] is red-hot and can damage the workers, extreme precautionary measures are required. In this section the workers not only need safety measures but also needed to make their stay short.

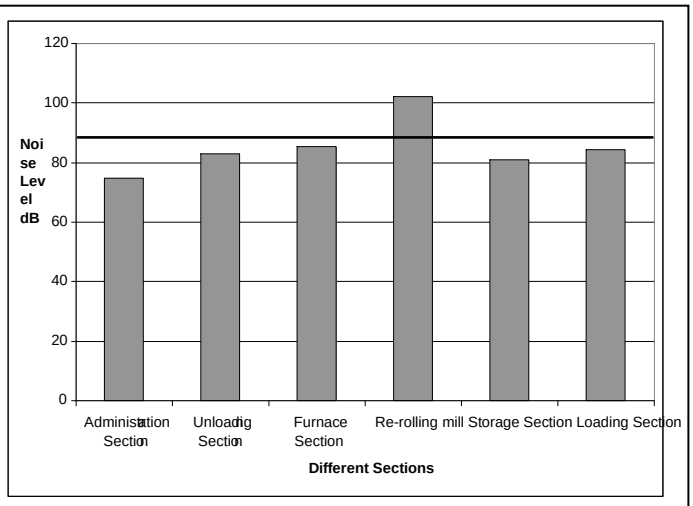

Figure. 5.5: Twelve hours noise level recorded at different zones of the Factory

The steel re-rolling area could be categorized as the nosiest place in the mill. The noise level recorded in the re-rolling zone exceeds the OSHA as well as Pakistan National Environmental Quality standards (Pak-NEQS). Moreover workers in the re-rolling and furnace sections of the mill seldom get break during their 8 hour shift. In steel re-rolling mill the workers sometime, observe a short break of 15 to 30 minutes for lunch and prayer have to work continuously and cautiously. By doing so, they increase their exposure level as well as duration to the elevated levels of noise and heat.

According to the OSHA a level of 90 dB should be considered the maximum limit for noise with continuous exposure over 8 hours (*Pandya GH, and Dharmadhikari DM. A., 2002*). Likewise, the permissible limit for noise set by Pakistan National Environmental Quality Standard is 85 dB with a distance of 7.5 meter from the source of noise (*Abbasi, et.al., 2011*). In steel re-rolling section the workers are at a $\leq$ 0.5 meter distance to source. According to standards set by OSHA, a worker can be exposed to 92 dB for 2 hours of duty (*Bulla, and Hall-III, 1998*). If OSHA guideline values were followed strictly, in steel re-rolling mill, the recommended continuous exposure time will be 2-4 hours. Sriwattanatamma and Breysse, (2000) compared to the recommended noise level set by National Institute for Occupational Safety and Health (NIOSH) and the U.S. Occupational Safety and Health Administration (OSHA). According to them the standard of 90dB is not that effective and recommended the standard of 85 dB set by NIOSH (*Sriwattanatamma P, and Breysse P. 2000*).

The results from our interviews with the workers show that the workers are not in good shape of health. A linear regression of the noise levels recorded at various sections of the factory verses the number of visits each

[2] Ingot is a block of raw-iron, typically 0.5 to 1.0 meter long.

worker makes to a hospital or a doctor resulted in a correlation coefficient of 0.6339. Given the fact that the heat in the furnace also contributes to the illness of the workers, this may be considered as a strong correlation (Figure. 5.6).

Temperature

Temperature ranged from 16°C to as high as 81°C in various sampled locations of the mill. The most comfortable working environment temperature according to OSHA is from 25°C to 30°C.The highest temperature of 56°C was recorded at the furnace section. Again, the furnace and re-rolling mill sections were critical areas where higher temperature values were recorded.

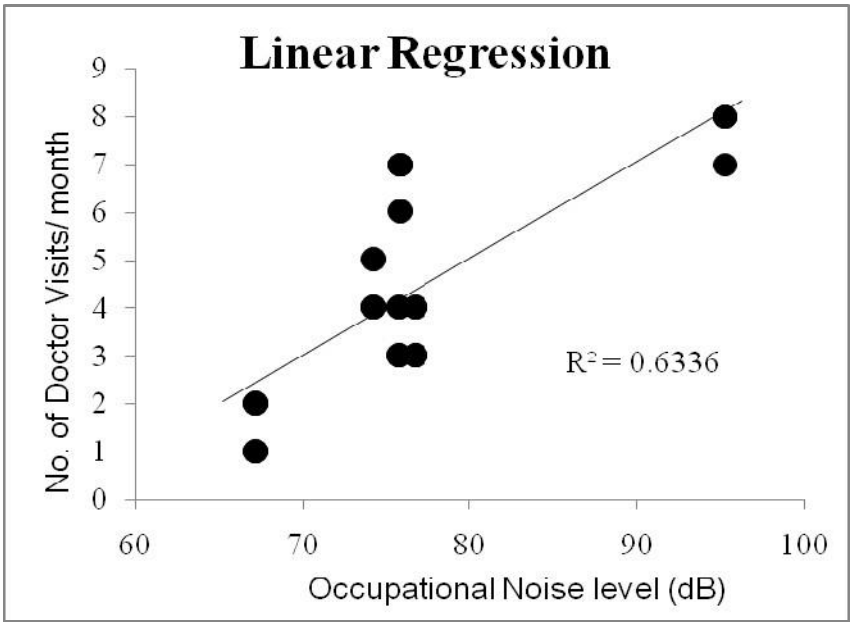

Fig. 4.6: Correlation between occupational nose level and number of doctor's visits

Temperature variations occur with change in season. The ambient air temperature in the surrounding of the mill range between 35-49 °C during summer months (May-Sept), whereas temperature of 21-26 ^{o}C is usually recorded during the months of October-April (Figure. 4.8).

The heat inside the factory during winter and summer were pair-wise compared with the ambient air temperature recorded during summer and winter. The results showed a statistically significant difference at p value = 0.05, indicating that the factory temperatures remains high during summer and winter (Table 5.19).

Table 5.20: Statistical Analysis of the measured Air temperature in and outside of the factory

Group	Summer temp air	Summer indoor factory	Winter air temp	Winter indoor factory
Mean	29.33	37.46	23.65	30.68
SD	9.96	10.27	11.31	12.45
Standard Error of Means	2.07	2.14	2.35	2.59
T-value	10.78		16.86	
p-value at 95 % CI	< 0.0001		< 0.0001	

The average daily ambient air temperature ranged between 14.0 – 40.4 °C and 5.0 – 35.5 °C in summer and winter respectively. The corresponding factory temperature ranges were 15.0 – 46 and 4 - 42.8 °C respectively for summer and winter. By comparing with the standard set by OSHA, 7.00 am to 9 am in summer and 1.00 am to 11.00 am in winter are comfortable (Figure. 5.8). In this way winter is

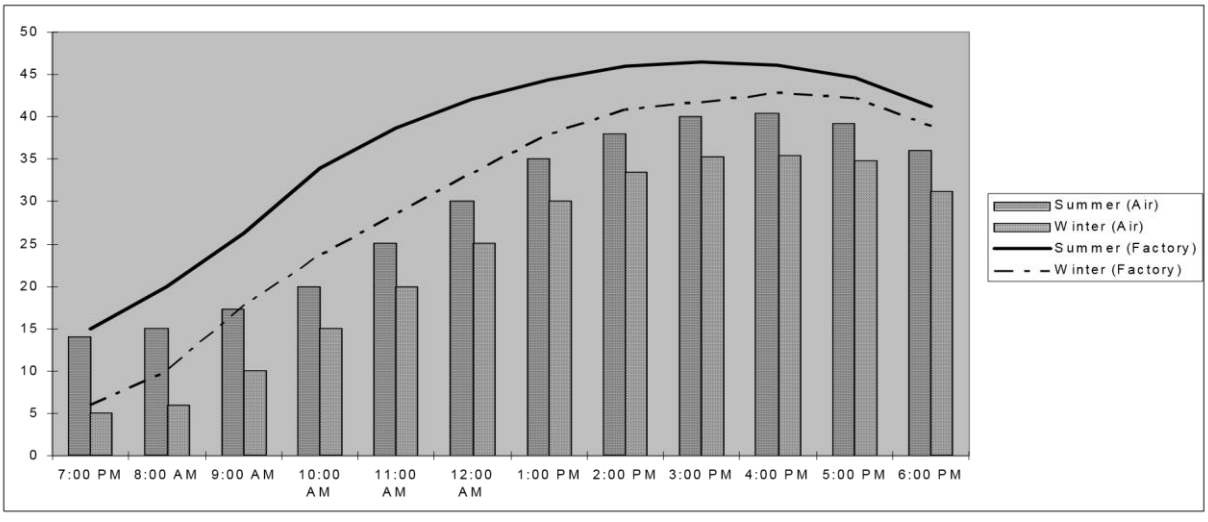

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Figure 5.7: Daily average temperature during duty hours

comparatively comfortable for four hours only, while the working hours in summer are only 2.

If the industry follows OSHA guidelines, the worker will work for two hours. In this way for eight hours shift the industry need to arrange four sub-shifts of two hours duration. This arrangement will add to the product cost. Another option is to rotate worker from noisy and hot area to other parts of the factory with less noise and temperature. In this way the factory will be running continuously with less input costs in terms of labor and minimum health hazard.

According to the interviews conducted with the administration and owners, if they follow the OSHA rules regulation, the mill will go in loss as they have to arrange a big number of workers with different shift ranging from 2-4 hours in summer and 4-6 hours in winter. This was discussed with workers also, and it was found out that, in summer they needed one hour rest after one hour work, while in winter the interval should be two hours. Another possibility explored during interview survey was that in summer they should be shifted to loading or storage section after one hour interval and in winter after two hours interval. In such situation they can resume their duty in furnace and re-rolling section after three hours in summer and two hours in winter. In this way they will work for two hours in furnace and re-rolling section and for 6 hours in other zones of the mill. While in winter, a worker will work for four hours in furnace and re-rolling section and four hours in other section of the mill.

Conclusions

From the overall discussion, it is concluded that elevated noise and exposed heat conditions pose a cumulative negative effects on workers. Chronic occupational exposure to both heat and high noise level can badly affect the workers health.

In comparison to worker of different other sections, the workers engaged in re-rolling and furnace sections are more vulnerable to noise caused hearing-loss and thermal effects (due to prolonged stay). It is recommended to implement suitable working hours along with noise related mitigations and heat stress.

Strictly following OSHA regulations will mean that the owners/ management will have to take measures to ensure that a particular worker in the furnace and re-rolling section is exposed for not more than 2 hours. The workers who were interviewed were not happy with the chronic exposure to noise and heat. For owners on the other hand it's economically costly to decrease the work duration of the workers. There is a need to introduce certain preventive measures to the workers e.g. making it mandatory for each worker to wear ear plugs. These can be managed through workers rotation at different duty places. It is therefore recommended that government and industrial management should introduce separate guidelines/ standards for such industries having both, noise and temperature hazard for protecting health of the industrial workers against the elevated temperature and noise level exposure along with proper implementation.

CHAPTER VI CONCLUSION AND RECOMMENDATIONS

6.1. Conclusion

The research analysis reveals that the industrial base of KPK is weak with impacts on environment. The role of EIAIEE was not effective in mitigating environmental pollution In order to mitigate environmental pollution and avoid further contamination the Environment Impact Assessment (EIA) regulation should be implemented properly. The various aspects are explained as below:

6.1.1 The industries in KPK in general and the three studied industrial estates in particular, are toward decrease. A lot of industries have been closed in the studied industrial estates. The reasons behind the closure of industries are non accessibility toward the raw materials, lack of infrastructure, law and order situation in the province and load shedding, Tax policy and lack of coordination between SDA and EPA.

Although large numbers of industrial units were found closed, however there is new investment and Industrial development is on the way by adding new industrial units, but most of the owners were not satisfied from the role of EPA and SDA.

Moreover the industries having the same nature are scattered in the estate with industry having different nature.

6.1.2. While exploring the pollution prevention and control technologies used in various units of steel mills and those industries that have been passed through the process of IEE/EIA ,it is found that the culture of water treatment does not exist. 2 out of five marble industries have not the standard size of settling tanks that is recommended by Environmental Protection Agency (EPA) i.e 10 x 12 x 06 feet, also in 3 marble industries no water recycling system was present

The installed treatment facility was of low standard and got no role in mitigating pollution load. No treatment plant was found functional in the visited industries, no proper occupational and health safety equipments were provided to the workers. Noise and exposed heat conditions pose cumulative negative effects on workers. Chronic occupational exposure to both heat and high noise level can badly affect the workers health.

6.1.3 The water data shows that almost all the studied industries are not complying the NEQS, A total of 25.7 million kg per year of pollution load to the River Kabul, Similarly there are 29 marble units in Hayatabad industrial estate. Wastes of these Marble Industries normally carry loads of suspended and dissolved solids, which is harmful to both aquatic and human life,

Emission from steel, paper mill and almost all industrial effluents were found exceeding safe limits. No fecal coliform tests are carried for the water used for the cooling of the bars in the steel rerolling mills.

6.1.4. Many parameters of the receiving water bodies of all the I.Es were exceeding the permissible limits as these water bodies are receiving the direct discharges from the industries

The effluent generated from these industries has got negative impacts on receiving water bodies i.e. Kabul River and Haro river. The various parameters that were toward increase, include BOD, COD, TSS,. TDS.

It was concluded from the study of the six industries of Gadoon industrial estate that a total of 10.65 million kg per year of pollution load is contributed to the environment.

6.1.5. Review of three EIA reports revealed that all these reports were of the same format. It seems that no base line study has been conducted. Most of the data was from secondary source. Most of the impacts have been ignored. The public participation and public hearings process was also weak.

There was no proper calculation for water use and its burden on the underground water resource in the EIA reports, that would bound the industrialists to recycle the water.

In the EIA process, mitigation measure, public participation and involvement has been ignored although these are important part of the process. Post and pre monitoring information are missing which is a source of prediction or in other words it is an alarm to show that if any negative impact is deteriorating the environment and what remedial action should be taken in which step before the impact reaches to its irreversible level.

The main problems of environment are related with the weak monitoring system of the EPA .The industries are not monitored on regular basis. The environmental tribunal is not functional and is a big hurdle in proper implementation of EIA regulation.

6.2 Recommendations

6.2.1 Facilities like infra structures should be provided by the government so as to smoothen the way of development in Pakistan. Smuggling of foreign goods should be properly controlled and monitored. Training should be arranged by the industrialist to produce skilled labor. The product should be selection by analyzing its market value. Mushroom growth of one type of industry should be avoided so as to minimize the expenditure of goods to transport it to the area where its demand is high. Taxes should be reduced and the industrialist should be properly guided before the installment of an industry, the guidance should be on the future scope of the product of that industry and also the full procedure for the installment of an industry. The same industries would be grouped together, like food industries should be in a separate sector and the steel mills or such

industries that are emitting a lot of pollution should be grouped separately so as to minimize the impact of these industries on t quality of food.

6.2.2. The industries should be checked for the treatment facilities and guidelines should be provided to the industrialist to minimize the pollution. OSHA should be enforced in each industry so as to avoid any catastrophe in the industry and to ensure the health of the workers

6.2.3. The NEQS for all the industrial units should be strictly followed by the industries and an awareness workshop should be arranged annually to make the industrialist aware of the NEQS and PEPA act 1997

As a sub office of EPA has been established at Abbotabad but still the industrial effluents were found exceeding safe limits. It is further recommended that the sub office Abbotabad should be strengthened for all the facilities and apparatus so as to strictly monitor the industries of the industrial estate Hattar. It is recommended that a sub office of EPA should also be formed at Gadoon industrial estate as these industries are contributing a lot of pollution to the environment..

As the reason behind the degrading environment in the three industrial estates of KPK is the weak monitoring system and the too much lengthy procedure for the prosecution of these industries and during the prosecution. It is recommended that a proper routine monitoring system should be implemented and the industries in violation should be strictly prosecuted.

The NEQS for air emissions are too relaxed to be complied by the industry. It is recommended that these standards should be revised and should be worked upon. The steel mills should also be monitored for the recycling of water as this industry has a huge burden on the underground water resource. These industries should be bound to recycle the water.

The procedure and process of EPA for industrialist should be made easy and guidance should be provided to the industrialist so as to make them understand the process of EIA. Incentives should be given to the industrialist so as to develop their interest for investment in this province

The fecal coliform tests should also be included for the NEQS for the steel mills. and

Mitigation measures be suggested for the fecal coliform control in the steel mills

6.2.4 Direct discharge to the water bodies when found should be strictly dealt with and regular sampling should also be done from the treatment plants. There is a need for

environmental education, capacity building, and proper training in the field of environment.

EPA should be strengthened with the required staff by the Government so as t launch a strict monitoring program. The process at EPA should be made fast and a permanent chairperson should be appointed for the Environmental tribunal. Pollution charges mentioned in PEPA Act 1997 should be implemented.

The amount collected a result of fine should be reinvested in the industry to educate to industrialists on how to set up environmentally friendly production systems as well as setting up a research facility to investigate how to dispose of or reuse environmentally hazardous wastage substances.

Environmental tribunals remain dormant for a long period due to the non-availability of the chairperson. This problem should be solved by the permanent appointment of a person on this post. Pollution concentration should be replaced with pollution load and the list of Pak NEQS should be revisited for proper correction. For long-term development, government of KPK should generate funds on its own for demonstration projects related to pollution mitigation and control.

According to the present rules regulation, industries are placed under main sectors of different nature in terms of environmental impacts. Parameters like pH; TDS, Iron and Cu appeared as hurdle in its re-cycling. It can create water scarcity in Peshawar. It is therefore, recommended to create separate guideline for each industry by including status of water use in EIA as well as in routine monitoring program.

The prosecution of the industries should be made quick and during the prosecution visits should be made to check the pollution level so that during the prosecution the industries should not get a free hand to pollute the environment. Permanent chairman should be appointed for the Environmental tribunal and this vacancy should be filled on permanent basis. The industries should be forced to install more efficient waste disposal systems or use such raw materials the wastages of which are not environmentally hazardous.

6.2.5. The review committee for IEE/EIA should be made on merit and competent, hard working and neutral personnel should be appointed. There EIA process should be given more importance in the decision making stage.

In the EIA process, mitigation measure, public participation and involvement should be given importance. Looking into the importance of development and environment public shall be given full opportunity for their comments on every IEE/EIA whether public or private.

The IEE/EIA reports should be evaluated through experts of the field and the rating should be given after discussion of the committee. The weak areas should be highlighted and mitigation measures with alternatives should be properly checked by the EPA. The copy paste culture in these reports should strictly be dealt.

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Annexure 1

1.National Environmental Quality Standards for Industrial Gaseous Emissions

S.No.	Parameter	Source of Emission Existing	Standards	Revised
1	2	3	4	5
1	**Smoke**	**Smoke opacity not to exceed**	**40% or 2 Ringlemann Scale**	**40% or 2 Ring-lemann Scale or equivalent smoke number**
2	**Particulate matter (1)**	**(a) Boilers and furnaces:**		
		(i) Oil fired	300	300
		(ii) Coal fired	500	500
		(iii) Cement Kilns	**200**	**300**
		(b) Grinding, crushing, clinker coolers and related processes, metallurgical processes, converters, blast furnaces and cupolas.	**500**	**500**
3	**Hydrogen Chloride**	**Any**	**400**	**400**
4	**Chlorine**	**Any**	**150**	**150**
5	**Hydrogen Fluoride**	**Any**	**15**	**150**
6	**Hydrogen Sulphide**	**Any**	**10**	**10**
7	**Sulphur Oxides (2) (3)**	**Sulfuric acid / Sulphonic acid plants**	**400**	**5000**

		Other plants except power plants operating on oil and coal	**400**	**1700**
8	**Carbon Monoxide**	**Any**	**800**	**800**
9	**Lead**	**Any**	**50**	**50**
10	**Mercury**	**Any**	**10**	**10**
11	**Cadmium**	**Any**	**20**	**20**
12	**Arsenic**	**Any**	**20**	**20**
13	**Copper**	**Any**	**50**	**50**
14	**Antimony**	**Any**	**20**	**20**
15	**Zinc**	**Any**	**200**	**200**
16	**Oxides of Nitrogen (3)**	**Nitric acid manufacturing unit**	**400**	**3000**
		Other plants except power plants operating on oil or coal:		
		Gas fired	400	400
		Oil fired	---------	**600**
		Coal fired	--------	**1200**