

# Air Pollution Caused by Iron and Steel Plants

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**Abstract**—The aim of this paper is to access the results allow to understand and rectify the various risks caused by industrial pollutants in general, and pollutants iron and steel plants in particular, and work on how to reduce these risks, and the possibility of finding optimal solutions and to ensure treatment immediate and follow-up and in a coordinated and periodically. Risks caused by iron and steel industry set in the waste of various solid, liquid and gaseous. The additional is the side effects of noise resulting from the industry, as it has been proven scientifically through studies and researches that have been made by some international organizations related to the environmental studies and health .There are emissions resulting from iron and steel plants have a direct impact on the environment , safety , human health, and also have direct cause of what is happening in the world of climate change, occurrence of the phenomenon of global warming, melting ocean ice and increasing the proportion of exposure to chronic diseases.

From background ,we can figure out that if we find satisfactory solutions , perfect, and access to low impact of this industry. It must work to develop modern methods and alternative efficient even be reduced the dust iron, emissions, pollutant gases, and making optimal designs for iron and steel plants, so that the environmental impact becomes minimal.

**Keywords**— Pollutants, Air, Iron and steel plants, environment

## I. INTRODUCTION

WHATEVER methods remove air pollutants resulting from advanced and sophisticated plants, it could not remove all of these pollutants, due to the relatively large size of the extrusion of air pollutants, especially from large plants, whether products of fuel combustion or outputs of gas and dust industrial from various industrial processes. So that the waste gas from the plants and addition of pollutants should spread on the largest area, and this is done by diluting them in the air through designed chimneys according to the accurate scientific accounts and take into considerations the following points :

- 1) Desired height of chimney.
- 2) The speed throwing pollutants from the chimney .
- 3) The wind speed .
- 4) The physical properties of pollutants.

Due to increasing environmental concerns associated with industrial waste, companies must now incorporate waste management and prevention strategies into their industrial processes.

What pollution prevention any in plant practice the reduces or eliminates the amount and/ or toxicity of pollutants which

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would have entered any waste stream or would other have been released into the environment prior to management techniques such as recycling, treatment ,or disposal.

Pollution prevention includes the design of products and processes that will lead to less waste being produced by manufacturer or the end user [1].

According to the results of the chemical engineering studies on the design plant chimneys showed that the concentration of pollutants to ground level (i.e. living people area) is directly proportional to the speed throwing pollutants from chimney , inversely with the wind speed ,and also inversely with the effective height of chimney. We can define the effective height of chimney, as real rising, plus the additional height of the polluting gases as a result of ejection speed to the top, and as a result of high temperature.

It is axiomatic that the more advanced the civilization becomes the more complex the problem related to men s environment will be.

Earth is an unique planet of the solar system as it has conditions favorable for the evolution and survival of various forms of life [2].

The protection of the natural environment is very important for the continuity of human life. Therefore any break in environment will impact on the air, water and food cycles in nature. Honestly it is so vital to the survival and human pleasure, and certainty that the most serious impact on the human environment is the effect in health and safety of human being directly.

## II. THE AIM OF RESEARCH

Can be presented as follows A brief explanation of the atmospheric pollution and related to the industry.

The degree of utilization of instrumentation , sensors and monitoring systems approved for environmental pollution levels within the LISCO.

The relationship between the environment pollution and the safety of human health.

## III. DIVISIONS OF THE RESEARCH

Through this paper we can make divisions as in the following points:

- 1) Introduction describing some points of air pollutants and the protection of the natural environment.
- 2) The target of the research indicated the relationship between the environment pollution and the safety of human health.
- 3) Use of Natural gas as source of energy and the effect on environment.
- 4) Comparison between pollution of natural resources & pollution of industrial waste.

## 5) Conclusions that have been reached.

Most industrial products are requirements of modern life. For example, iron and steel products. Therefore ,no one can build a modern building without these products. As well as transportation and others. So, iron and steel industry is one of the most industry's voracious energy consumption. In this industry there is most polluted environment surrounding. If we know that to produce one ton of iron products, we need to burn about 460 cubic meters of natural gas, and about 59 kg of oil, and about 1400 kwh , as consumption of electricity as shown in Table (1).

TABLE I  
THE CONSUMPTION OF SOME ENERGY ELEMENTS PER EACH TON OF FINAL PRODUCTS IN LISCO

Mth	Electrical Energy		Heavy Fuel		Natural Gas	
	Mwh	Kwh/Ton	Ton	Kg/Ton	Nm <sup>3</sup> x10	M <sup>3</sup> /Ton
1	13407	651	1259	61	0.183	8.86
2	30325	1030	1722	59	8.7	295.6
3	32502	888	2239	61	3.2	87.4
4	38376	1246	2486	81	9.8	318.2
5	51623	1370	3237	86	12.97	344

From background ,that what can be the consequences of this pollution of the air, water and soil, it deserves special attention and sustained monitoring and current study in order to detect any problem before it gets worse and turned into a disaster which will be difficult to treat.

Libyan Iron and Steel company ( LISCO ) is one of the largest companies in North Africa as an output of liquid iron about 1.3 million tons annually. Although modern technology used in the operations of different production and in spite of the precautions taken to minimize the impact on the surrounding environment, but the ability to maintain equipment and devices relationship and change the efficiency of what can happen then from environmental pollution, raising fears interested in matters of the environment in this area. [3]

In this research Will be described with some explanation of some quantities of energy consumed in LISCO and compared with global consumption, that can be illustrated by possibility of providing where consumption is one of the most important means of reducing and limiting of pollution. Recently most of industrial enterprises are using of electric techniques in iron and steel industry .This has taken in considerations for economical point of view and represented in reducing specific energy consumption as well as the need to control pollution and protect the environment.

## IV. USES OF NATURAL GAS AS SOURCE OF ENERGY AND THE EFFECT ON ENVIRONMENT (DIRECT REDUCTION PLANT – LISCO- MISURATA )

The abundance of natural gas in Libya has led to the choice of Midrex process in the direct reduction plant in LISCO .The natural gas is used in the DR plant in two ways:

- 1) Combustion of natural gas with air to produce thermal energy required for heating up the plant.
- 2) For cracking the natural gas to produce the reducing

gases, Namely carbon monoxide and hydrogen.

The products of the combustion of natural gas with air are water vapor and carbon dioxide. Other effects of DR Plant on the environment such as air pollution , water pollution, noise,...etc.

The natural gas is used in heating of the plant. It is burned with air for the production of thermal energy required for heating of gas reformer, for heating of shaft furnace, and for the reduction temperature of the iron oxide.

The effect of DR Plant on the environment is the emission of gas, liquid ,solid, and other pollutants. The gas pollution is mainly from the emission of Co, Co<sub>2</sub>, No<sub>2</sub>, and So<sub>2</sub> .The gas sources in DR Plant are mainly from the following:

- 1) Smoke ( Once considered the sign of property ).
- 2) Gases from combustion and process.
- 3) Most from quenching.
- 4) Some times from accidents of fire.

In conclusion , the DR Plant is a plant which utilizes the natural gas as energy source in producing iron and steel .It is a clean and efficient process however there are no pollution free process. The effect of DR Plant on environment is summarized in the effect of solid, liquid and gas pollution .Even though, these effects are not as harmful as the effects of the same plant capacity which uses heavy oil for fuel due to the fact that NG burning is a clean or has less pollutants to the environment [3].

## V.POLLUTION RESULTING FROM THE BURNING OF FUEL IN THE INDUSTRY

All countries agree on the need to preserve the environment from pollution and reduce soil and air contaminants and water, in order to preserve the neighborhoods of human , animals and plants.

Consequently , the pollution of the environment is closely linked to energy consumption, it has become essential for all countries, rich and poor countries to take care of reducing energy consumption - producing burning fuel - to a minimum and searching for alternative resources, and to protect the environment from pollution. Therefore the industry's contribution in the pollution is too large. Industrial processes caused direct and indirect impacts on the environment, whether to be air pollution , water or solid contaminants.

The combustion process is a process of oxidation, a reaction flammable material with an oxidizing agent under certain circumstances. And by this combustion with oxygen in air, it produces some poison gases such as carbon monoxide , carbon dioxide , sulfur dioxide and sulfur trioxide ... etc. They are polluting gases into the air.

In the industry there is combustion process of burning heavy oil and natural gas in industrial furnaces, and this process released into the atmosphere the bulk of toxic elements such as mercury and this contributes effectively to pollution chromium and manganese .Therefore, it Can be compared the estimated global rates of heavy minerals from natural resources and other industrial waste as presented in table (2) and Presented in Fig. ( 1 ) and Fig. ( 2 ).

TABLE II

COMPARISON BETWEEN POLLUTION OF NATURAL RESOURCES &amp; POLLUTION OF INDUSTRIAL WASTE

No.	Mineral	Natural Resources Ton/Yr( 10 <sup>3</sup> )	Industrial Waste Ton/Yr( 10 <sup>3</sup> )
1	Cadmium	1	44.9
2	Mercury	6	18.1
3	Nickel	26	578.1
4	Copper	19	2197.1
5	Zinc	46	2607.9

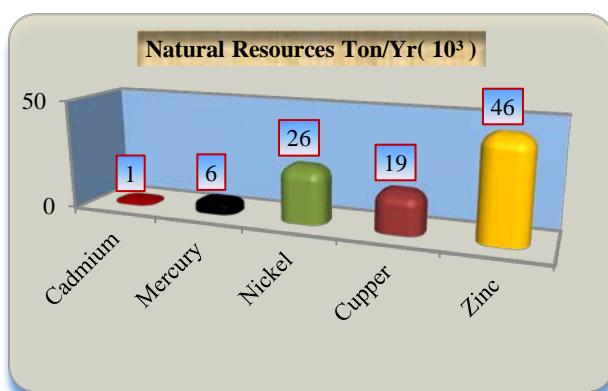


Fig.1 pollution of natural resources

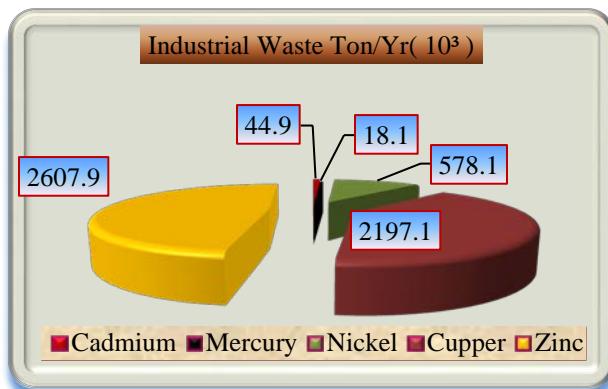


Fig.2 pollution of industrial waste

Note through the table (3) that the annual quantity of heavy minerals that are throw out by the industry is more than that are in atmospheric air. As shown in the comparison between air pollution with toxic mineral as well as the contamination of water and soil. Can observe that the water used in melting furnaces are rich of elements such as cadmium , nickel, lead ,and selenium.

Practically , the polluting of soil is more than air and water pollution, where the soil receives large amounts of toxic waste and that by remaining ash from combustion processes and the loose ends of industrial products, either solid or liquid.

TABLE III

THE INTERNATIONAL POLLUTION OF HEAVY MINERALS( 10<sup>3</sup> TON/yr )

The environment pollution medium	Cadmium	Mercury	Copper	Nickel	Zinc
Air	7.57	3.56	35.37	55.65	131.88
Water	9.4	4.6	112	113	226
Soil	27.9	10.2	2050	410	2250
The atmospheric Cover	29.73	11.2	2126.63	467.35	2344.12

Improvements in efficiency of energy and the quality of materials used in manufacturing will lead faster access to the desired aim for researchers and scientists. The reduction of about 20% of the emission of carbon dioxide into the atmosphere in the next decades, will prevent the earth planet from overheat. The relationship between energy consumption and environmental pollutants can be illustrated as follows:

- Reducing energy consumption = Maintain depletion of energy sources.
- Reduce energy consumption = Reduce production costs..
- Reducing energy consumption = Reduce the proportion of carbon.dioxide.
- Reducing energy consumption = Reduce environmental pollutants.

## VI. CONTRIBUTION OF ELECTRICITY IN A CLEAN ENVIRONMENT [4]

With regard to the expansion of electricity and their relevance to the environment should be understood that the use of electrical energy has already contributed for improving the environment ,particularly with respect to air pollution. Almost energy used in the plant operation which produced either from primary fuel (coal - wood - oil - natural gas) or from local power generation stations in the plants. We can imagine the causes of air pollution from thousands of plants ,which do not control air pollution and compared with the high degree of controlling the causes of air pollution in local power generation stations ,which supplying energy to the plants.

## VII. THE ASSISTANCE IMPROVEMENTS TO THE ENVIRONMENT IN FUTURE

All will be accomplished by environmental improvements using the devices and machines. Therefore , these devices will operate with clean energy (Electric Energy), and can be considered that the continued expansion in the electric energy is a factor of helping to achieve the desired purposes in improving the environment.

Some examples of the methods which used the clean energy as:

- Electricity and transportation, which includes rail and public transport within cities and limited electric vehicles.
- Water purification processes
- Desalination processes

- Use the waste to generate electricity
- Conversion of coal to oil and gas
- Re-use of waste and debris
- Heating and electric heating.

Many devices as presented in Figure (3), Figure (4), and also by modern control of industrial pollution, with high quality. Therefore, it can keep pace with developments in the sophisticated and industrialized advanced countries [5].



Fig.3 Measuring Devices Of Gas In air

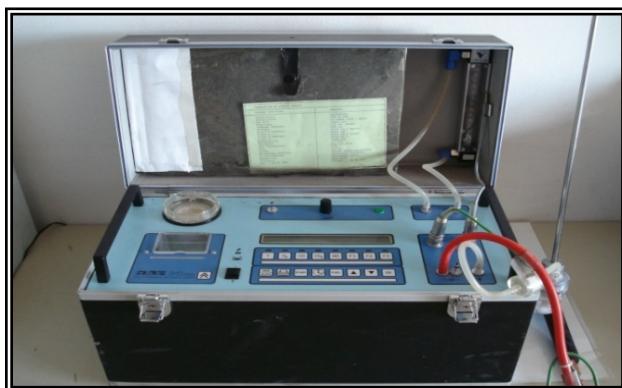


Fig.4 Measuring Device Of Chimney Gases

### VIII. CONCLUSIONS

Through what has been presented in this paper, and in order to preserve the health of workers and the health of the society and future generations, we call:

- 1) The development of safety standards, and protection measures to provide the necessary protection for workers.
- 2) Adoption of the state for a research project to study the health effects and to provide the necessary support for the protection of the factors of production.
- 3) It is very important reasons for pushing in the direction of the use of advanced technologies in the wide areas of industrial environment.
- 4) Develop and train specialized environmentally keep pace with increasing use of modern technologies related.
- 5) Take into the considerations the necessary precautions to protect workers from the dangers of exposure to chemical

substances used and dusts ,...etc.

- 6) Continuous and adequate support by senior management to provide personal protective equipment appropriate to the nature of the chemical industry work, including appropriate safety boots, helmets , work clothes and goggles.
- 7) Ensure the provision of signboards and warning sites and yards of raw materials used and processed materials, machinery, indicating the risks arising from dealing with these materials and machinery.
- 8) Increasing of the assurance to carry out the necessary maintenance of pollution control systems, hardware and machinery by specialized technicians to ensure safety and documented in the records to be prepared for this purpose.

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