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ENVIRONMENTAL POLLUTION BY THERMAL POWER PLANTS.

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ABSTRACT

Like other industries, thermal power plants are considered as a major source of air pollution in the form of fly ash, dust, SOx and NOx emmission. In Pakistan, these power plants use poor quality coal with high contents of ash and low volatile matter and fuel oil. This paper highlights some products of fuel consumption in thermal power plants and their effects on environment in general and on human in particular.

Key words: **Pollution, Thermal Power Plants.**

Introduction:

Thermal power stations consume more than 1/3 of all the fuel produced and thus can significantly affect the local environment and the local biosphere. The influence of thermal power stations on the surrounding is determined by their ejection of the flue gases, heat and contaminated waste water [1].

The products of fuel combustion, mainly consists of oxides of carbon and hydrogen. The principal combustible elements in fuel also carry fly ash, particles of unburned fuel, sulphurous and sulfuric n-hydride, nitrogen oxides, minor quantities of fluorine compounds and gaseous products of incomplete fuel combustion, vanadium compounds, sodium salts and scale from heating surfaces of boilers. Most of them are toxic and can have detrimental effects even in relatively low concentration on nature and man [2].

Formation of Nitrogen Oxides in Boiler Furnace and its Effects on Human Environment.

Nitrogen oxides belongs to harmful impurities present in the air even in low concentrations, they can initiate respiration organs, destroy equipment's and materials and promote the formation of smog and impair visibilities in cities. Maximum permissible concentrations is 0.85 mg/m^3

For the oxidation of atmospheric nitrogen, molecules of oxygen in the air should dissociate at higher temperatures. The reaction occurring with the absorption of heat.

$$0_2 \rightleftharpoons O + O$$

Atomic oxygen reacts with molecules of nitrogen, and the atomic nitrogen formed by this reaction enters into the exo-thermic reaction with molecular oxygen.

$$N_2 + O_2 \rightleftharpoons NO_2 + N$$

$$O_2 + N \rightleftharpoons NO + O$$

$$N_2 + O_2 \rightleftharpoons {}_2NO$$

More than 95% NO. is formed in boiler furnace [3].

Effects of NOx on Human and Environment.

Oxides of Nitrogen are toxic and produce a sharp irritating effect, specially on mucous membrane of eye.

Nitrogen oxides are poorly soluble in liquids and for that reason can not penetrate deep into lungs and cause injury to alveular, epithelium and bronchi.

Experimental results and natural observations indicates that nitrogen oxides poses high biological activity. Experiments carried out in number of countries demonstrates that people living in NO_2 contaminated areas suffer from

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reduced respiratory function and have a higher incidence of respiratory disease and exhibit certain changes in the peripheric blood.

Nitrogen dioxide in concentrations of 4-6 mg/m^3 can cause heavy injuries to plants. A long exposure of vegetables to NO_2 at concentrations below $2mg/m^3$ can produce chlorosis. Nitrogen oxides absorb the natural radiation both in the ultraviolet and visible region of the spectrum and thus reduce the transparency of the atmosphere and produce the formation of photochemical mist or smog that could disrupt the air traffic and accidents of vehicular traffic [4].

Formation of Sulphur Dioxide and its Effects on Environment

Most of thermal Power plants in Pakistan use furnace oil as a fuel which consists of 3% Sulphur which is ultimately discharged from the chimneys of the plants in the from of SO_2 gas which is very harmful to the human health as well as animals, vegetation's and over all environment. In contrast to animals it appears that humans respiratory tract is affected by lower concentrations of sulphur dioxide The effect produced is one of the constriction of air passages causing an increase in air way resistance to flow. There are, however Considerable individual variations, some persons experiencing ill effects with as little as 1-2ppm (2860-5720 $\mu g/m^3$ of sulphur dioxide [S]

Sulphuric acid, which is derived from sulphur tri-oxide So_3 in polluted foggy air, has also been tested experimentally. A concentration of 5.2ppm ($18580\ hg/m^3$) was observed by Sim and Pattle to increase airway resistance in man. Guinea pigs are much more sensitive to sulfuric acid mist than are other animals and develop broncho constriction and even death [6].

Acid rain due to SOx and NOx

The gases entering the atmosphere from anthropogenic sources are solely responsible for acid rain. Specially the gases produced by thermal power plants take part in this process. The problem of acid rain is greater in industrial areas or Countries but other Countries are no exception. Acid rain is the result of air pollution. This problem is not so dangerous in developing countries like Pakistan but there was a survey made in 1982 and it was found that concentration of acid rain is increasing from north area to south area. On account of having more thermal Power Plants in Pakistan this could further accelerate the concentration of acid rain. The acid rain is the result of production of SO_2 and NO. These acids can exhibit their effect far and wide up to 1000-2000 km.

The acid rain affects our environment in several ways. It not only affects our soil but its effects are also observed on Plants, ponds, lakes etc. So that soil acidification occurs up to greater extent . Various physical and chemical processes are due to lower pH [7].

The committee of experts of world health Organisation (WHO) has summarized the available results and established the following relation ship between the level of air pollution and its effects on human health.

Expected Effect of Air Pollutants on Health and Welfare of Ppopulation.

Poll-utant	Increased rate of mortality & Higher incidence of illness	Deterio-ration of health in patients with lung Disease	Increase Freq: of respiratory symptoms	Decrease in Visibility & increase in discomfort
SO gas mg^3/m^3	0.5*	0.5 – 025*	0.1**	0.08**
Particulate matter mg/m^3	0.5*	0.25*	0.1**	0.08**

* Daily concentration

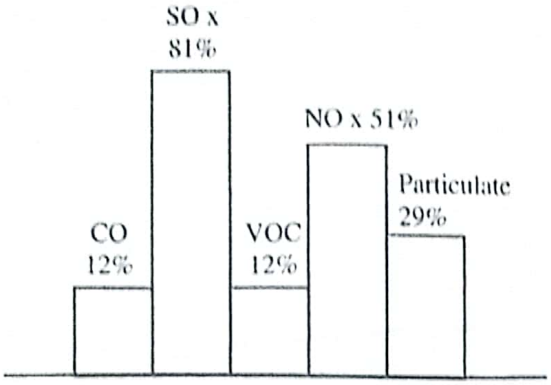
** Average annual concentration

Source (WHO)

Beside above gases i.e. SOx & NOx some other products are also generated as a result of fuel burring by thermal power plants e.g. carbon mono oxide, volatile organic compounds and praticulates. Their contribution in polluting the environment is shown in the figure given below.

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environment is shown in the figure given below.



Above figure reveals that SOx, NOx and particulates are major contributor in polluting the environment.(4)

Contamination of Water by Thermal Power Plants

From the stand point of power station, the term waste water can be applied to water that has been used in the technological processes and, for its poorer quality, can not be further used for the purpose. This water must be subjected to purification so as to remove the impurities from it, and then to reuse it at the plant or to discharge it into water basin.

There are different sources of water pollution in power plant which have to be treated properly before being discharged but thermal contamination of water is the one which has significant impact on the ecosystem of water body where this water is discharged. In order to avoid effect of rejected heat on the ecological systems of water basins, it is required by the sanitary specifications that the temperature rise in the water basins due to hot water discharge be not more than 5^0C in winter time and 3^0C in summer (5).

The unit quantity of heat removed with the cooling water which is heated in turbine condensers is 8^0C – 10^0C. This increase in the temperature disturb the various species present in water basins and ultimately impair their habitat.

Conclusion

Since pollution caused by thermal power plant is recongnised fact all over the world, it is not only polluting air, soil but water too. Therefore there is a need to go for sustainable development. Environmental issues should be taken into account in nearly all economic decisions. Unfortunately poor countries find it very difficult to invest money on environmental problems. Secondly government departments responsible for managing natural resources and protecting the environment are separated from those responsible for managing the economy. One department is dealing with environmental issues, an other with agriculture and industry is looked after by totally different department. The department of industry views its goals as maximizing industrial development, leaving the environmental department to worry about the pollution, the industry causes. This situation demands the integrity of Govt. Department so that they can act more efficiently on environmental affairs.

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