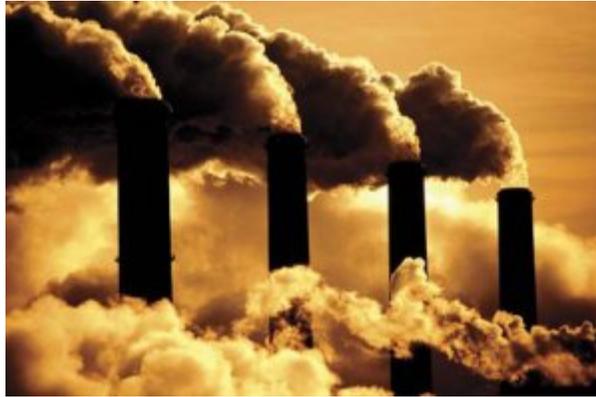


COAL FIRED POWER PLANTS AND POLLUTION

Coal-fired power plants are the single largest stationary source of pollution in any country. The toxins these coal fired power plants produce severely damage both human health and the environment and contribute to a reduced quality of life. Cleaning up these plants and finding cleaner, alternative energy sources is the overall objective to achieving clean, healthy air in every country.



Air pollution consists of a mixture of chemicals with various harmful effects on the human body, wildlife, plants, and climate. Coal-fired power plants are responsible for release over 85% of total global carbon dioxide emissions, a prime contributor to global warming. The main ingredients of air pollution are described below:

- * Carbon dioxide (CO₂): Coal-fired electric power plants comprise the single biggest source of CO₂ emissions in the world. Burning fossil fuels such as coal releases carbon dioxide (CO₂) pollution, making energy use the single largest source of greenhouse gases in the world. Currently there is 30% more CO₂ in the atmosphere than there was at the start of the Industrial Revolution, and we are well on the way to doubling CO₂ levels in the atmosphere during this century. Coal-fired power plants have the highest output rate of CO₂ per unit of electricity among all fossil fuels.

- * Ozone Smog: Formed at ground level when sunlight mixes with nitrogen oxides and hydrocarbon vapors emitted by power plants, vehicles, and industry. It contributes to airway irritation, coughing, wheezing, asthma attacks, and immune suppression.

- * Sulfur Dioxide (SO₂): Gas emitted through burning coal and oil, that converts into acid gases (sulfuric acid) and sulfur particulate matter (pm). Health effects include: airway irritation, heart rhythm destabilization, and asthma attacks.

* Nitrogen Oxide (NO_x): General term for NO/O₂ hazes formed from burning coal, oil, natural gas, and gasoline. It is a main ingredient in acid rain and ozone smog.

* Particulate Matter (PM): Soil, soot, SO₂, and NO_x particles from power plants, cars, and factories that are tiny enough to penetrate indoor spaces and deep into the lungs. They can trigger premature death from heart attacks, lung diseases, and cancer in adults; and stunted lung growth, low birth weight, neurological impairment, and SIDS in children.

* Mercury (Hg): Toxic metal particles settle in water, contaminate fish, and move up the food chain. Mercury ingestion can result in premature birth, low birth weight, structural defects, learning disorders, heart and neurological defects. Mercury is a developmental toxin, primarily affecting fetal development. In unborn children, it can cause brain damage, mental retardation, blindness, and many other problems. Infants are also exposed to these dangers through contaminated breast milk. While the dangers of mercury are most often associated with women and children, eating fish high in mercury has also been found to put middle-aged men at a greater risk for coronary heart disease.

* Acid Rain : Acid rain, or acid deposition, occurs when sulfur dioxide (SO₂) and nitrogen oxide (NO_x) react with water and oxygen in the atmosphere to form acidic compounds, most commonly sulfuric and nitric acid. These acidic compounds then either mix with natural precipitation and fall to the earth as acid rain, or remain dry and then settle to the ground. Acid rain destroys ecosystems, including streams and lakes, by changing their delicate pH balance making them unable to support life. Acid rain can destroy forests, devastate plant and animal life, and eat away at man-made monuments and buildings to effectively destroy our natural and historical treasures.

Nuisances of fly-ash generated by coal-fired power plant -

Fly ash comes primarily from coal-fired electricity generating power plants. These power plants grind coal to powder fineness before it is burned. Fly ash – the mineral residue produced by burning coal – is captured from the power plant's exhaust gases and collected for use. Fly ash is a fine, glass powder recovered from the gases of burning coal during the production of electricity. These micron-sized earth elements consist primarily of silica, alumina and iron.

Coal-fired power plants using pulverized coal or lignite as fuel generate large quantities of fly-ash as a by-product. With the increase in commissioning of several super thermal power plants with large capacity and with the increasing use of low grade coal of high ash content, the amount of generation of ash from them is becoming very large. This poses serious ecological problems. Most of the ash generated from the power plants is disposed off in the vicinity of the plant as a waste material covering several hectares of valuable land. Looking into the nuisances poses by fly-ash; it has been well appreciated by everybody and various Government agencies, the need for the safe disposal and

effective utilisation of fly-ash. The properties of fly-ash depend on several variables such as coal source, degree of pulverization, design of boiler unit, loading and firing conditions, handling and storage methods etc.

At present in the under-developed country like India, the focus is on demonstration of coal ash related technologies – such as

(a) Fly-ash characterisation,

(b) Hydraulic Structures, Handling and Transportation, Agriculture related studies and Application,

(c) Ash Ponds and Dams, Reclamation of Ash Ponds for Human Settlement, Roads and Embankments, Underground Mine Fills etc.

Only a small quantity of the total ash produced is utilized in concrete, brick making, soil-stabilization treatment etc. The bulk utilization of ash is yet to begin in full swing.

* Fly-ash characterization – The physical, geotechnical and chemical parameters to characterize fly-ash are the same as those for natural soils, e.g., specific gravity, grain size, Atterberg limits, compaction characteristics, permeability coefficient, shear strength parameters and consolidation parameters.

*Fly-ash disposal in Ash Ponds - Fly-ash is mostly disposed off using either Dry or Wet disposal procedure. (a) In the case of dry disposal method, the fly-ash is transported by truck, chute or conveyor from the power plant to the site of disposal where these are disposed off by constructing a dry embankment (dyke). (b) In wet disposal, the fly-ash is transported as slurry through pipe and disposed off in impoundment called “ash pond”. Most of the power plants use wet disposal system.

Environmental concerns of fly-ash disposal - The ash produced in thermal power plants cause all three environmental risks, such as, air, surface water and groundwater pollution. . Directly related to these concerns is the additional environmental goal of aesthetically enhancing ash disposal facilities.

* Air pollution is caused by direct emissions of toxic gases from the power plants as well as wind-blown ash dust from ash mound/pond. The air-borne dust can fall in surface water system or soil and may contaminate the water/soil system.

* The wet system of disposal in most power plants causes discharge of particulate ash directly into the nearby surface water system. The long storage of ash in ponds under wet condition and humid climate can cause leaching of toxic metals from ash and contaminate the underlying soil and ultimately the groundwater system.

* The environmental aspects of ash disposal should be taken care of in order to minimize air and water pollution. Most of the above environmental problems can be minimized by incorporating engineering measures in the design of ash ponds and continuous monitoring of surface and groundwater water systems.

Clean coal Technology (CCT) – So-called “clean coal technologies” are a variety of evolving responses to late 20th century environmental concerns, including that of global warming due to carbon dioxide releases to the atmosphere.

As discussed above, coal when burned is the dirtiest of all fossil fuels. A range of technologies are being used and developed to reduce the environmental impact of coal-fired power stations. Thus, clean coal technology (CCT) is the name attributed to coal chemically washed of minerals and impurities and gasified thereafter to generate energy after burning of the produced syngas. The resulting flue gases treated with steam, with the purpose of removing sulfur dioxide, and reburned so as to make the carbon dioxide in the flue gas economically recoverable.

In relation to clean coal technology, a terminology ‘carbon capture and storage’ (CCS) is being discussed. CCS is nothing but method of capturing the carbon dioxide, preventing the greenhouse gas entering the atmosphere, and storing it deep underground by various ways, such as:

(a) CO₂ pumped into disused coal fields displaces methane which can be used as fuel,

(b) CO₂ may be pumped into and stored safely in saline aquifers, or

(c) CO₂ pumped into oil fields helps maintain pressure, making extraction easier.

A range of approaches of CCS have been developed and have proved to be technically feasible. They have yet to be made available on a large-scale commercial basis because of the costs involved.

Conclusion - Coal-fired power plants and the pollution they release every day are a major threat to human health and our environment. We need to act now to clean up dirty coal power through pollution reductions. We also need to reduce our dependence on dirty coal by retiring and replacing these plants with clean energy alternatives like wind, solar, and improvements in energy efficiency. It would be our prime objective, not only for the general public, but for Govt. concerned to prepare effective means / legislations to control such hazards immediately.

Coal combustion and coal gasification processes produce byproducts — high volumes of extremely variable wastes that vary by combustion process, flue gas treatment type, feed coal content or mix, pollution control mechanisms, etc. Regulations are needed to improve health and safety of this industry's waste.

Activities like coal mining and coal burning emit tons of greenhouse gases into the atmosphere. So does the process of making cement for concrete. Coal fly-ash, a waste byproduct from burning coal, has certain cementitious properties (in addition to multiple toxic elements like mercury) that mean that in some applications, it can be used as a partial replacement for energy-intensive Portland cement used in concrete.

Pollutant	Definition	Source	Damaging to:
Aerosols	Suspended liquid or solid particles	Old cosmetics, paint, cleaning supplies	Good, upper atmosphere ozone
Ammonia	Volatile chemical compound	Agricultural production	Human cells, respiratory health
Asbestos	Fibrous, silicate minerals	Building materials, friction products	Respiratory health
Carbon dioxide (CO ₂)	Gas that traps heat in the atmosphere	Burning fossil fuels	Climate
Carbon monoxide (CO)	Poisonous gas	Incomplete combustion from heaters, furnaces, automobiles	Blood, vision, brain function
Chlorofluorocarbons (CFCs)	Airborne chemical compound	Old aerosols, fire extinguishers,	Good, upper atmosphere ozone
Ground level ozone / smog (O ₃)	The chemical reaction of O ₃ , NO _x , VOCs, and sunlight	Motor vehicles, chemical solvents, industrial emissions	Respiratory health
Hydrochlorofluorocarbons (HCFCs)	Airborne chemicals	Air conditioning and refrigerants	Good, upper atmosphere ozone
Lead	Metal	Dust and soil, old paint, metal processing plant and	Human and animal organs, blood, nervous systems
Mercury	Natural element	Emissions from burning coal or hazardous waste	Human and animal organs, blood, nervous systems
Methane	Gas that traps heat in the atmosphere	Landfills, natural gas systems, coal mining, livestock	Climate
Nitrogen oxides (Nox)	Gas that contributes to smog and traps heat in the atmosphere	Burning fuel	Respiratory health, climate, water ecosystems
Particulate matter (PM)	Tiny, suspended dust and liquid particles	Smoke and Dust; cooking fires in poor countries	Respiratory health, visibility, immune system
Pesticides	Chemical compounds	Agricultural or household pest killers or disinfectants	Respiratory, nervous system, cancer
Propellants	Compressed gas that releases an aerosol	Old cosmetics, paint, cleaning supplies	Good, upper atmosphere ozone
Radon	Natural radioactive gas	Soil, rocks, water	Respiratory health
Refrigerants	Cooling gas	Old refrigerators and air conditioners	Good, upper atmosphere ozone
Sulfur oxide (SO ₂)	Gas that dissolves easily in water	Burning fuel, gasoline and metal extraction	Buildings, visibility, natural water ways, respiratory health

TABLE OF POLLUTANTS, THEIR SOURCE AND EFFECTS

Source : <http://saferenvironment.wordpress.com/2008/09/05/coal-fired-power-plants-and-pollution/>