



# HEALTH HAZARDS OF FOUNDRIES AND FORGES

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## ABSTRACT

A huge amount of dust, SPM, RSPM and gaseous pollutants is released into the environment – both workplace and ambient environment from various foundries, forges of Iron & Steel industries and other manufacturing industries. These pollutants cause health hazards. Many health hazards are reported in the foundrymen and forge shops workers of the industries.

**Keywords** : Foundries, Forges, Health hazards.

## INTRODUCTION

In Iron & Steel and other manufacturing industries, foundries and forges produce a lots of pollutants in the environment – both working and ambient environment. In these processes, metals are extracted and produced from ores by various metallurgical processes and processes for moulding, melting and castings etc. are accompanied by evolution of heat, noise, dust fines, fly-ash, oxides of Nitrogen, Sulphur and metals. Particulate matters are generated in large quantities when preparing mould core sands and moulds melting metals, pouring metal, knocking out poured moulds and loading and unloading raw materials. Here metals are given a specific shape by metal castings for various engineering purposes.

Gaseous matters like gases, vapours, fumes and smoke are produced during melting and pouring operations. The major pollutants are emitted from various work areas in Foundry i.e. Pattern shop, Sand preparation, moulding and core making, mould drying and ladle heating, cupola, electric arc furnace, pouring and mould cooling, knockout, fettling, heat treatment etc. In addition, various air pollutants and noise pollutants (Davis, 2002)<sup>1</sup> are produced from forge shops and other manufacturing industrial units. Pollutants are also emitted in sintering, pelletisation, rolling mills, coke-oven plants, refractories etc. in steel making and by-products manufacturing. Coke-

fired cupolas in Agra, glass making units at Firozabad (Singh<sup>2</sup> and Vaish 2008) and more than 200 foundries around Kolkata, Howarah urban metropolitan complex have reported to produce huge amount of particulates and gaseous matter in the atmosphere (Dutta<sup>3</sup> et.al. 2008). These pollutants cause various health hazards in human beings.

## GENERAL HEALTH HAZARDS OF FOUNDRIES AND FORGES

Many people are exposed to common air pollutants in their occupations e.g. smoke, dust, SPM, RSPM, carbon mono-oxide, sulphur dioxide, oxides of nitrogen (Nox), hydrocarbons, and heavy metals like Pb, Cd, Cr, As, Ni etc. Their prolonged exposure causes various health hazards. Heavy metals cause acute and chronic poisoning. Some disastrous episodes have focused attention upon air pollution as a health hazard.

Some fugitive gaseous and dust emissions may cause primary occupational health problems to the workers engaged in the foundries, gaseous and dust emissions from the foundries pose potential health risk to the populations residing in the surrounding areas. Black lung, metal fume fever, silicosis, pneumoconiosis etc. are all occupational maladies which are attributed to inhalation of one or other type of fine dust particles (Khoshoo<sup>4</sup>, 1984).



Some general health hazards are caused as a result of contact between the pollutants and the body. These hazards are as follows :

- Eye irritation.
- Headache.
- Nose and throat irritation.
- Irritability of respiratory tract.
- Gases like hydrogen sulphide, ammonia and mercaptans cause odour nuisance even at low concentrations.
- High temperature can cause fatigue and dehydration.
- Chronic pulmonary diseases like Bronchitis and asthma, are aggravated by a high concentration of SO<sub>2</sub>, NO<sub>2</sub>, particulate matter and photochemical smog.
- Carbon monoxide combines with the haemoglobin in the blood and consequently increases stress on those suffering from cardiovascular and pulmonary diseases.
- Dust particles cause respiratory disease. Diseases like silicosis, asbestosis etc. result from specific dust.
- Carcinogenic agents like PAH's, Cr(VI), Cd etc. cause cancer.
- Hydrogen fluoride causes diseases of bone (fluorosis) and mottling of teeth.
- Certain heavy metals like lead, cadmium, mercury, chromium, nickel, manganese etc. enter into body by inhalation, skin absorption and through food chain. They cause acute and chronic poisoning.

#### **SPECIFIC HEALTH HAZARDS OF FOUNDRIES & FORGES**

Apart from the general health hazards described

above, some specific health hazards are prevalent amongst workers in foundries & forges of Iron & Steel industries and other manufacturing industries.

Dust, SPM, noise and gaseous pollutants pose a potential threat to health of workers in industries and populations residing in the surrounding areas. Dust also absorb gases and in such a combination prove to be a more serious health hazards due to synergism. It has recently been demonstrated that SO<sub>2</sub> absorbed on submicroscopic particles penetrate deep into the lungs and this is a greater danger to health (Khoshoo<sup>4</sup>, 1984).

Silicosis and siderosis are common diseases in foundrymen and forge shops workers. Most of the cases of silicosis, however, have arisen in the manufacture of silica containing materials and in foundry workers. Pottery industry got such a bad reputation for silicosis. Grinders in the cutlery industry using sandstone wheels died in large numbers from silicosis. Pneumoconiosis and black lung diseases are caused due to coal dust. Asbestosis is common in asbestos workers in industries.

Direct IR radiation poses a risk to sight. Contact with hot metal or hot water may result in severe burns. Workers exposed to gamma rays and related ionising radiations suffer from several hazards. Explosion and fire hazards occur during handling of liquid metal and the presence of flammable chemicals & liquid fuel. Iron foundry slag may be highly reactive if calcium carbide is used to desulphurise the iron (A.K. Anand<sup>5</sup>, 2008).

#### **HEALTH HAZARDS DUE TO HEAVY METALS**

Heavy metals pollution either directly or indirectly entering the food chain are becoming an increasing threat to health. Mercury metal is toxic for living beings. It enters into the body through either food chain or by skin or inhalation, which causes mercury poisoning. The symptoms of mercury poisoning are tremor, gingivitis and loss of teeth, together with a condition called "erethism", an individual shyness (Murray<sup>6</sup>, 1988).

Organic mercurials are used as bactericides



and fungicides and are used in the paint, paper and alkali industries. Methyl mercury is more poisonous than mercury itself, which is used as a catalyst in a factory in Minamata. Tetra ethyl lead (TEL) used as antiknock agent in gasoline and TML cause potential health hazard. The harmful effects include blocking of spindle fibre mechanism in cell division, uncoupling oxidative phosphorylation and altered rapid eye movement phase of sleep leading to insomnia. Other metals with toxic effects, known to occur as pollutants in some localised areas are cadmium, Be, Pb, Cu, Zn, Cd, Fe, Ni etc. Lead causes 'Plumbism in human beings'.

Vanadium levels in the environment are rising as a consequence of the burning of vanadium containing fossil fuels and of mining and processing in order to meet growing needs for the metal in industries. Both acute and chronic effects of occupational exposure to V compounds are manifested in the respiratory tract by irritation, including bronchitis and pneumonia.

Some studies on health hazards of dust, fume, gaseous pollutants, noise heavy metals etc from foundry, forge of Iron & Steel and other manufacturing industries have been reported e.g. Risk of bladder cancer in foundry workers (Gaertner<sup>7</sup> et.al. 2002).

In the epidemiological studies, a meta analysis of foundry workers was done. Summary risk estimates (SRE) were calculated from 40 systematically extracted results. Weekly increased risks were overall with an SRE of 1.11. Exposure response finding showed significantly increased risk of about 1.6 or 1.7 after 20 or more years of employment. Occupation specific SREs showed a 40-50% increased risk among moulders, casters and unskilled foundry labourers. There was limited evidence that bladder cancer risk correlated with lung cancer risk, which is a more established risk among foundry workers.

Mortality from lung cancer disease in steel industries workers had been reported due to chromium and PAH. Silicosis and cardio-vascular

diseases have been reported. Public health assessment in forges and foundries was done. High burn hazards were seen in longitudinal wear study of four work shirts in ferrous metals in forge and foundry workers. Some health hazards are seen in forges and foundries of industries from emissions of their propane burner. Sometime explosion hazards are seen in propane burner. Noise from forges and foundries cause loss of hearing and disorder in central nervous system.

## CONCLUSION

Various health hazards are observed in persons who are regularly exposed to different kinds of pollutants e.g. dust, fume, gaseous pollutants, noise, heat in forges and foundries of Iron & Steel and other manufacturing industries. There is urgent need for development of an eco-friendly cokeless cupola, to minimize pollution. Emission standards should be followed by different foundries. Workers should use appropriate insulated gloves, shoes, goggles and clothing to protect against heat and radiations. Industrial safety officers/ environ managers should tackle environmental problems of the industries. The environmental, health and safety management must play a strategic role in organisational governance, environmental risk, and compliance.

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