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A Survey of Toxic/Heavy Metals in Factories/Industries: Hazardous Effect of the Pollutants; Special Reference to Power Generation and Coal Field Area of Chhattisgarh State.

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The problem with toxic substance in general and toxic metals in particular, is one of protecting people from poisoning. This in turn resolves itself into two problems-one of protecting the workers who may possess unique protective equipment but who may also be subjected to uniquely high concentration and the second of protecting the public from the results of factory emissions, transport spills, etc. Among the toxic substances, the metals are particularly bad. Mercury has become infamous through the Minimata disease: Cadmium through the ouchi-ouchi disease.The question of defining toxic metal is a complicated one. There are a variety of criteria for defining a list of toxic metals, none of which are in complete agreement with all the others. Table No. 1 gives some of the lists from various sources. The council of Environment Quality has listed metals for which adverse human effects have been documented. This list has been shown in the first column of the table. The office of toxic substances of the U.S. Environmental protection agency takes a slightly different view as indicated by reports published by them on various metals. This list has been shown in the second column of the table. The third column lists those metals which were of immediate concern to EPA in their criteria laid down for drinking water. There are other metals that could also be included. Thus, even iron has its toxic aspects as shown by the following quotation. “Inhalation of iron and iron oxides produces “siderosis” (or pneumoconiosis). There may be very serious synergistic effects as well as other effects, such as chronic bronchitis. Iron oxides acts as a vehicle for transport of carcinogens in high concentrations to the target tissue. Similarly, sulphur dioxide is transported in high local concentration deep into the lung by iron oxide particles. Finally, there is the most toxic of all metals, plutonium, but it has not been considered here because of its specialized use in the atomic field.

Key words: - Atomic, Toxic, Protection, Disease, Cadmium, Mercury.

Definition:

As per classical definition, a heavy metal is that which is precipitable in acid solution by Hydrogen sulfide. These are listed in the first column of Table 2. However, as shown in second column of the same table, the Environmental Engineers Handbook, gives a very different listing which includes aluminium and iron in addition to other metals. An EPA listing in a 1973 document relating to the development of criteria for the cement industry gives yet another listing.

The point in the above discussion is that there is no acceptable current definition of heavy metals. In any event they are not synonymous with toxic metals, and the term of heavy metal has been used as little as possible in the work reported in the present work.

Observation:

Of the chemical elements, metals make up the largest group: In the last few years it has become especially clear that it is not the total concentration of a certain element that produces a negative or positive effect on the organism, but rather the specific compound form that decisively influences the toxic effect of an element. Viewed from the standpoint of environmental pollution, metals may be classified according to three criteria:

1. **Noncritical**
2. **Toxic but very insoluble or very rare, and**
3. **Very toxic and relatively accessible.**

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Such a classification has been made by Wood and others.

Table No. 1

List of Toxic Metals

CEO	EPA	EPA (Drinking water criteria)
----	Sb	----
As	----	As
Ba	----	Ba
Be	----	----
----	B	----
Cd	----	Cd
Cr	----	Cr
Cu	----	----
----	In	----
Pb	----	Pb
Mn	----	----
Hg	----	Hg
Ni	Ni	----
Se	Se	Se
Ag	----	Ag
----	Sn	----
V	V	----
Zn	----	----

Table 2

List of Heavy Metals

As per classical definition	As per Environmental Engg. Handbook	As per EPA Definition
----	Al	----
Sb	----	----
As	----	----
Bi	----	----
Cd	----	Cd
----	Cr	Cr
Cu	Cu	Cu
Au		----
----	Fe	----
Pb	----	Pb
Hg	----	Hg
----	----	----
Ag	----	----
Sn	----	----
----	Zn	----

Table 3

Classification of elements according to toxicity and availability

Noncritical	Toxicity but very insoluble or very rare	Very toxic and relatively accessible
Na C F	TiGa	BeAs Au
KP Li	Hf La	Co Se Hg

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Mg Fe Rb	Zr Os	Ni TeTi
Ca S Sr	Ac Rh	Cu Pd Pb
H Cl Al	Nb Ir	ZnAg Sb
O Br Si	Ta Ru	SnCd Bi
N	Re Ba	Pt

According to this classification, out of the thirty-four elements estimated, thirteen are under the category of very toxic and relatively accessible, two under the category of toxic but very insoluble or very rare, and eleven are under the category of noncritical of elements.
Several elements not listed fit mor than one category, but should not be neglected in an environmental sense.

Hazardous effects of the pollutants.

The hazardous effect described shall have to be viewed in the light of the dose of the pollutant, and the sensitivity of the receptor system. The concentration and the period of time that the pollutant is exposed to a receptor system (such as population) is considered to be a dose, and it plays a significant role in the ultimate effects of the pollutant. A dose is in turn influenced by a number of parameters. In air pollution, meteorology is important, in water pollution, stream flow is important. In both cases, the rate of emission of the pollutant into the air or water plays a significant role in the ultimate dose that is presented to a receptor system. The sensitivity of the receptor system is equally important. There are some plant materials that are extremely sensitive to even very low doses of certain toxicant whereas there are other plant systems apparently to the same dose of the same material. There are many factors, such as the environmental matrix in which they exist. {1, 2,3} Or the innate properties of the physical systems all these play a significant role in the sensitivity of the receptor system and consequently. In the ultimate effects. The details of the toxic metals and non-metals, and the levels of their concentrations in the waste matters discharged by various industries. {4, 5,6, 7, 8} will be discussed.
The impact of these effects should have covered human life, plant life and other ecosystems. The toxicities, extents of exposures, and environmental standards for toxic metals involved in the studies here are being described element-wise below: -

CADMIUM

Cadmium has been found to be present in :
Thermal power fly-ash: (3.0 g/kg).
Alumina plant: (i) red mud (2.0 mg/kg) (ii) Cryolite mud (1.0 mg/kg) (iii) Vanadium sludge (3.5 mg/kg)
Iron ore industry: (i) raw iron ore (1.0 mg/kg), (ii) fine ore (1.0 mg/kg), (iii) slime residue (1.0 mg/kg)

We ingest cadmium from a number of sources, the air, our food and tobacco. Of the total cadmium released to the environment through the activities of man, only 15% is in the form of air pollution from stationary sources, and only 1% is in the form of water pollution from point sources. Of the three most important exposure routes for cadmium, exposure via. Breathing ambient air is the least significant. Cadmium and cadmium compounds are toxic substances by all means of administration, producing acute or chronic symptoms varying in intensity from irritation to extensive disturbances resulting death. Inhalation of cadmium fumes, oxides and salts often produces emphysema, which may be followed by bronchitis.

Cadmium may also be a carcinogen. Cadmium affects the kidney, lungs, heart, liver and gastro intestinal organs, and the nervous and reproductive system. Many workers regularly exposed to cadmium dust and fumes show symptoms of lungs disease similar to emphysema. Thus, the health effects of cadmium, both proven and probable, are: increased blood pressure, kidney damage, protein excretion, anemia and emphysema may result. Cadmium, usually considered a toxic metal, and under certain circumstances a nephrotoxic one, has been found in the kidneys of all adult humans. The toxicity of cadmium has also been discussed by at more length by Tucker and by Schroeder {9, 10, 11}. It has also been discussed in exhaustive details by Fribery et al. Finally, the National Environmental Research Center has done a recent summary report on cadmium, including its toxicology. Uptake of cadmium from the soil by a number of plants has been demonstrated by deliberately increasing its cadmium content. The recommended maximum allowable concentration

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for cadmium in air has been set at 0.1 mg/m3 of air by the ASA. The American Conference of Governmental Industrial Hygienists has set a standard of 0.05 mg/m3 for cadmium oxide and for dusts and salts. The permissible concentration of cadmium in domestic water supplies is 0.01 ppm.

LEAD

The occurrence of this metal in various industrial waste matters has been found as follows:

Thermal power fly-ash: (46.5 mg/kg)

Alumina plant: (i) red mud (71.0 mg/kg) (ii) Cryolite mud (23.0 mg/kg) (iii) Vanadium sludge (19.5 mg/kg)

Iron ore industry: (i) raw iron ore (32.0 mg/kg), (ii) fine ore (33.0 mg/kg), (iii) slime residue (31.0 mg/kg)

Lubricating oil refuge: (i) tractor (40 mg/kg), (ii) jeep (25 mg/kg), (iii) car (60 mg/kg), (iv) ambulance (30 mg/kg), (v) motor cycle (15 mg/kg), (vi) truck (60 mg/kg).

The source of lead induced into the atmosphere as a consequence of the activities of man have been reviewed by Snyder et.al. The major stationary sources have been found to be the primary and secondary smelting of lead, smelting of brass, nonferrous foundries, storage battery manufacturing, paint manufacturing, glass, insecticide manufacturing, and coal combustion. The anthropogenic source of atmospheric lead is motor vehicle. The toxicology of lead has been studied extensively and a number of excellent reviews are available including those by Passow et.al. , Kehos, Chisholm {12}. A recent guide to the literature on the biological impact of lead is presented by Kinnison. {13}. The important routes of absorption of lead in man and animal are ingestion and inhalation. In lead colic, there may be severe abdominal pain, such that abdominal surgery has occasionally been performed. Descriptions of lead poisoning appear in many texts and reviews, for example, “Airborne Lead in Perspective” and “the disease of occupations” by Hunter. Lead can interfere with the synthesis of their derivatives. Anemias from lead poisoning is associated with a reduced red cell life span and with reticulocytotic and basophilic cells in peripheral blood. Gastrointestinal sequence of lead poisoning includes intestinal colic, nausea often without vomiting, and constipation (or, occasionally, diarrhea).Peripheral and central nervous system effects occur4 in severe poisoning. Extensor muscles of the hand and feet are often involved; extensor weakness normally precedes wrist drop or palsy. Lead workers who died during employment also showed and excess of death toll from exposure to lead. The recommended standard for occupational exposure to inorganic lead has been promulgated by NIOSH is 0.15 mg/m3. The permissible concentration of lead in domestic water supplies is below 0.05 ppm,and effluents being discharged to a stream or stream is 0.1 ppm.

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