Industrial Landfill Sources of Air, Water and Land pollution in India

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Abstract: Landfill source at mining site in Orissa's Jajpur district in India is one of the highest water pollution , in particular with chromium heavy metal. The chromite mining has resulted in landfills which are the sources air, water and land pollution. Industrial landfills are sources of air , water and land pollution in many industrial cities and towns of India due to the generation of large quantity of industrial dumps from mining , metallurgical, chemical , mechanical , mineral , other engineering and technological processes. Million tones of total mass of residues such as pyrite, ferric , chromium, lead, zinc, cadmium, and other associated metals arsenic, antimony, mercury and silver are dumped in landfills. The heavy metal content in air , water and land which surround industrial landfill towns cause many environmental impacts and economic losses. Cities like Chennai, Delhi, Kolkata , Mumbai and Bangalore etc. are surrounded with industrial wastes. Further air pollution occur from windblown dusts as well as wind erosion of fine particulates from uncovered industrial landfills. Atmospheric transport leads to serious heavy metal pollution of a waste area. Soils within a least radius of distance from the stacks are heavily polluted mostly from highly toxic elements such as iron, chromium , lead and cadmium in an investigated site. Many case studies were performed with respect to environmental health impacts of polluted landfill sites . Few sites are namely, Chromite mining at Orissa ,India , Union Carbide site at Bhopal , India, and Ambattur industrial landfill site at Chennai . In this context are explored the features of air pollution case suspended particles , water pollution case of toxic heavy metals and land pollution case of toxic heavy metals. Monitoring of air, water and soil is conducted in different parts of the town , respectively in rural, urban and industrial zones. From the values obtained based on chemical analysis of dust, water and soil , it follows that the presence of suspended particulates containing heavy metals exceed permitted values. In certain places even ten times than the allowed values. While the source of pollution is known , the amount of pollutants reaches in to millions of tones , it is urged to prepare s strategic plan for rehabilitation and elimination of these landfills.

Key Words: air pollution, heavy metals, landfills, land pollution, total suspended particulate matter, water pollution

1 Introduction

Industrial landfills are the sources of air, water and land pollution in many industrialized towns and cities(1).

2 Problem Formulation

Million tones of waste generated from the mining and metallurgical process dumped in landfills. For a case study, a contaminated landfill site by a ferrous chloride private industry at Pamba was investigated in 2011. During the processing of ferrous chloride which is a raw material used in this company, copious hazardous wastes dumped in a landfill and subsequently waste bearing toxic heavy metals such as cadmium, nickel, chromium and zinc etc.. discharged to a Pamba Triveni river water.

For an another case study, the deposition of lead contaminated landfill site is of concern for the community . Health risks to the adjacent residential areas through uncontrolled emissions of airborne dust containing heavy and toxic metals (2). The blood lead concentration exceeded 70 µg/ dL in inhabitants and occupationally exposed workers. It was estimated that children might have lead blood concentrations above 40 µg/ dL. It was also lead blood levels in pregnant women were 60 µg/ dL. Severe lead poisoning at levels exceeding 65 µg/ dL of blood can lead to encephalopathy and death. A dose of 25 µg/ dL is potentially harmful , especially during development. Third case study investigation at Chromite mining at Orissa . Therefore , the heavy metal content in air , water and land which surround industrial landfill towns cause many environmental problems associated with human health and economic losses. Dust emissions containing toxic elements are a further source for contaminant disposition in the land fill regions. High level of dust pollution value of 6000 $mg/m^2/day$, which exceeds as against the World Health Organization (WHO) standards of 300 $mg/m^2/day$. Exposure to respirable fine fractions of particulate matter and toxic metals are fifteen times more than WHO standards. Health report on air quality monitoring, weather monitoring , dust concentration levels, fugitive dust particles concentration, laboratory analysis on assaying the concentration of cadmium, copper, lead, strontium and zinc.

3 Problem Solution

For air, water and soil sampling of fugitive dust (pollutants) was used by the following facilities and equipments:

1. High volume air samplers and gravimetric samplers using cascade impactors;
2. Online air, water and soil sampling kits
3. Personal samplers
4. Meteorological instruments
5. Atomic absorption spectrophotometer;

Measurement have been dune on various samples concerned to airborne dust concentration using samplers and on site sampling of fugitive dust, gravimetric determination of concentration of fugitive dust , chemical analysis of collected dust and water samples, health reports, and determination of concentration heavy metals in soil .

The air pollution in the industrial landfill sites which are heavy metals exceeds the limits of WHO standards. This zone may be classified as ‘injurious for health of the people’ and hereby noticed that human health impacts are adverse .

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Table 1 : Results of total suspended particulate matter (TSP) , fractions of particles of collected dust with aerodynamic diameter of 10 μm and toxic heavy metals

Measurement spots	TSP ($\mu g/m^3$)*	Mass of collected dust, RSPM ($\mu g/m^3$)	Lead , $\mu g/m^3$	Zinc , $\mu g/m^3$
Road near	219	122	3.3	2.5
Landfill	439	268	5.2	7.1

*WHO standards : Maximum permissible TSP is 120 $\mu g/m^3$, RSPM is 50$\mu g/m^3$, Pb = 0.05 $\mu g/m^3$, Zn = 0.05 $\mu g/m^3$, Cr = 0.05 $\mu g/m^3$

The landfill source at mining sites at Jajpur town at Orissa was investigated. Orissa accounts for 96 percent of the chromium ore reserves of India, which are estimated at 180 million tones, where 14 chromite mines operate. The chromite mining has resulted in landfills which are the sources of air, water and land pollution in Jajpur town. The town is surrounded with industrial chromium bearing waste. Because of the poor management of mining, water quality was affected due to toxic hexavent chromium beyond World Health Organization (WHO) standards of 0 mg/l. It is found that landfill water pollution with hexavalent chromium was present in drainage water of 1 mg/litre . There are 14 chromite mines in Sukinda have directly or indirectly pollute water resources like Brahmani river which contains toxic hexavalent chromium. The landfills comprising of slurries as well as the over burden stockpiles. About 70 million tones of overburden have been stockpiled in the Sukinda valley over the last six decades as landfills. These landfills with stockpile have polluted the surface and groundwater of the area beyond WHO standards . This toxic heavy metals enter into the food chain and affected the ecosystem . The suspended and respirable particulate matter in this town are beyond air pollution standards of about 243 $\mu g/m^3$.

The impact of fluoride pollution is severe in Orissa mining belts. The incidence of white spots all over the body, incurable skin infections and lumps of dead skin is increasing among the population.

Effluents from the coal mining and coal utilization sites not only run over the farms, but are also discharged into various tributaries of the river. These effluents slow down seed germination and initial plant growth of rice and wheat.

4 Conclusion

The air pollution in all investigated landfill sites exceed the limit of allowable values , comparing the norms of World Health Organization (WHO) Standards. This zone is classified as Injurious for health of the people . Concern grows even more when it is known that pollutants are heavy metals and their sources from tones and tones of landfills including their impacts are known. The heavy metal content in air , water and land which surround industrial landfill towns cause many environmental impacts and economic losses. Further air pollution occur from windblown dusts as well as wind erosion of fine particulates from uncovered industrial landfills. Many case studies were performed with respect to environmental health impacts of polluted landfill sites . Investigated Few sites which are are namely, Chromite mining at Orissa , Union

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Carbide site at Bhopal , Ambattur industrial landfill site at Chennai, etc.
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It is suggested that the elimination of pollution source has to be there in order to improve the air quality in the industrial landfill sites. Although we are dealing with millions and millions tones of wastes and for elimination of this pollution sources are needed financial sources to prepare a strategic plan for these residues , for temporary coverage or construction of drainage channels for water or reprocessing because these residues have an economical value. It is necessary to undertake regular cleaning of the sites, regular monitoring of air and water because the air and water around the landfill is not monitored.

It is recommended that environmental impact assessment (EIA) has to be undertaken for new industrial projects to formulate environmental management plans (EMPs) for mitigating any possible environmental impacts due to landfills. Environmental and Social mitigation projects (ESMPs) have to be aimed to mitigate adverse effects of metallurgical and mining activities on environment and people affected by such activities.

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