A review of air carcinogenic risk assessment

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**ABSTRACT**

A carcinogen is any substance, radionuclide or radiation that is an agent directly involved in causing cancer. Public generally associates carcinogenicity with synthetic chemicals, it is equally to arise in both natural and synthetic substances. Inhalation is an important route of occupational exposure to airborne carcinogens in relation to health risk. The objective of this paper is to summarize the current overview of the occurrence of airborne carcinogens in the environment and their risk assessment. This topic is very broad, this review is briefly concerned with the air carcinogenic risk assessment, sources of air carcinogens and its health effects.

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**INTRODUCTION**

Air pollution has become extremely serious problem for the modern industrialized world. Air pollution may be defined as any atmospheric condition in which certain substances are present in such concentration that may produce undesirable effects on man and environment. These substances include gases (Sulphur dioxide, Nitrogen oxide, Carbon monoxide, Hydrocarbons etc.), particulate matters (Smoke, Dust, Fumes, Aerosols etc.), radioactive materials, carcinogens (Acrylonitrile, Benzene, Beryllium, Cadmium, Dioxane, Hydrazine etc.) and many others (Heck et al., 1988).

A carcinogen is any substance, radionuclide or radiation that is an agent directly involved in causing cancer. This may be due to ability to damage genome or to the disruption of cellular metabolic processes. Although the public generally associates carcinogenicity with synthetic chemicals, it is likely to arise in both natural and synthetic substances. (1)

The international Agency for Research on Cancer (IARC) is an agency which forms part of world health organization since 1971; it has published a series of monographs on the evaluation of carcinogenic risk to humans (2). The carcinogens are a composite of its effects on multiple genetic and epigenetic processes (3, 4).

Challahan and Sexton (5) comment that risk is not necessarily an intrinsically quantifiable variable. In principle, some form of qualitative risk assessment should precede quantification of risk as a basis for considering whether the additional efforts, inherent in making a quantitative assessment of carcinogenic risk is predicted a consideration of relevant carcinogenicity and exposure data (6, 7, 8).

The risk presented by a situation may vary with time as consequence of alteration in the agent or circumstances of its usage (14, 15). Across different situations, exposure to polycyclic hydrocarbons is associated with increased risk of lung cancer (16), arsenic with skin, kidney, urinary bladder, kidney and liver cancer (17) and asbestos with mesothelimo (18).

Low income population is at rise for higher exposure to poor quality indoor air, outdoor air and industrial pollutants. Outdoor air quality is more polluted due to mobile emissions (19, 20, 21). It has become evident that increasing human activities have modified the global cycle of heavy metals and metalloids, including the toxic non essential elements like As, Hg, Cd and Pb (22). Risk assessment may be radially
characterized in the progression from identifying carcinogens to preventing cancer (23, 24).

A large Danish epidemiological study found an increased risk of lung cancer for patient who lived in areas with high nitrogen oxide concentration. In this study, the association was higher for non smoker than smoker (25). There are also possible association between air pollution and other forms of cancers (26).

Risk assessments provide a snapshot of the outdoor air quality and the risk to the human health that would result if air toxic emissions level remained unchanged (27). (28) Quantitative estimation of risk of the airborne carcinogens in outdoor air consistently show that polycyclic organic matter from product of incomplete combustion make the largest single contribution to human cancer risk. (29) Residential wood combustion accounted for 75% of the exposure to particles associated organics, but only 20% of estimated cancer risk. The remaining 80% of the risk appears to be associated with the mobile source component and atmospheric transformation products from these source emissions (29). Human exposure to the combustion emissions including the associated airborne fine particles and mutagenic and carcinogenic constituents have been studied in populations in Europe, America, Asia and increasingly in third world countries that may cause oxidative and DNA damage that can lead to reproductive and cardiovascular effects (30).

Different measures are used to prevent unacceptable carcinogenic exposure from different sources in the external environment, be it accumulated carcinogens from previous pollution, exposure related to life style and exposure related to the living standards and organization of the community as a whole (31).

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Metals</th>
<th>Cancers</th>
<th>Present in</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arsenic</td>
<td>Skin, Lung, Kidney, Liver</td>
<td>Bladder, Wood preservative, Glass, Pesticides</td>
</tr>
<tr>
<td>2</td>
<td>Beryllium</td>
<td>Lung</td>
<td>Nuclear weapons, Ceramics, Glass, Plastic</td>
</tr>
<tr>
<td>3</td>
<td>Cadmium</td>
<td>Lung</td>
<td>Automotive parts, Floor covering, Paper, Metal plating</td>
</tr>
<tr>
<td>4</td>
<td>Lead</td>
<td>Kidney, Brain</td>
<td>Cotton dyes, Metal coating, Drier in paints, Plastic, Glass</td>
</tr>
<tr>
<td>5</td>
<td>Nickel</td>
<td>Nasal cavity, Lung</td>
<td>Steel, Copper, Brass, Batteries, Glazes</td>
</tr>
<tr>
<td>6</td>
<td>Diesel exhaust</td>
<td>Particles</td>
<td>Vehicles, Engines</td>
</tr>
<tr>
<td>7</td>
<td>Vinyl chloride</td>
<td>Lung, Liver, Brain</td>
<td>Electrical insulation, Wrapping film, Drain pipes</td>
</tr>
<tr>
<td>8</td>
<td>Benzidine</td>
<td>Bladder</td>
<td>Dyes for textile, paper and Leather products</td>
</tr>
</tbody>
</table>

Arsenic present in various metals ores and coal is released during the smelting process or in coal burning which produces the stack dust and flue gas to contaminate the soil and water with arsenic, downwind from the operation (32). The acute effects due to contamination of arsenic at a high dose are different from chronic effects due to long time exposure (36, 37, 38). The epidemiological studies in Thailand (39), Taiwan (40), west Bengal (41) and Bangladesh (42) revealed that under nourishment and deficiency in protein diet (43, 44) in particular were significantly associated with increase prevalence of arsenic carcinogenesis.

Diesel combustion exhaust is major source of atmospheric soot and fine particles which is fraction of air pollution implemented in human lung cancer (45). Inhalation exposure in occupational setting is a primary route for Nickel induced toxicity and may cause toxic effects in respiratory tract (46). The exposure of general population to nickel mainly concerned oral intake primarily through water and food (47, 48). Nickel find its way into ambient air as a result of combustion of a coal, diesel oil and fuel oil, the incineration of waste and sewage and miscellaneous sources (49-53). Nickel compounds have been well established as carcinogenic in many animals species and by many modes of human exposure but their underlying mechanisms are still not fully understood (54, 55).

Asbestos being predominantly in cement products. One feature of current occupational exposure is that there has been a substantial decrease of use of asbestos in thermal insulation because asbestos is radially release. Approximately 70% of current asbestos related lung cancer can be attributed to fibers released from thermal insulation materials (56). In vehicular pollution, common air pollutants that draw intense concerns include particulate matters, ozone, carbon monoxide, sulphur dioxide, lead, volatile organic compounds, polycyclic aromatic hydrocarbon. Many epidemiological studies on adverse human effects of air pollutants have been carried out. It has asthma, chronic obstructive pulmonary disease, stroke, lung cancer, leukemia etc. (57-65). Formaldehyde is component of the cigarette smoke. It has been found in industrial exhaust and is used in some sterilizing and preserving solutions in medical and school setting (66-68). Adult epidemiological studies have found formaldehyde to be significantly associated with cancer

**CONCLUSION**

This paper is review of airborne carcinogenic risk assessment. Exposure to various airborne carcinogens in environment and are associated with increase cancer risk. Over the last 30 years, scientist have worked hard to identify carcinogenic substances in the home, work place and general environment that cause cancer. Evidence for cancer causing substances and their risk comes from three sources namely human studies, animal studies and laboratory experiment with human cells.
Evidences from each of these sources is important in helping public health officials decide whether exposure to certain carcinogenic substances needs to be reduced or eliminated. This paper includes the study of airborne carcinogenic risk assessment and has helped industries and public health specialists to develop processes and safety procedures designed to minimize worker exposure to airborne carcinogenic substances and to minimizes the airborne carcinogenic risk. Assessment of airborne carcinogenic risk consequent upon environmental exposure may increase understanding and contribute to cancer prevention.

References

Sanner T.,Dybing E. (2005), “Comparison of carcinogenic and carcinogenic substances and to minimizes the airborne carcinogenic risk. Assessment of airborne carcinogenic risk consequent upon environmental exposure may increase understanding and contribute to cancer prevention.

Environmental Protection Agency.www.epa.gov/nata main.
Gonsebatt M.E. et.al.(1997),Mutat Res. 386 : 219-228.
Calderon-Garciduenasl et.al. (2003), “Respiratory damage in children exposed to urban pollution” 3 : 259-311.

Suresh Y.et.al. (2000), “Oxidant stress, antioxidants and nitric oxides in traffic polic of Hyderabad, India” Environ.Pollut. 109 : 321-
WHO (1999), “International programme on chemical safety, environmental health criteria 89 : Formaldehyde”

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