

Cancer- Air and Water Pollutants- A Review

Dr. Rajni Verma¹

Associate Professor; Department of Applied Science
Chandigarh Engineering College-Jhanjeri

Dr. Ashwani K. Sharma²

Professor; Department of Applied Science
Chandigarh Engineering College-Jhanjeri

ABSTRACT

In the past 30 years, Punjab's economy has experienced rapid development, which led to a vast increase in energy consumption and serious environmental pollution. Many different water pollutants increase cancer risk. Exposure to these pollutants can occur by drinking contaminated water or bathing, showering or swimming in it. Ironically, one major water pollutant that increases cancer risk comes from disinfection, a process that protects our health from other diseases but, when chlorine during disinfection process interacts with organic compounds that often found in surface water, hundreds of different chemical mixtures called disinfection byproducts like chloroform, other trihalomethanes, and some haloacetic acids were found which cause bladder cancer and possibly colon, rectal and esophageal cancers. Studies of water contamination by many different pollutants like perchloroethylene, trichloroethylene, chlorophenols, and nitrates from hazardous waste sites and industrial, commercial, agricultural and domestic sources have observed that are associated with elevated risks of several cancer types.

Major sources of outdoor air pollutants can include industrial sources, power plants and motor vehicles. A large number of carcinogenic pollutants are emitted in the combustion of fossil fuels and as constituents of airborne soot, including: diesel exhaust; benzo[a]pyrene and other polycyclic aromatic hydrocarbons (PAHs); 1,3-butadiene; benzene; inorganic compounds such as arsenic and chromium; radionuclides; formaldehyde; and fine particulate matter (called PM_{2.5} or particles with diameters less than 2.5 micrometers). Studies comparing cancer rates in rural and urban populations, which have consistently found excesses of lung cancer in urban areas, some of which implicate specific industrial air pollution point sources and motor vehicle traffic density.

Indoor air pollutants such as environmental tobacco smoke, asbestos, formaldehyde, chloroform and pesticides can contribute to a wide range of acute and chronic health conditions and cancer. Environmental tobacco smoke alone contains approximately 50 known carcinogens.

Water and Air pollution, which poses even greater risks to public health and sustainable development, has yet to gain policymakers' attention. The purpose of this paper is to explore effective countermeasures for this type of pollution in Punjab. It also presents a few recommendations and measures for prevention of water and air pollution.

Keywords: water pollutants; air pollutants; health risk; cancer; pollution control; Punjab.

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I. INTRODUCTION

Beginning with the landmark Clean Air Act of 1970 and Safe Drinking Water Act of 1974, the Federal government has recognized the need to safeguard two of our most fundamental natural and public health resources: the water we drink and the air we breathe. Over 105 million people in 2006 lived in counties with air pollutant levels exceeding Clean Air Act standards¹.

About 24 million people in 2007 were served by community water systems that reported

violations of health-based drinking water standards² in 2006 alone, industries reporting to the Toxics Release Inventory released or disposed of 820 million pounds of known or suspected carcinogens³. 70 million pounds of which went directly into the air or water⁴. Mounting evidence links dozens of air and water pollutants including two widespread categories of pollutants, particulate pollution in air and disinfection by products in water with cancer.

II. WATER POLLUTION AND CANCER

Disinfection byproducts are not the only water pollutants that may increase cancer risk. Radon in drinking water can contribute to a small but significant increase in the risk of lung cancer by contributing to radiation levels inside buildings^{5,6}. Exposure to arsenic is a well-established cause of bladder cancer as well as of lung, kidney, and non-melanoma skin cancers⁵. In addition, prostate and liver cancers may also be linked with arsenic in drinking water although the evidence is only suggestive⁵. Public and private water supplies can be contaminated by many different pollutants from hazardous waste sites and industrial, commercial, agricultural and domestic sources. Studies of water contamination by these sources have observed that a range of pollutants among them perchloroethylene, trichloroethylene, chlorophenols, and nitrates are associated with elevated risks of several cancer types⁵⁻⁸.

Strength of the evidence linking specific cancers with human exposure to water contaminants⁵⁻⁸

Bladder Strong: arsenic, water disinfection byproducts

Breast Suspected: organic solvents

Colorectal Suspected: water disinfection byproducts, nitrate

Esophageal Suspected: water disinfection byproducts

Kidney Strong: arsenic Suspected: nitrate, organic solvents

Leukemia Strong: benzene Suspected: organic solvents, pesticides

Liver Suspected: arsenic **Lung** Strong: arsenic, radon

Non-Hodgkin's Lymphoma Suspected: organic solvents, pesticides

Prostate Suspected: arsenic **Skin** Strong: arsenic

III. AIR POLLUTION AND CANCER

3.1. Outdoor air pollution and Human Health

Outdoor air pollution also called ambient air pollution is a mixture of gases and particulates, the exact composition of which depends upon the pollutant sources and meteorological conditions of a given area¹⁰. Major sources of outdoor air pollutants can include industrial sources, power plants and motor vehicles.

Many outdoor air pollutants are known or suspected to increase the risk of cancer¹¹⁻¹². Several studies provide evidence that outdoor air pollution can increase cancer risk, among them:

■ Occupational studies demonstrating increased risk of lung cancer among railroad, bus garage, trucking,

and dock workers exposed to diesel exhaust¹⁴. Studies examining populations near specific air pollution point sources such as waste incinerators or metal smelters¹³⁻¹⁵.

■ Studies comparing cancer rates in rural and urban populations, which have consistently found excesses of lung cancer in urban areas, some of which implicate specific industrial air pollution point sources and motor vehicle traffic density¹³.

3.2 Indoor air pollution and Human health

Indoor air pollution comes from many sources, including outdoor pollution filtering into buildings; contaminants in construction materials; consumer and office products containing or producing volatile or aerosolized compounds; gases or volatile compounds emanating from the soil or water near or below buildings; showers or other hot-water sources containing volatile contaminants; vehicular exhaust from attached garages; tobacco smoke; and combustion byproducts from heating and cooking¹⁶. The levels of indoor air contaminants are also highly dependent on ventilation characteristics of the building as well as the season.

Indoor air pollutants can contribute to a wide range of acute and chronic health conditions, including cancer. Agents detected in the indoor environment with known or suspected links to cancer include radon, environmental tobacco smoke, asbestos, formaldehyde, chloroform and pesticides^{6,17-18}. Environmental tobacco smoke alone contains approximately 50 known carcinogens¹⁹.

Estimates suggested that fine particulate matter was causing or contributing to a range of respiratory and cardiac conditions, killing 60,000 people each year.

EVIDENCE: Strength of the evidence linking specific cancers with human exposure to agents in air pollutants¹⁰⁻¹³

Bladder Strong: coal tars Suspected: diesel exhaust, PAHs

Breast Strong: environmental tobacco smoke Suspected: dioxin, PAHs

Esophageal Suspected: soot **Laryngeal** Strong: asbestos

Leukemia Strong: benzene and other solvents Suspected: pesticides

Lung Strong: air pollution, arsenic, asbestos, chromium, coal tars, diesel exhaust, environmental tobacco smoke, nickel, PAHs, particulate air pollution, radon, soot, wood dust Suspected: benzene

Multiple myeloma Strong: benzene Suspected: dioxin

Mesothelioma Strong: asbestos **Non-Hodgkin's Lymphoma** Strong: benzene, dioxin Suspected: pesticides

Prostate Suspected: arsenic, dioxin, PAHs **Soft-tissue sarcoma** Strong: dioxin **Skin** Strong: arsenic, coal tars, PAHs

IV. THE POLICIES AND CHALLENGES OF WATER AND AIR POLLUTION CONTROL

4.1 The Primary Measures to Control Air pollution

Eliminating the pollutant source is key to improving air quality and reducing associated health risks. Although EPA has the authority to address indoor air quality indirectly through regulation of outdoor air under the Clean Air Act, and the Occupational Safety and Health Administration has rules limiting some airborne hazards in workplaces, Local and state policies have been extremely effective at controlling exposure to environmental tobacco smoke in public spaces including restaurants and bars. Policies that have dramatically reduced exposure to carcinogens in indoor air that impact both workers and patrons. Yet more action is needed to protect people from toxic consumer products and building materials, including labeling laws that require complete information about the chemical ingredients in products and their possible health effects; market incentives to develop cleaner and safer products, technologies, and buildings; and pre-market testing requirements to ensure the safety of products on the market.

4.2 The Primary Measures to Control Water pollution

Update water treatment facilities and delivery infrastructure to reduce disinfection byproducts. Enhance watershed protection programs to reduce contamination of surface waters. Reduce pollution by promoting green chemistry, alternatives assessment, and the sun setting of cancer-contributing substances. Ensure that current drinking water standards truly protect public health. For example, EPA recently reduced the standard for arsenic from 50 parts per billion (ppb) first set in 1942 to 10 ppb. Yet the estimated cancer risk associated with this new standard is still about 1 in 333 people: a risk 30 times greater than EPA usually considers acceptable⁹. Create more protective standards for a range of common water pollutants, such as radon, atrazine, arsenic and various disinfection byproducts⁹.

V. CONCLUSIONS

Air and water pollution are often direct consequences of the industrial society in which we

live. If we want to prevent cancer associated with air and water pollutants, we need to control or eliminate the release of cancer-contributing substances along the entire lifecycle of products and materials, from manufacturing to use to disposal.

Despite an increase in clean-up efforts in recent years, overall degradation of Punjab's waterways continues. Since the early 1990s, there has been some increase in both the number and capacity of industrial wastewater treatment facilities. Efforts have begun to build modern wastewater treatment plants which will lower the pollutants discharged into the rivers²⁰. Regulations aimed at controlling industrial water dumping have been more strictly enforced in recent years, and have been shown to affect the pollution intensity of firm production methods²¹. In combination with evidence presented here regarding the health consequences of water pollution, policies that increase the costs to pollution for firms may better reflect the societal costs of the dumping. Likewise, the results indicate that chemicals from agricultural runoff have grave consequences on digestive cancer rates. Efforts to clean waterways or discourage excessive fertilizer should also be considered, due to the strong relationship observed between nitrogen compounds and cancer rates.

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