

## Volatile organic compounds (VOCs)

Volatile organic compounds, or VOCs, are a class of compounds characterized by having high vapor pressure, meaning they readily volatilize from solid and water surfaces to the air. Dozens of these compounds are present in the environment as a result of fuel combustion, chemical manufacturing, and their use in consumer products. Exposure to these chemicals via inhalation, or presence in drinking water can lead to a variety of health effects ranging from irritation of mucus membranes to cancer. To help in distinguishing between the many kinds of VOCs, the Technical Work Groups divided VOCs into different categories. For this report, there are two categories of VOCs summarized: those VOCs causing cancer (p. 183) and those VOCs not thought to cause cancer (p. 184). Separate analyses were also conducted for the following specific VOCs: acrolein (p. 104), benzene (p. 108), 1,3-butadiene (p.102), formaldehyde (p. 127), MTBE (p. 148), and polycyclic aromatic hydrocarbons (p. 170). VOCs that originate as by-products of the drinking water treatment process itself (e.g., chloroform) are covered in the report for disinfection by-products (p. 121). VOCs contribute to the formation of ground level ozone, also the subject of another analysis (p. 156).

## Volatile organic compounds (VOCs), carcinogenic

Human Health Risk	M - H
Ecological Risk	L
Socioeconomic Risk	M - L

This summary focuses on the risks from VOCs found in New Jersey ambient air and groundwater that are known or suspected to cause cancer. The chemicals of concern in both air and drinking water are: 1,3 dichloropropene, ethylene dibromide, ethylene dichloride, p-dichlorobenzene, trichloroethylene, vinyl chloride, acetaldehyde, acrylonitrile, hydrazine, ethyl acrylate, and ethylene oxide. Chemicals included in this summary based on risks from exposures through the air (drinking water exposures are covered within the Disinfection By-products report), are carbon tetrachloride, chloroform, methyl chloride, and methylene chloride.

### What's at risk?

The general population is exposed primarily as a result of the use of VOCs in chemical manufacturing. Residents of urban counties with industrial activity are at increased risk. Individual exposures vary depending upon proximity to industrial sources, workplace exposures, use of volatile consumer products, and source of drinking water. Plants and nesting birds near highways and industrial areas are also at increased risk.

### What are the human health impacts in New Jersey?

Modeled and measured New Jersey concentrations of the carcinogenic VOCs considered in this analysis may result in 252 excess lifetime cancer cases, or 3.6 additional cases annually. Almost one-half of this risk is attributable to background levels of carbon tetrachloride and ethylene dibromide, which are found statewide with little local variation. Indoor concentrations may reach 100 times outdoor levels, but vary widely making statewide risks difficult to estimate. Drinking water exposures may contribute one additional lifetime cancer statewide.

### What are the ecological impacts in New Jersey?

VOCs typically volatilize before causing a long-term impact on an ecosystem. Potential effects on ecological systems are more likely to result from accidental exposures to high concentrations rather than continual exposure. VOCs will dissolve in water, and thus may cause short-term impacts to aquatic organisms, but evaporate quickly from water surfaces.

### What are the socioeconomic impacts of VOCs in New Jersey?

Apart from the specific compounds reported on separately, the residual socioeconomic risk associated with VOCs generally is low. Health care costs may total as much as \$1 million to \$2 million annually when indoor exposures are considered. Aesthetic concerns related to the odors from indoor concentrations of VOCs are also possible.

### What's being done?

Most consumer uses of halogenated VOCs have been phased out and industrial releases have been reduced significantly over the past 20 years. Concentrations of some compounds (e.g., carbon tetrachloride) reflect global background concentrations rather than New Jersey sources. Public drinking water suppliers are required to monitor for, and report the presence of carcinogenic VOCs.

## Volatile organic compounds (VOCs), non-carcinogenic

Human Health Risk	M - L
Ecological Risk	L
Socioeconomic Risk	M - L

This summary focuses on the risks associated from a subset of VOCs that are suspected of having some health impacts and are found in New Jersey indoor and outdoor air. None of these compounds are suspected of causing cancer. The compounds included in this analysis are glycol ethers, methanol, methyl ethyl ketone, toluene, and xylene.

### What's at risk?

The general population is exposed to low levels throughout the state, but exposure varies significantly due to local variations in industrial and transportation emissions. Certain populations may be sensitive to low concentrations of VOCs and exhibit symptoms of neurological distress. Plants and nesting birds in industrial areas may also be at greater risk.

### What are the human health impacts in New Jersey?

Non-cancer effects—which may include irritation to mucous membranes, neurological effects, and liver damage—are negligible at concentrations likely to be encountered in non-occupational settings. A lack of certainty regarding the specific level of exposure and the inability to include all possible VOCs in the analysis resulted in the ranking of Low/Medium.

### What are the ecological impacts in New Jersey?

VOCs typically volatilize before causing a long-term impact on an ecosystem. Potential effects on ecological systems are more likely to result from accidental exposures to high concentrations rather than continual exposure. VOCs will dissolve in water, and thus may cause short-term impacts to aquatic organisms, but evaporate quickly from water surfaces.

### What are the socioeconomic impacts of VOCs in New Jersey?

The residual socioeconomic risk associated with VOCs generally is low. Health care costs may total (including carcinogenic VOCs) as much as \$1-2 million annually when indoor exposures are considered. Aesthetic concerns related to the odors from indoor concentrations of VOCs are also possible.

### What's being done?

Industrial emissions are regulated via the permit process, and pollution prevention efforts are resulting in a general decrease in the use and release of VOCs. While many VOCs decreased in ambient concentrations during the 1990s, there is evidence that ethylene oxide increased by about 10% between 1990 and 1996.