Coke Oven Emissions

COKE OVEN EMISSIONS (A)

Hazard Summary

Exposure to coke oven emissions may occur for workers in the aluminum, steel, graphite, electrical, and construction industries. Chronic (long-term) exposure to coke oven emissions in humans results in conjunctivitis, severe dermatitis, and lesions of the respiratory system and digestive system. Cancer is the major concern from exposure to coke oven emissions. Epidemiologic studies of coke oven workers have reported an increase in cancer of the lung, trachea, bronchus, kidney, prostate, and other sites. Animal studies have reported tumors of the lung and skin from inhalation exposure to coal tar. EPA has classified coke oven emissions as a Group A, known human carcinogen.

Please Note: The main source of information for this fact sheet is EPA's Integrated Risk Information System (IRIS) (3), which contains information on the carcinogenic effects of coke oven emissions including the unit cancer risk for inhalation exposure. Other secondary sources include the Hazardous Substances Data Bank (HSDB) (2), a database of summaries of peer-reviewed literature, and The Handbook of Toxic and Hazardous Chemicals and Carcinogens, a reference book that summarizes the key effects from exposure to hazardous chemicals. (1)

Uses

- At coke oven batteries, coal is processed to produce coke (pure carbon) which is a component in manufacturing iron and steel.
- Chemicals recovered from coke oven emissions are used as a raw material for plastics, solvents, dyes, drugs, waterproofing, paints, pipecoating, roads, roofing, insulation, and as pesticides and sealants. (2)

Sources and Potential Exposure

- Occupational exposure to coke oven emissions may occur for those workers in the aluminum, steel, graphite, electrical, and construction industries. (1)

Assessing Personal Exposure

- No information is available on the assessment of personal exposure to coke oven emissions.

Health Hazard Information

Acute Effects:

- No information is available on the effects of coke oven emissions from acute (short-term) exposure in humans.
- Animal studies have reported weakness, depression, shortness of breath, general edema, and effects on the liver from acute oral exposure to coke oven emissions. (2)

Chronic Effects (Noncancer):

- Chronic exposure to coke oven emissions in humans results in conjunctivitis, severe dermatitis, and lesions of the respiratory and digestive systems. (2)
- Animal studies have reported effects on the liver from chronic oral exposure to coke oven emissions. (2)
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for coke oven emissions. (3)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of coke oven emissions in humans or animals.

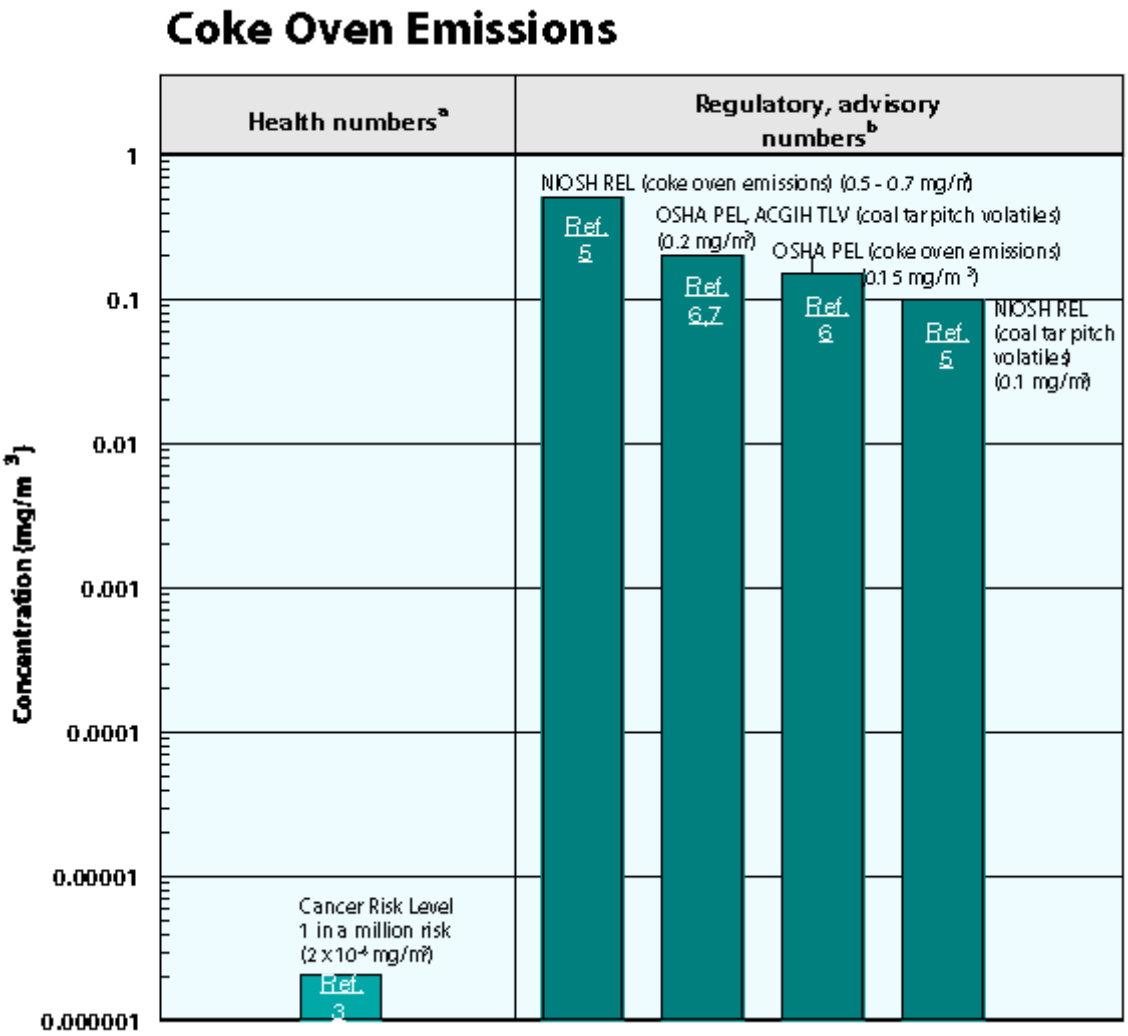
Cancer Risk:

- Epidemiologic studies of coke oven workers have reported an increase in cancer of the lung, trachea, bronchus, kidney, prostate, and other sites. (3)
- Animal studies have reported tumors of the lung and skin from inhalation exposure to coal tar. (3)
- EPA has classified coke oven emissions as a Group A, known human carcinogen. (3)
- EPA uses mathematical models, based on animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA calculated an inhalation unit risk estimate of 6.2×10^{-4} $(\mu g/m^3)^{-1}$. EPA estimates that, if an individual were to continuously breathe air containing coke oven emissions at an average of 0.002 $\mu g/m^3$ (2×10^{-6} mg/m^3) over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of continuously breathing air containing this chemical. Similarly, EPA estimates that breathing air containing 0.02 $\mu g/m^3$ (2×10^{-5} mg/m^3) would result in not greater than a one-in-a-hundred-thousand increased chance of developing cancer during a lifetime, and air containing 0.2 $\mu g/m^3$ (2×10^{-4} mg/m^3) would result in not greater than a one-in-ten-thousand increased chance of developing cancer during a lifetime. For a detailed discussion of confidence in the potency estimates, please see IRIS. (3)

Physical Properties

- Coke oven emissions are a mixture of coal tar, coal tar pitch, volatiles, creosote, polycyclic aromatic hydrocarbons (PAHs), and metals. PAHs are semi-volatile compounds; over 20 different PAHs are found in coke oven emissions, including benzo(a)pyrene, benzanthracene, chrysene, and phenanthrene. Approximately 80% of coal tar is unspecified carbon chains (C18-22); coal tar volatiles include benzene, toluene, and xylenes. (1)
- Condensed coke oven emissions are a brownish, thick liquid or semisolid with a naphthalene-like odor, while uncondensed coke oven emissions are vapors that escape when the ovens are changed and emptied. (2)
- The odor threshold for coke oven emissions is not available. The actual chemical content of the emissions depends on the process variables.

Health Data from Inhalation Exposure



ACGIH TLV--American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

NIOSH REL--National Institute of Occupational Safety and Health's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

[a] Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

[b] Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

Summary created in April 1992, updated in January 2000

References

1. M. Sittig. Handbook of Toxic and Hazardous Chemicals and Carcinogens. 2nd ed. Noyes Publications, Park Ridge, NJ. 1985.
2. U.S. Department of Health and Human Services. Hazardous Substances Data Bank (HSDB, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
3. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on Coke Oven Emissions. National Center for Environmental Assessment, Office of Research and Development, Washington, DC.

1999.
4. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances (RTECS, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
5. National Institute for Occupational Safety and Health (NIOSH). Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Cincinnati, OH. 1997.
6. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.
7. American Conference of Governmental Industrial Hygienists (ACGIH). 1999 TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices. Cincinnati, OH. 1999.

A. *Coke oven emissions include coal tar, creosote, and coal tar pitch.