

Cancer Association of South Africa (CANSA)

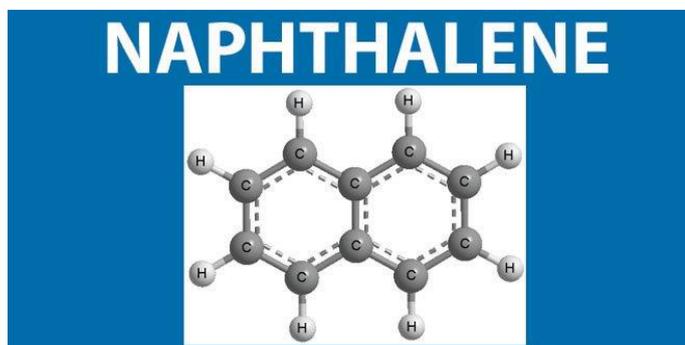


Fact Sheet on Naphthalene

Research • Educate • Support

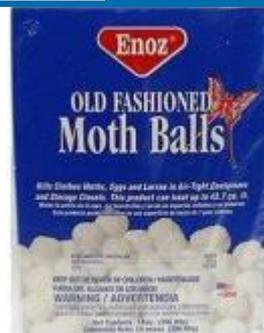
Introduction

Naphthalene is made from crude oil or coal tar. It is also produced when things burn, so naphthalene is found in cigarette smoke, car exhaust, and smoke from forest fires. It is used as an insecticide and pest repellent. Naphthalene was first registered as a pesticide in the United States in 1948. Mothballs and other products containing naphthalene are solids that turn into toxic gas. The toxic gas kills insects and may repel animals. (National Pesticide Information Center).



[Picture Credit: Naphthalene]

[Picture Credit: Moth Balls]



IARC Classification of Naphthalene

Naphthalene is classified as a Group 2B substance by the International Agency for Research on Cancer (IARC). This means that this agent is possibly carcinogenic (cancer causing) to humans. This category is used for agents, mixtures and exposure circumstances for which there is limited evidence of carcinogenicity in humans but there is sufficient evidence of carcinogenicity in experimental animals. In some instances, an agent, mixture or exposure for which there is inadequate evidence of carcinogenicity in humans but limited evidence of carcinogenicity in experimental animals together with supporting evidence from other relevant data may be placed in this group. (IARC Monograph Volume 82; Wikipedia).

Naphthalene

Naphthalene is a white crystalline, volatile solid with an odour of mothballs. It sublimes at room temperature (transition of a substance directly from the solid to the gas phase).

Naphthalene is insoluble in water and is soluble in benzene, absolute alcohol, ether, carbon tetrachloride, carbon disulphide, hydronaphthalenes, and in fixed and volatile oils.

Naphthalene is produced from petroleum refining and coal tar distillation. It is used as a chemical intermediate in the production of phthalic anhydride, naphthol, and chlorinated naphthalenes. It is also used in smokeless powder, cutting fluids, lubricants, antiseptics, synthetic resins, tanning products, preservatives, textile chemicals, emulsion breakers, and scintillation counters. It is also found in combustion processes including refuse combustion, tobacco smoke, coal tar pitch fumes, and oil spills.

The primary stationary sources that have reported emissions of naphthalene are paper mills, manufacturers of miscellaneous wood products, and electrical services. Naphthalene has also been detected, but not quantified, in motor vehicle exhaust by the Air Resources Board (ARB).

Naphthalene was registered for use as a pesticide in the United States of America in 1948.

It is also known as:

- Tar Camphor
- White Tar
- Moth Flakes.

Its main hazards include:

- It is flammable
- Its dust can form an explosive mixtures with air
- It is a sensitiser
- It is a possible carcinogen

(Scorecard; New World Encyclopedia).

Uses of Naphthalene

- Naphthalene's most familiar use is as a household fumigant, such as in mothballs. In a sealed container of naphthalene pellets, naphthalene vapours build up to levels toxic to both the adult and larval forms of many moths that are destructive to textiles. Other fumigant uses of naphthalene include use in soil as a fumigant pesticide, and in attic spaces to repel animals.
- In the past, naphthalene was administered orally to kill parasitic worms in livestock.
- Larger volumes of naphthalene are used as a chemical intermediate to produce other chemicals. The single largest use of naphthalene is the industrial production of phthalic anhydride, although more phthalic anhydride is made from o-xylene than from naphthalene. Other naphthalene-derived chemicals include alkyl naphthalene sulfonate surfactants, and the insecticide carbaryl.
- Naphthalenes substituted with combinations of strongly electron-donating functional groups, such as alcohols and amines, and strongly electron-withdrawing groups, especially sulfonic acids, are intermediates in the preparation of many synthetic dyes.
- The hydrogenated naphthalenes tetrahydronaphthalene (Tetralin) and decahydronaphthalene (Decalin) are used as low-volatility solvents.

- Naphthalene vapour can also slow the onset of rust, and, thus, sometimes moth balls are used in places like a tool box.
- Naphthalene is used to make products like moth balls that repel and keep moths away.
- Naphthalene is also used in the manufacturing of certain leather goods.
- Naphthalene (mothballs) is also used as a deodorant air freshener, especially in male urinals.
- It could not be determined whether the following is an urban legend or not. There appears to be evidence that before World War II naphthalene was used as a fuel. Race drivers used it to boost octane by adding 1 moth ball to every 5 litres of fuel. Today, many people are apparently still using it to get better mileage out of gasoline and diesel engines. It is said that engine performance is improved and fuel economy is much better if one add 1 naphthalene moth ball to 20 litres of gasoline or diesel fuel.
(Environmental Protection Agency; New World Encyclopedia; hho4free).

Health Hazards of Naphthalene

Acute Effects:

- Acute exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with haemolytic anaemia, damage to the liver, and, in infants, neurological damage. Symptoms of acute exposure include headache, nausea, vomiting, diarrhoea, malaise, confusion, anaemia, jaundice, convulsions, and coma.
- Cataracts have been reported in humans acutely exposed to naphthalene by inhalation and ingestion. Cataracts have also been reported in animals following acute oral exposure.
- Tests involving acute exposure of rats, mice, rabbits, and guinea pigs have demonstrated naphthalene to have moderate to high acute toxicity from ingestion and low to moderate acute toxicity from dermal exposure.

[Picture Credit: Mothballs 1]

Chronic Effects (Non-cancer):

- Chronic exposure of workers to naphthalene has been reported to cause cataracts and retinal haemorrhage.
- Chronic inflammation of the lung, chronic nasal inflammation, hyperplasia of the respiratory epithelium in the nose, and metaplasia of the olfactory epithelium were reported in mice chronically exposed to naphthalene via inhalation.
- Rats, rabbits, and mice chronically exposed to naphthalene via ingestion have developed cataracts and degeneration of the retina.
- Diarrhoea, lethargy, hunched posture, rough coats, decreased body weight, and lesions in the kidneys and thymus were observed in rats and mice chronically exposed via gavage (experimentally placing the chemical in the stomach).



Reproductive/Developmental Effects:

- Haemolytic anaemia has been reported in infants born to mothers who "sniffed" and ingested naphthalene (as mothballs) during pregnancy. The mothers themselves were anaemic, but to a lesser extent than the infants.
- Signs of maternal toxicity (e.g., decreased body weight and lethargy) but no foetal effects were reported in rats and rabbits exposed to naphthalene via gavage.
- Maternal toxicity (increased mortality and reduced weight gain) and foetotoxicity (reduced number of live pups per litter) were observed in mice exposed via gavage (force-feeding a person or an animal against their will).

Cancer Risk:

- Workers occupationally exposed to vapours of naphthalene and coal tar developed laryngeal carcinomas or neoplasms of the pylorus and caecum. However, this study is inadequate because there were no controls, exposure levels were not determined, and subjects were exposed to complex mixtures containing other demonstrated carcinogens.
- Di-, tri-, and tetramethyl naphthalene contaminants of coal tar were found to be carcinogenic when applied to the skin of mice, but naphthalene alone was not.
- An increased number of alveolar/bronchiolar adenomas and carcinomas were reported in female mice exposed by inhalation.
- No carcinogenic responses were reported in rats exposed to naphthalene in their diet and by injection.
- EPA has classified naphthalene as a Group C, possible human carcinogen.

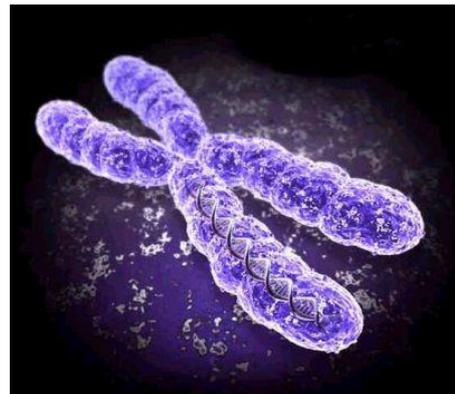
(United States Environmental Protection Agency; New Jersey Department of Health and Senior Services).

Chromosomal Aberrations Due to Naphthalene

According to a new study, children exposed to high levels of the common air pollutant naphthalene are at increased risk for chromosomal aberrations (CAs), which have been previously associated with cancer. These include chromosomal translocations, a potentially more harmful and long-lasting subtype of CAs.

[Picture Credit: Chromosomal Aberration]

Researchers from the Columbia Center for Children's Environmental Health (CCCEH) at the Mailman School of Public Health, Columbia University Medical Center, and the Centers for Disease Control and Prevention (CDC) report the new findings in *Cancer, Epidemiology, Biomarkers & Prevention*, a journal of the American Association for Cancer Research.



The researchers followed 113 children, age 5, who are part of a larger cohort study in New York City. They assessed the children's exposure to naphthalene; a CDC laboratory measured levels of its metabolites--1- and 2-naphthol--in urine samples. (Metabolites are products of the body's metabolism, and can serve as marker for the presence of a chemical.) Researchers also measured CAs in the children's white blood cells using a technique called fluorescent *in situ* hybridisation. Chromosomal aberrations were present in 30 children; of these, 11 had translocations. With every doubling

of levels of 1- and 2-naphthol, translocations were 1.55 and 1.92 times more likely, respectively, to occur.
(Columbia University's Mailman School of Public Health).

Naphthalene Poisoning

Poisoning from naphthalene destroys or changes red blood cells so they cannot carry oxygen. This can cause organ damage.

Symptoms of Naphthalene Poisoning - Stomach problems may not occur until 2 days after coming in contact with the poison. They can include:

- Abdominal pain
- Nausea and vomiting
- Diarrhoea

The person may also have a fever. Over time, the following symptoms also may occur:

- Coma
- Confusion
- Convulsions
- Drowsiness
- Headache
- Increased heart rate (tachycardia)
- Low blood pressure
- Low urine output (may stop completely)
- Pain when urinating (may be blood in the urine)
- Shortness of breath
- Yellowing of skin (jaundice)

NOTE: People with a condition called glucose-6-phosphate dehydrogenase deficiency are more vulnerable to the effects of naphthalene.

Before Calling Emergency - determine the following information:

- Person's age, weight, and condition
- Name of the product (ingredients and strengths, if known)
- Time it was swallowed
- Amount swallowed

What to Expect at the Emergency Room - the health care provider will measure and monitor the person's vital signs, including temperature, pulse, breathing rate, and blood pressure. Symptoms will be treated as needed.

- Blood and urine tests will be done.
- People who have recently eaten many mothballs containing naphthalene may be forced to vomit.

Other treatments may include:

- Activated charcoal to prevent the poison from absorbing in the digestive system.
- Airway and breathing support, including oxygen. In extreme cases, a tube may be passed through the mouth into the lungs to prevent aspiration. A breathing machine (ventilator) would then be needed as well.
- Chest x-ray.
- EKG (electrocardiogram or heart tracing).
- Fluids through a vein (by IV).
- Laxatives to move the poison quickly through the body and remove it.
- Medicines to treat symptoms and reverse the effects of the poison.

Outlook (Prognosis) - it can take several weeks or longer to recover from some of the poison's effects.

If the person has convulsions and coma, the outlook is not good.
(MedlinePlus.

Remember the Following Regarding Naphthalene

- Naphthalene can damage one's health
- Naphthalene is a chemical found in moth balls and commonly used as a pesticide
- Always follow the instructions provided on the product label
- Integrated Pest Management (IPM) is a comprehensive approach to pest control that emphasizes environmental responsibility and reducing the use of chemical pesticides

Medical Disclaimer

This Fact Sheet is intended to provide general information only and, as such, should not be considered as a substitute for advice, medically or otherwise, covering any specific situation. Users should seek appropriate advice before taking or refraining from taking any action in reliance on any information contained in this Fact Sheet. So far as permissible by law, the Cancer Association of South Africa (CANSA) does not accept any liability to any person (or his/her dependants/estate/heirs) relating to the use of any information contained in this Fact Sheet.

Whilst the Cancer Association of South Africa (CANSA) has taken every precaution in compiling this Fact Sheet, neither it, nor any contributor(s) to this Fact Sheet can be held responsible for any action (or the lack thereof) taken by any person or organisation wherever they shall be based, as a result, direct or otherwise, of information contained in, or accessed through, this Fact Sheet.

Sources and References

Colombia University's Mailman School of Public Health

http://www.eurekalert.org/pub_releases/2012-05/cums-cet052912.php

Chromosomal Aberration

<http://health-e-waste.blogspot.com/2009/12/dna-damage-and-chromosomal-aberrations.html>

Hho4free

<http://www.hho4free.com/additives/naphthalene.htm>

IARC Monograph Volume 82

<http://monographs.iarc.fr/ENG/Monographs/vol82/mono82-8.pdf>

MedlinePlus

<https://medlineplus.gov/ency/article/002477.htm>

Molecular Structure – Naphthalene

<http://npic.orst.edu/factsheets/naphtech.html>

Moth Balls 1

<http://www.ridmothsaturally.com/author/admin/>

Moth Balls

<http://www.hho4free.com/additives/naphthalene.htm>

Naphthalene

<http://npic.orst.edu/ingred/naphth.html>

National Pesticide Information Center

<http://npic.orst.edu/factsheets/naphgen.html>

New Jersey Department of Health and Senior Services

<http://nj.gov/health/eoh/rtkweb/documents/fs/1472.pdf>

New World Encyclopedia

<http://www.newworldencyclopedia.org/entry/Naphthalene>

Scorecard

<http://scorecard.goodguide.com/chemical-profiles/html/naphthalene.html>

United States Environmental Protection Agency

<http://www.epa.gov/ttnatw01/hlthef/naphthal.html>

<http://www.epa.gov/osw/hazard/wastemin/minimize/factshts/naphthal.pdf>

Wikipedia

http://en.wikipedia.org/wiki/List_of_IARC_Group_2B_carcinogens