

Naphthalene - Guidance for Air

The following guidance was developed by the Minnesota Department of Health (MDH) at the request of the Minnesota Pollution Control Agency (MPCA).

Acute and Chronic Health-Based Values; Inhalation Unit Risk Consultation

Chemical: Naphthalene

CAS number: 91-20-3

Endpoint(s): Respiratory System

Acute Value: 200 $\mu\text{g}/\text{m}^3$ (2004)

Chronic Value: 9 $\mu\text{g}/\text{m}^3$ (2004)

Cancer Value: **NA** For more information regarding cancer see:

- Naphthalene Inhalation Unit Risk Consultation
<https://www.health.state.mn.us/communities/environment/risk/docs/guidance/air/naphconsult.pdf>

Sources: NTP (1992, 2000) for chronic value

The Minnesota Department of Health (MDH) has derived both an acute Health-Based Value (HBV) of 200 $\mu\text{g}/\text{m}^3$ and a chronic HBV of 9 $\mu\text{g}/\text{m}^3$ for inhalation exposures to naphthalene. A description of the techniques, assumptions and caveats used in developing these numbers follows, as well as further information on cancer.

Note: MDH has less confidence in the acute value and recommends that it be considered a site-specific screening number to be used to trigger remedial action, where appropriate.

Acute (2004)

There are limited data addressing the impacts of acute exposures of experimental animals to naphthalene. However, because there are a number of anecdotal reports of naphthalene toxicity in humans (nausea, vomiting, abdominal pain, and hemolytic anemia) at concentrations above those that trigger an odor (200 - 440 $\mu\text{g}/\text{m}^3$) MDH recommends the use of an acute HBV (one hour exposure) of 200 $\mu\text{g}/\text{m}^3$ as a reasonable maximum exposure level.

The use of this number is supported by results from a study on rats that reported respiratory changes (cell swelling and sloughing) following four hours of exposure to 380 mg/m^3 of naphthalene (Buckpitt, 1982). In this study 204 mg/m^3 was a No Observed Adverse Effect Level (NOAEL). Applying an uncertainty factor of 1000 (10 for intraspecies variability, 10 for interspecies variability, and 10 for database deficiencies) gives an acute value of 200 $\mu\text{g}/\text{m}^3$ for

a four-hour exposure. As an additional precaution, MDH recommends that this number be applied using a 1 hour averaging time.

Chronic (2004)

Two chronic rodent bioassays, one in mice (NTP, 1992) and one in rats (NTP, 2000) are the basis for MDH's chronic HBV of $9 \mu\text{g}/\text{m}^3$. Both of these studies involved the administration of naphthalene for 6 hours per day, five days per week for two years. Both studies produced a Lowest Observed Adverse Effect Level (LOAEL) of 10 ppm naphthalene with fairly marked respiratory and nasal impacts as adverse endpoints.

Manipulating this exposure to allow for a 24 hour/day and a seven day/week exposure yields an adjusted LOAEL of 1.78 ppm which converts to a value of $9.3 \text{ mg naphthalene}/\text{m}^3$. Applying an uncertainty factor of 1000 (10 for intraspecies variability, 10 for interspecies variability, and 10 for the use of a LOAEL rather than a NOAEL) results in a final chronic HBV for naphthalene of $9 \mu\text{g}/\text{m}^3$.

Please be advised that although MDH has a reasonable level of confidence in the chronic naphthalene number, available data do not address two additional toxic endpoints reported in humans - cataracts, and the blood disorder, hemolytic anemia. MDH is therefore less certain about the conservative nature of the naphthalene number for these endpoints.

Cancer

Emerging data suggest that humans would be significantly less susceptible to naphthalene as a carcinogen than rodents based on physiology and enzymatic biotransformation. MDH's recommendation at this time is to use the established chronic MDH HBV ($9 \mu\text{g}/\text{m}^3$) for naphthalene to assess possible long-term health risks, which is expected to be protective of carcinogenicity, until the U.S. Environmental Protection Agency's (EPA's) Integrated Risk Information System (IRIS) program provides definitive quantitative Inhalation Unit Risk guidance. The presence of respiratory tract tumors in animals following naphthalene exposure by inhalation is sufficient to demonstrate carcinogenicity in these model systems, but the quantification of human cancer risk at low exposure levels based on these studies is a point of considerable debate. Use of the higher chronic MDH HBV compared to the available inhalation unit risk is considered sufficiently health protective until refinements to the quantitative cancer risk assessment are completed by EPA's IRIS program.

References

Buckpitt, A.R. (1982). Comparative biochemistry and metabolism. Part 2: Naphthalene lung toxicity. AFAMRL-TR-82-52, pg. 25-30. Air Force Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio.

NTP (1992). National Toxicology Program. Toxicology and carcinogenesis studies of naphthalene (CAS No. 91-20-3) in B6C3F1 mice (inhalation studies). NTP Technical Report Series No. 410. NIH publication no. 92-3141. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, Research Triangle Park, N.C.

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NTP (2000). National Toxicology Program. Toxicology and carcinogenesis studies of naphthalene (CAS No. 91-20-3) in F344/N rats (inhalation studies). NTP Technical Report Series No. 500. NIH publication no. 01-4434. U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, Research Triangle Park, N.C.

Minnesota Department of Health
ESA-EIA
625 Roberts St N
St. Paul, MN 55164
651-201-4899
health.risk@state.mn.us
www.health.state.mn.us

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