Health Based Guidance for Water
Health Risk Assessment Unit, Environmental Health Division
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Toxicological Summary for: Anthracene

CAS: **120-12-7**
Synonyms: Anthracen, paranaphthalene, p-naphthalene, anthracin, Green Oil

The toxicity database for anthracene contained only one high quality study for guidance development. While health effects were observed in limited, lower quality studies, no effects were observed in the higher quality study. This does not mean that ingesting anthracene has no health effects at all, but instead that the doses tested and examinations conducted to date have not revealed any. Therefore, MDH used the highest dose tested, corresponding to the no observed adverse effects level (NOAEL), from the best available study to derive Risk Assessment Advice (RAA). Though this value does not provide an estimated value above which health effects may be observed, it does provide some context if anthracene is found in environmental samples at levels lower than the RAA.

Acute Non-Cancer Risk Assessment Advice ($nRAA_{Acute}$) = Not Derived (Insufficient Data)

Short-term Non-Cancer Risk Assessment Advice ($nRAA_{Short\text{-}term}$) = Not Derived (Insufficient Data)

Subchronic Non-Cancer Risk Assessment Advice ($nRAA_{Subchronic}$) = 1000 µg/L

$$\frac{\text{(Reference Dose, mg/kg-d) x (Relative Source Contribution) x (Conversion Factor)}}{\text{(Subchronic Intake Rate, L/kg-d)}}$$

$$= \frac{\text{(0.43 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.070 L/kg-d)}^{**}}$$

= 1228 rounded to **1000 µg/L**

*Relative Source Contribution: MDH 2008, Section IV.E.1.
**Intake Rate: MDH 2008, Section IV.E.1. and US EPA 2011, Exposure Factors Handbook, Tables 3-1 and 3-81

Reference Dose/Concentration:	HED/Total UF = 130 / 300 = 0.43 mg/kg-d (CD-1 mouse)
Source of toxicity value:	Determined by MDH in 2019
Point of Departure (POD):	1000 mg/kg-d (administered dose NOAEL, US EPA 1989)

Dose Adjustment Factor (DAF):	0.13 based on body weight scaling, default (US EPA, 2011 and MDH, 2017)
Human Equivalent Dose (HED):	POD x DAF = 1000 mg/kg-d x 0.13 = 130 mg/kg-d
Total uncertainty factor (UF):	300
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics), 10 for intraspecies variability, and 10 for database uncertainty to account for the absence of developmental and reproductive studies in the database.
Critical effect(s):	None identified
Co-critical effect(s):	Not applicable
Additivity endpoint(s):	Not applicable

Chronic Non-Cancer Risk Assessment Advice ($nRAA_{Chronic}$) = 600 µg/L

$$\frac{\text{(Reference Dose, mg/kg-d) x (Relative Source Contribution) x (Conversion Factor)}}{\text{(Chronic Intake Rate, L/kg-d)}}$$

$$= \frac{\text{(0.13 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.044 L/kg-d)}^{**}}$$

= 590.9 rounded to **600 µg/L**

*Relative Source Contribution: MDH 2008, Section IV.E.1.
**Intake Rate: MDH 2008, Section IV.E.1. and US EPA 2011, Exposure Factors Handbook, Tables 3-1 and 3-81

Reference Dose/Concentration:	HED/Total UF = 130 / 1000 = 0.13 mg/kg-d (CD-1 mouse)
Source of toxicity value:	Determined by MDH in 2019
Point of Departure (POD):	1000 mg/kg-d (administered dose NOAEL, US EPA, 1989, subchronic exposure)
Dose Adjustment Factor (DAF):	0.13 based on body weight scaling, default (US EPA, 2011 and MDH, 2017)
Human Equivalent Dose (HED):	POD x DAF = 1000 mg/kg-d x 0.13 = 130 mg/kg-d
Total uncertainty factor (UF):	1000
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics), 10 for intraspecies variability, 10 for database uncertainty to account for the absence of developmental and reproductive studies in the database, and 3 for subchronic-to-chronic extrapolation.
Critical effect(s):	None identified
Co-critical effect(s):	Not applicable
Additivity endpoint(s):	Not applicable

Cancer Risk Assessment Advice (cRAA) = Not Applicable

Cancer classification:	Not Classified
Slope factor (SF):	Not Applicable
Source of cancer slope factor (SF):	Not Applicable
Tumor site(s):	Not Applicable

Volatile: Yes (moderate)

Summary of Guidance Value History:

A non-cancer chronic HRL of 2000 µg/L was promulgated in 1993. In 2019, MDH derived subchronic and chronic nRAAs of 1000 and 600 µg/L, respectively. Both the 2019 subchronic and chronic nRAAs are lower than the previous HRL as a result of using MDH's most recent risk assessment methodology.

Summary of toxicity testing for health effects identified in the Health Standards Statute (144.0751):

Even if testing for a specific health effect was not conducted for this chemical, information about that effect might be available from studies conducted for other purposes. MDH has considered the following information in developing health protective guidance.

	Endocrine	Immunotoxicity	Development	Reproductive	Neurotoxicity
Tested for specific effect?	No	No	No	No	No
Effects observed?	-	-[1]	-[2]	-	-

Comments on extent of testing or effects:

[1] In the critical study, male mice in the low dose group had a slight decrease in segmented neutrophils (~1.1%) compared to controls; however, there was no decrease observed in mice receiving higher doses. Because there was no dose response for this endpoint and the biological significance of such a small decrease in neutrophils is unknown, this endpoint was not listed as a critical effect. A database uncertainty factor of 10 was applied, in part, to account for the lack of direct immunotoxicity testing via oral route of exposure.

[2] There is very little information about the effects of anthracene on the developing organism. The only oral study available was an extremely limited transplacental carcinogenicity study in mice. Although the report was published in a foreign language, a summary of the results indicated that there were histological changes in embryonic kidneys in culture following maternal anthracene exposure. The study design and limited reporting of results and methodology in the summary make interpretation of the results difficult. A database uncertainty factor of 10 was applied, in part, to account for the lack of direct developmental testing.

Resources Consulted During Review:

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