Health Based Guidance for Water
Health Risk Assessment Unit, Environmental Health Division
651-201-4899

Adopted as Rule: August 2018

Toxicological Summary for: Fluoranthene

CAS: **206-44-0**
Synonyms: Benzo(j,k)fluorine, 1,2-Benzacenaphthene

Acute Non-Cancer Health Risk Limit ($nHRL_{Acute}$) = Not Derived (Insufficient Data)

Short-term Non-Cancer Health Risk Limit ($nHRL_{Short\text{-}term}$) = Not Derived (Insufficient Data)

Subchronic Non-Cancer Health Risk Limit ($nHRL_{Subchronic}$) = 200 µg/L

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

$$= \frac{\text{(0.053 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.070 L/kg-d)}^{**}}$$

= 151 rounded to **200 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:	HED/Total UF = 16/300 = 0.053 mg/kg-d (CD-1 mice)
Source of toxicity value:	Determined by MDH in 2017
Point of Departure (POD):	124 mg/kg-d $BMDL_{10}$ (U.S. Environmental Protection Agency, 2012)
Dose Adjustment Factor (DAF):	0.13 Body weight scaling, default (US EPA 2011 and MDH 2011)
Human Equivalent Dose (HED):	POD x DAF = 124 mg/kg-d x 0.13 = 16 mg/kg-d
Total uncertainty factor (UF):	300
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics); 10 for intraspecies variability; 10 for database uncertainty due to lack of reproductive and developmental studies
Critical effect(s):	Nephropathy
Co-critical effect(s):	Increased relative liver weight, increased SGPT
Additivity endpoint(s):	Hepatic (liver) system, Renal (kidney) system

Chronic Non-Cancer Health Risk Limit ($nHRL_{Chronic}$) = 70 µg/L

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

$$= \frac{\text{(0.016 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.044 L/kg-d)}^{**}}$$

= 72.7 rounded to **70 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:	HED/Total UF = 16/1000 = 0.016 mg/kg-d (CD-1 mice)
Source of toxicity value:	Determined by MDH in 2017
Point of Departure (POD):	124 mg/kg-d ($BMDL_{10}$, U.S. Environmental Protection Agency, 2012, subchronic study)
Dose Adjustment Factor (DAF):	0.13 Body weight scaling, default (US EPA 2011 and MDH 2011)
Human Equivalent Dose (HED):	POD x DAF = 124 mg/kg-d x 0.13 = 16 mg/kg-d
Total uncertainty factor (UF):	1000
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics); 10 for intraspecies variability; 3 for extrapolation from a subchronic to chronic study; and 10 for database uncertainty due to lack of reproductive and developmental studies
Critical effect(s):	Nephropathy
Co-critical effect(s):	Increased relative liver weight, increased SGPT
Additivity endpoint(s):	Hepatic (liver) system, Renal (kidney) system

Cancer Health Risk Limit (cHRL) = Not Applicable

Cancer classification:	Class D, not classifiable as to human carcinogenicity (U. S. Environmental Protection Agency, 1990
Slope factor (SF):	Not Applicable
Source of cancer slope factor (SF):	Not Applicable
Tumor site(s):	Not Applicable

EPA's finding (EPA, 1990) that fluoranthene cannot be classified (class D) for oral carcinogenicity is due to a lack of suitable data. No oral cancer study or EPA slope factor for fluoranthene is available and MDH has determined that a cancer health based guidance value cannot be developed.

Fluoranthene often occurs in environmental mixtures that are evaluated for carcinogenicity. To evaluate the cancer potency of mixtures, including fluoranthene, please consult the MDH RPF guidance document. http://www.health.state.mn.us/divs/eh/risk/guidance/pahguidance.pdf

Volatile: Yes (Low)

Summary of Guidance Value History:
Fluoranthene has a chronic HRL of 300 µg/L from 1993. In addition, a Pesticide Rapid Assessment of 10 µg/L was derived in 2014 and was lower than the HRL due to the conservative rapid assessment method (MDH 2014). Subchronic and Chronic HBVs of 100 µg/L and 70 µg/L were derived in 2015. The 2015 chronic HBV was 4 times lower than the 1993 HRL as a result of: 1) the use of new methodology, including benchmark dose analysis, body weight scaling, and updated water intake rates, and 2) the rounding of values to one significant digit. In 2016 MDH updated the intake rate values used to derive guidance values. Due to rounding to one significant digit the updated intake rates resulted in a revised Subchronic nHBV of 200 µg/L but did not result in any change to the Chronic nHBV value derived in 2015. The 2016 guidance was adopted into rule as HRLs in 2018.

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	Yes
Effects observed?	No	--[1]	No	No	Yes

Comments on extent of testing or effects:
[1] Although the immunotoxicity of fluoranthene has not been studied, effects have been reported in a number of studies. In a single dose study, significantly decreased white blood cell counts were observed in rats at a dose nearly 8000 times the subchronic RfD. White blood cell counts were also decreased in longer studies in rats at a dose 5900 times the subchronic RfD. In addition, white blood cell numbers were decreased in female mice at a dose more than 1200 times the subchronic RfD.

[2] In one study, the following parameters were reported as significantly changed at doses more than 800 times the subchronic RfD: motor activity, neuromuscular, sensorimotor, autonomic, physiological, and excitability. However, none of these effects were replicated in any other study.

Resources Consulted During Review:
Agency for Toxic Substances and Disease Registry (ATSDR) - MRLs. (2009). Minimal Risk Levels for Hazardous Substances (MRLs). from http://www.atsdr.cdc.gov/mrls/mrls_list.html

Dutch National Institute for Public Health and the Environment (RIVM). (2001). Re-evaluation of human-toxicological maximum permissible risk levels.

International Agency for Research on Cancer (IARC). (2010). Monograph 92: Some non-heterocyclic polycyclic aromatic hydrocarbons and some related exposures.

Knuckles, M. E., Inyang, F., & Ramesh, A. (2004). Acute and subchronic oral toxicity of fluoranthene in F-344 rats. *Ecotoxicol Environ Saf, 59*(1), 102-108. doi: 10.1016/S0147-6513(03)00110-6

Minnesota Department of Health (MDH). (2008). Statement of Need and Reasonableness (SONAR), July 11, 2008. Support document relating to Health Risk Limits for Groundwater Rules. Retrieved from http://www.health.state.mn.us/divs/eh/risk/rules/water/hrlsonar08.pdf

Minnesota Department of Health. (2014). Guidance for Evaluating the Cancer Potency of Polycyclic Aromatic Hydrocarbon (PAH) Mixtures in Environmental Samples. Retrieved from: http://www.health.state.mn.us/divs/eh/risk/guidance/pahguidance.pdf

Minnesota Department of Health (MDH). (2011). MDH Health Risk Assessment Methods to Incorporate Human Equivalent Dose Calculations into Derivation of Oral Reference Doses (May 2011, revised 2017) from http://www.health.state.mn.us/divs/eh/risk/guidance/hedrefguide.pdf

Minnesota Department of Health (MDH). (2014). Report on Pesticide Rapid Assessments. Retrieved from: http://www.health.state.mn.us/divs/eh/risk/guidance/dwec/rapassrept.pdf

Saunders, C. R., Shockley, D. C., & Knuckles, M. E. (2003). Fluoranthene-induced neurobehavioral toxicity in F-344 rats. *Int J Toxicol, 22*(4), 263-276.

Stocker, K. J., Howard, W. R., Statham, J., & Proudlock, R. J. (1996). Assessment of the potential in vivo genotoxicity of fluoranthene. *Mutagenesis, 11*(5), 493-496.

U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR). (1995). Toxicological Profile For Polycyclic Aromatic Hydrocarbons. Retrieved from: http://www.atsdr.cdc.gov/toxprofiles/tp69.pdf

U.S. Environmental Protection Agency - IRIS. Integrated Risk Information Systems (IRIS) A-Z List of Substances. from http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList

U.S. Environmental Protection Agency - Office of Research and Development. (1988). Recommendations for and Documentation of Biological Values for Use in Risk Assessment. from http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=34855

U.S. Environmental Protection Agency - Office of the Science Advisor. (2011). Recommended Use of Body Weight¾ as the Default Method in Derivation of the Oral Reference Dose. from http://www.epa.gov/raf/publications/pdfs/recommended-use-of-bw34.pdf

U.S. Environmental Protection Agency - Regional Screening Tables. Mid-Atlantic Risk Assessment - Regional Screening Table. from http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

U.S. Environmental Protection Agency. (1990). IRIS Summary for Fluoranthene. Retrieved from: http://www.epa.gov/iris/subst/0444.htm

U.S. Environmental Protection Agency. (2010). Development of a Relative Potency Factor (RPF) Approach for Polycyclic Aromatic Hydrocarbon (PAH) Mixtures (External Review Draft). Retrieved from: http://cfpub.epa.gov/ncea/iris_drafts/recordisplay.cfm?deid=194584

U.S. Environmental Protection Agency. (2012a). Provisional Peer-Reviewed Toxicity Values for Fluoranthene (CASRN 206-44-0). Retrieved from: http://hhpprtv.ornl.gov/issue_papers/Fluoranthene.pdf

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U.S. Environmental Protection Agency. (2012b). Benchmark Dose Technical Guidance. Retrieved from: http://www.epa.gov/raf/publications/pdfs/benchmark_dose_guidance.pdf

U.S. Geological Survey - Health-Based Screening Levels. from https://cida.usgs.gov/hbsl/apex/f?p=104:1: