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

Adopted as Rule: November 2023

Toxicological Summary for: Quinoline

CAS: **91-22-5**

Synonyms: Leukol, quinoleine, 1-Azanaphthalene, benzo[b]pyridine

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 ($nHRL_{Subchronic}$) = Not Derived (Insufficient Data)

Chronic Non-Cancer Health Risk Limit ($nHRL_{Chronic}$) = 4 µg/L

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

$$= \frac{\text{(0.00079 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.045 L/kg-d)}^{**}}$$

= 3.51 rounded to **4 µg/L**

*Relative Source Contribution: MDH 2008, Section IV.E.1.
**Intake Rate: MDH 2008, Section IV.E.1. and US EPA 2019, Exposure Factors Handbook, Tables 3-1, 3-3 and 3-5.

Reference Dose/Concentration:	HED/Total UF = 2.38/3000 = 0.00079 mg/kg-d (F344 rats)
Source of toxicity value:	Determined by MDH in 2019
Point of Departure (POD):	8.8 mg/kg-d (LOAEL, Matsumoto, 2018)
Dose Adjustment Factor (DAF):	Body weight scaling, default MDH 2017 and US EPA 2011
Human Equivalent Dose (HED):	POD x DAF = 8.8 mg/kg-d x 0.27 = 2.38 mg/kg-d
Total uncertainty factor (UF):	3000
Uncertainty factor allocation:	3 for interspecies differences (for toxicodynamics), 10 for intraspecies variability, 10 for LOAEL to NOAEL, and 10 for database uncertainty (lack of reproductive, developmental, immunotoxicity, and neurotoxicity studies)
Critical effect(s):	Increased cellular changes in the liver and kidney including necrosis, increased hematopoiesis in the bone marrow of

	both sexes, increased extramedullary hematopoiesis in the spleen of male rats.
Co-critical effect(s):	Central degeneration of the liver, increased immature blood cells in the liver and lungs, increased erythropoiesis/hematopoiesis in the bone marrow, spleen, and liver, increased inflammatory infiltration in the lungs, and hemosiderin deposits in the kidney in both male and female mice; increased eosinophilic changes in the respiratory epithelium and increased Kupffer cell mobilization in the liver of female mice.
Additivity endpoint(s):	Hematological (blood) system, Hepatic (liver) system, Renal (kidney) system, Respiratory system, Spleen

Cancer Health Risk Limit cHRL= 0.03 µg/L

$$\frac{\text{(Additional Lifetime Cancer Risk) x (Conversion Factor)}}{[(SF \times ADAF_{<2\ yr} \times IR_{<2yr} \times 2) + (SF \times ADAF_{2-<16\ yr} \times IR_{2-<16yr} \times 14) + (SF \times ADAF_{16+\ yr} \times IR_{16+yr} \times 54)] / 70}$$

$$= \frac{\text{(1E-5) x (1000 µg/mg)}}{[(3 \times 10^{*} \times 0.155\ \text{L/kg-d}^{**} \times 2) + (3 \times 3^{*} \times 0.040\ \text{L/kg-d}^{**} \times 14) + (3 \times 1^{*} \times 0.042\ \text{L/kg-d}^{**} \times 54)] / 70}$$

= 0.033 rounded to **0.03 µg/L**

*ADAF (Age-dependent adjustment factor): MDH 2008, Section IV.E.2.
**Intake Rate: MDH 2008, Section IV.E.1. and US EPA 2019, Exposure Factors Handbook, Tables 3-1, 3-3 and 3-5.

Cancer classification:	Likely to be carcinogenic in humans EPA, 2001
Slope factor (SF):	3 $(mg/kg\text{-}day)^{-1}$ (hepatic hemangioendotheliomas or hemangiosarcomas in SD rats, Hirao, 1976)
Source of cancer slope factor (SF):	EPA (2001)
Tumor site(s):	Liver

Volatile: Yes (low)

Summary of Guidance Value History:
In 2019 MDH derived chronic noncancer and cancer guidance values for quinoline. Quinoline had not been evaluated by MDH previously. In 2020 MDH incorporated updated intake rates (US EPA 2019). Use of the updated intake rates lowered the cHBV to 0.03 from 0.04 µg/L but did not change the chronic noncancer value. In November 2023, the guidance values were adopted into Minnesota Rules, 4717.7860, as Health Risk Limits (HRLs).

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?	–	–[1]	–	–	No[2]

[1] No studies directly testing immunotoxicity have been conducted, however, one study did note endpoints associated with immune system activation in the liver and respiratory system. While these effects did not indicate immune system toxicity, little information is currently available. The lack of available information on how quinoline may impact the immune system is part of the rationale for selecting a 10-fold database uncertainty factor.

[2] One aspect of neurotoxicity has been investigated in a limited study, which reported that quinoline was not a dopaminergic neurotoxicant. Lack of more complete neurotoxicity testing also contributed to the selection of a database uncertainty factor of 10.

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