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

Adopted as Rule: November 2023

Toxicological Summary for: 1H-Benzotriazole

CAS: **95-14-7**

Synonyms: 1,2,3-Benzotriazole, Benzotriazole, 1H-Benzo[d][1,2,3]triazole, 1H-1,2,3-benzotriazole

Note: 1H-benzotriazole is the surrogate for water guidance values for 5-methyl-1H-benzotriazole and Tolyltriazole (https://www.health.state.mn.us/communities/environment/risk/docs/guidance/gw/5mebtttr.pdf)

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

Short-term Non-Cancer Health Risk Limits ($nHRL_{Short\text{-}term}$) = 20 µg/L

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

$$= \frac{\text{(0.023 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.290 L/kg-d)}^{**}}$$

= 15.8 rounded to **20 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 = 6.9/300 = 0.023 mg/kg-d (SD rats)
Source of toxicity value:	Determined by MDH in 2019
Point of Departure (POD):	30 mg/kg-d (administered dose NOAEL, JBRC, 2007)
Dose Adjustment Factor (DAF):	0.23, Body weight scaling, default (MDH 2017 and US EPA 2011)
Human Equivalent Dose (HED):	POD x DAF = 30 mg/kg-d x 0.23 = 6.9 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 due to the lack of reproductive/developmental studies of sufficient exposure duration
Critical effect(s):	Reduced offspring body weight
Co-critical effect(s):	None
Additivity endpoint(s):	Developmental

Subchronic Non-Cancer Health Risk Limits ($nHRL_{Subchronic}$) = $nHRL_{Short\text{-}term}$ = 20 µg/L

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

$$= \frac{\text{(0.017 mg/kg-d) x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.074 L/kg-d)}^{**}}$$

= 45.9 rounded to 50 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 = 5.15/300 = 0.017 mg/kg-d (SD rats)
Source of toxicity value:	Determined by MDH in 2019
Point of Departure (POD):	22.4 mg/kg-d (administered dose $BMDL_{10\%}$, JBRC, 2007)
Dose Adjustment Factor (DAF):	0.23, Body weight scaling, default (MDH 2017 and US EPA 2011)
Human Equivalent Dose (HED):	POD x DAF = 22.4 mg/kg-d x 0.23 = 5.15 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 due to the lack of adequate subchronic toxicity studies and lack of reproductive/developmental studies of sufficient exposure duration
Critical effect(s):	Proximal tubule regeneration in kidney of female rats
Co-critical effect(s):	None
Additivity endpoint(s):	Renal (kidney) system

The Subchronic nHRL must be protective of the short-term exposures that occur within the subchronic period and therefore, the Subchronic nHRL is set equal to the Short-term nHRL of 20 µg/L. Additivity endpoints: Developmental

Chronic Non-Cancer Health Risk Limits ($nHRL_{Chronic}$) = $nHRL_{Short\text{-}term}$ = 20 µg/L

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

$$= \frac{\text{(0.017 mg/kg-d)}^{***} \text{ x (0.2)}^{*} \text{ x (1000 µg/mg)}}{\text{(0.045 L/kg-d)}^{**}}$$

= 75.5 rounded to 80 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
[***] The candidate Chronic RfD is significantly higher than the Subchronic RfD (0.017 mg/kg-d). Although, both identify kidney as the sensitive effect, the chronic study does not include information in the lower part of the dose-response range. Given the significant limitations of the chronic database, MDH has selected the Subchronic RfD as the final Chronic RfD.

The Chronic nHRL must be protective of the short-term exposures that occur within the chronic period and therefore, the Chronic nHRL is set equal to the Short-term nHRL of 20 µg/L. Additivity endpoints: Developmental

Cancer Health Risk Limits (cHRL) = 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 (low)

Summary of Guidance Value History:
No previous guidance has been developed for 1H-Benzotriazole. In 2020 MDH incorporated updated intake rates (US EPA 2019). Use of the updated intake rates did not result in any changes to the guidance values. 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	Yes	Yes	No
Effects observed?	--	--	Yes[1]	Yes[2]	--

Comments on extent of testing or effects:
[1] The short-term reference dose is based on developmental toxicity in offspring (decreased body weight). A lack reproductive/developmental studies of sufficient duration form a major part of the basis for the selection of a 10-fold database uncertainty factor.

[2] Changes in reproductive organs were noted in a two-year study in males (prostate inflammation) and females (uterus/endometrium inflammation and cystic hyperplasia) at doses over 8,000 times higher than the short-term and subchronic reference doses. A lack of reproductive/developmental studies of sufficient duration form a major part of the basis for the

selection of a 10-fold database uncertainty factor.

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