



## North Carolina Groundwater Interim Maximum Allowable Concentration (IMAC)

### Tetrahydrofuran (THF)

**CASRN 109-99-9**

North Carolina Ground Water (GW) IMAC = **2000 µg/L**

#### Summary

The North Carolina GW IMAC for tetrahydrofuran is based on its reported odor threshold in accordance with selection criteria defined in 15A NCAC 02L .0202. Groundwater standards are to be the "lesser of" the criteria in 15A NCAC 02L .0202(d)(1-6) (highlighted in yellow below).

Critical health effect: odor threshold (not health-based)

#### GW IMAC based on noncancer endpoint

$$GWQS = [(RfD \times WT \times RSC) / WI] \times 1000$$

RfD = reference dose <sup>1</sup>	9.0E-01	mg/kg/day
WT = average adult human body weight <sup>2</sup>	70	kg
RSC= relative source contribution	0.2	unitless value
WI = average daily adult human water intake <sup>3</sup>	2	L/day
1000 = conversion factor	1000	µg/mg
<b>Calculated GW IMAC using noncancer endpoint</b>	<b>6300</b>	<b>µg/L</b>

#### GW IMAC based on cancer endpoint

$$GWQS = [(RL \times WT) / (q1^* \times WI)] \times 1000$$

RL = risk level	1.0E-06	
WT = average adult human body weight <sup>2</sup>	70	kg
q1* = carcinogenic potency factor (slope factor) <sup>4</sup>	NA	(mg/kg/day) <sup>-1</sup>
WI = average daily adult human water intake <sup>3</sup>	2	L/day
1000 = conversion factor	1000	µg/mg
<b>Calculated GW IMAC using cancer endpoint</b>	<b>NA</b>	<b>µg/L</b>

#### GW IMAC based on published values

<b>Taste Threshold<sup>5</sup></b>	<b>NA</b>	<b>µg/L</b>
<b>Odor Threshold<sup>6</sup></b>	<b>2000</b>	<b>µg/L</b>
<b>Maximum Contaminant Level (MCL)<sup>7</sup></b>	<b>NA</b>	<b>µg/L</b>
<b>Secondary Drinking Water Standard (SMCL)<sup>8</sup></b>	<b>NA</b>	<b>µg/L</b>

Practical Quantitation Limit (PQL)<sup>9</sup> 5 µg/L

#### References

<sup>1</sup> U.S. EPA Integrated Risk Information System (IRIS) (accessed 4/1/2019). IRIS assessment last revised 2/21/2012.

Link to IRIS document: [https://cfpub.epa.gov/ncea/iris/iris\\_documents/documents/subst/1023\\_summary.pdf](https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/1023_summary.pdf)

<sup>2</sup> Average adult body weight from 15A NCAC 02L .0202 (effective date April 1, 2013).

<sup>3</sup> Average water consumption from 15A NCAC 02L .0202 (effective date April 1, 2013).

<sup>4</sup> THF has been classified by US EPA as having "suggestive evidence of carcinogenicity" based on the database. However, an oral slope factor has not been

<sup>5</sup> NA; Contact NC DEQ Groundwater Standards Coordinator for list of taste threshold resources examined.

<sup>6</sup> U.S. EPA Integrated Risk Information System (IRIS) (accessed 4/1/2019). IRIS assessment last revised 2/21/2012. Odor threshold reported as a range (2-7.4 ppm).

The lowest reported value was selected in accordance with DWR's SOP for Reviewing Groundwater Standards.

Link to IRIS document: [https://cfpub.epa.gov/ncea/iris/iris\\_documents/documents/toxreviews/1023tr.pdf](https://cfpub.epa.gov/ncea/iris/iris_documents/documents/toxreviews/1023tr.pdf)

<sup>7</sup> NA; MCL: <https://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants#Organic> (accessed 4/1/2019)

<sup>8</sup> NA; SMCL : <https://www.epa.gov/dwstandardsregulations/secondary-drinking-water-standards-guidance-nuisance-chemicals> (accessed 4/1/2019)

<sup>9</sup> PQL provided for informational purposes only. PQL not established by North Carolina Water Resources Laboratory. PQL estimated as 5 µg/L based on reported MDL of 1 µg/L from EPA method SW-846 8260.

NA = Not available

RSC = 0.1 for nonorganics, 0.2 for organics

#### History

February 28, 2019 - IMAC for THF requested by DWM



# Groundwater Interim Maximum Allowable Concentration (IMAC) Summary Document

## *Division of Water Resources*

### **TETRAHYDROFURAN (THF) (CASRN 109-99-9)**

#### ***Health Effects Summary***

Human health effects associated with low, oral environmental exposures to THF are unknown. Potential human exposures most often result from occupational exposures related to its use as a solvent. These occupational exposures primarily occur through inhalation and dermal absorption. A number of occupational exposure studies reported health effects on the nervous system and liver and symptoms including nausea, headache, dizziness, chest pain, labored breathing, and cough.

#### ***Data used for IMAC***

U.S. EPA's Integrated Risk Information System (IRIS) established an oral reference dose (RfD) of 0.9 mg/kg-day for THF based on a two-generation reproductive study in rats (Hellwig et al., 2002; BASF, 1996). Dose-response modeling resulted in a BMDL of 928 mg/kg-day, based on the critical effect of decreased pup weight gain in F1 and F2 pups. An uncertainty factor of 1000 was applied (10 for variation in sensitivity among the human population, 10 for interspecies extrapolation, and 10 for deficiencies in the oral database). A systemic threshold concentration of 6300 µg/L (ppb) can be calculated using the oral reference dose for THF in accordance with 15A NCAC 02L .0202(d)(1).

U.S. EPA's IRIS program has classified THF as having "suggestive evidence of carcinogenicity". However, no oral slope factor for THF was derived due to the absence of cancer assays involving oral exposures and lack of physiologically based pharmacokinetic models. Therefore, a human exposure concentration associated with an incremental lifetime cancer risk estimate of  $1 \times 10^{-6}$  cannot be calculated according to the requirements of 15A NCAC 02L .0202(d)(2).

A range of odor thresholds have been reported for THF from multiple sources. U.S. EPA's IRIS Toxicological Review of THF lists an odor threshold range of 2-7.4 ppm (2000-7400 ppb) (ACGIH, 2001).

A taste threshold, federal maximum contaminant level, or secondary drinking water standard have not been established for THF.

#### ***Recommended IMAC***

Groundwater standards are to be the "lesser of" the criteria in 15A NCAC 02L .0202(d)(1-6).

**The recommended interim maximum allowable concentration for tetrahydrofuran is 2,000 ug/L (ppb) based on its reported odor threshold.**

#### ***Uses:***

Tetrahydrofuran is a synthesized organic compound. It is a colorless, volatile liquid that has an acetone-like smell. THF is used as a solvent for many substances including polyvinyl chlorides, vinylidene chloride polymers, and natural and synthetic resins, and in top coating solutions, polymer coatings, cellophane, protective coatings, adhesives, magnetic strips, and printing inks. THF is also used in the preparation of chemicals as an intermediate in chemical synthesis.



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## *Division of Water Resources*

### ***References***

ACGIH (American Conference of Governmental Industrial Hygienists). (2001) Tetrahydrofuran. In: Documentation of the threshold limit values and biological exposure indices. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

BASF. (1996) Tetrahydrofuran: two-generation reproduction toxicity study in Wistar rats, continuous administration in the drinking water, with cover letter dated 8/30/96. Study No.71R0144/93038. Submitted under TSCA Section 8D. EPA Document No. 86960000573. NTIS No. OTS558774.

Hellwig, J; Gembardt, C; Jasti, S. (2002) Tetrahydrofuran: two-generation reproduction toxicity in Wistar rats by continuous administration in the drinking water. Food Chem Toxicol 40(10):1515–1523.

U.S. EPA Drinking Water Standards and Health Advisories. 2012. Office of Water (EPA 822-S-12-001) <https://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf>.

U.S. EPA. (2012). Integrated Risk Information System (IRIS) Toxicological Review of Tetrahydrofuran. National Center for Environmental Assessment, Office of Research and Development (EPA/635/R-11/006F). [https://cfpub.epa.gov/ncea/iris/iris\\_documents/documents/toxreviews/1023tr.pdf](https://cfpub.epa.gov/ncea/iris/iris_documents/documents/toxreviews/1023tr.pdf)