TRIHALOMETHANES IN DRINKING WATER

HSE NATIONAL DRINKING WATER GROUP
Frequently Asked Questions (FAQs)

What are trihalomethanes?

- All drinking water sources have potential to contain micro-organisms such as bacteria, viruses, and protozoa, which may cause serious illness. All public drinking water supplies in Ireland are disinfected to destroy or inactivate such organisms.

- Chlorine is the most common disinfectant added to drinking water in the world, and Ireland is no exception.[1] It is an effective disinfectant. However, when it is added to water with organic matter (e.g. decaying plants and algae), by-products can form. Trihalomethanes (THMs) are the most common type of by-product.

- The THMs most commonly found in drinking water are Chloroform ($CHCl_3$), Bromodichloromethane (BDCM; $CHCl_2Br$), Dibromochloromethane (DBCM; $CHClBr_2$) and Bromoform ($CHBr_3$).

- Water with high organic content will generally form more THMs than water with low organic content. Water sources with higher organic content include:
    - Surface water (e.g. lakes, reservoirs, rivers, streams etc.)
    - Shallow or poorly-built wells or springs that may be at risk of contamination from surface water.

- Groundwater from deeper wells usually has lower organic content and is less likely to produce as much THMs.

- Filtering water before adding chlorine helps reduce the organic content and THMs.

- As THMs are volatile in drinking water, and maybe released into the air during showering and through a range of household activities; adequate indoor ventilation helps to reduce inhalation as a significant route of exposure.

[1] Irish Statute Book (**ISB**) 2023. S.I. No. 99 of 2023. **European Union (Drinking Water) Regulations 2023**. Available URL: https://www.irishstatutebook.ie/eli/2023/si/99/made/en/pdf (Accessed: 25th March 2024).

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What are the EU legal limits and the WHO guideline health values for Trihlomethanes in drinking water?

- The EU limit for THMs is 100 µg/L in drinking water.[1] This is a statutory quality standard, and is not a health-based value. It is based on an EU objective to minimise the presence of THMs in drinking water as much as possible.

- The World Health Organization (WHO) has established health-based guideline values for drinking quality for THMs.[2]

- The breakdown of the legal limits and guideline levels are shown in **Table 1** below.

Table 1: *Legal limits and guideline values for Trihalomethanes.*

	EU (Drinking Water) Regulations 2023 Parametric value (µg/l)	WHO Guideline values (µg/l)	WHO TDI (µg/kg/day)
Trihalomethanes (total)	100	* Ratio ≤ 1	
Chloroform		300	**15**
Bromoform		100	**17.9**
Dibromochloromethane		100	**21.4**
Bromodichloromethane		60	-

For authorities wishing to establish a total THM standard to account for additive toxicity, the following fractionation approach could be taken:

$$\frac{C_{bromoform}}{GV_{bromoform}} + \frac{C_{DBCM}}{GV_{DBCM}} + \frac{C_{BDCM}}{GV_{BDCM}} + \frac{C_{chloroform}}{GV_{chloroform}} \leq 1$$

where C = concentration and GV = guideline value.

Abbreviations:
EU: European Union; **WHO**: World Health Organization; **TDI:** Tolerable daily intake; **DBCM:** Dibromochloromethane; **BDCM:** Bromodichloromethane; **GV:** Guideline value
* The sum of the ratio of the concentration of each to its respective guideline value should not exceed 1.[2]

How could I be exposed to Trihalomethanes?

- Consuming water containing THMs is a potential exposure route. Other possible ways of exposure include showering, bathing and using water for recreation (e.g. swimming, hot tubs), if the water involved contains THMs. THMs can be ingested, absorbed through skin or inhaled by breathing water vapour when showering, bathing etc.

- THMs do not cause discolouration of water and do not affect the taste of water.

How can Trihalomethanes potentially affect health?

- As a precautionary measure, the WHO drinking water guidelines are set to ensure a very low level of potential risk over a typical lifetime of consumption (i.e. 70 years).[2]

[2] World Health Organization (**WHO**) 2022. **Guidelines for drinking water quality: Fourth edition incorporating the first and second addenda**. Available URL: https://www.who.int/publications/i/item/9789240045064 (Accessed: 25th March 2024).

Short-term use of drinking water that exceeds guidelines is unlikely to have an impact on human health.

- There is scientific evidence that some of the individual THM chemicals could pose both short- and long-term health effects, such as: dizziness; fatigue; headache; sleepiness; incoordination; dull chest pain; liver damage; kidney damage; testicle damage; and skin sores.

- There is insufficient scientific evidence to indicate that THMs cause cancer in people. Cancers have been detected in some studies in which animals (i.e. mice and rats) were exposed to high doses.[1] More research is needed to fully understand any health effects in humans. The WHO has highlighted that some of the THMs (i.e. chloroform, and BDCM) are classified as possibly carcinogenic to humans.[2] Therefore, lifetime exposure to THM levels above the WHO guideline value could slightly increase the risk of certain cancers such as bladder, colon, and rectal.

- It should be noted that any potential health risks from disinfection by-products, including THMs, are much less than the risks from consuming water that has not been disinfected.[2]

- More scientific research is needed to fully understand any potential health effects in humans.

Can I be tested for Trihalomethanes?

- There are specific tests that can determine if you have been exposed to THMs. These tests are not readily available in Ireland.

- However, such tests have limitations. There is no reliable way to determine the quantity of THMs an individual may have been exposed to. Neither is there any reliable way to determine whether or not exposure to THMs might cause health problems.

How can I learn more on Trihalomethanes:

Environmental Protection Agency
Health Service Executive
Uisce Éireann

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