

# Levels of one 'forever chemical' are increasing in groundwater, study finds

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Rain and water in ponds and lakes slowly seeps into the soil, moving through minute cracks to refill underground aquifers. Per- and polyfluoroalkyl substances (PFAS), often described as forever

chemicals, can tag along into groundwater that's later removed for drinking. Researchers analyzed water from over 100 wells in Denmark for one particularly persistent PFAS: trifluoroacetate.

In *Environmental Science & Technology Letters* they [report](#) steadily increasing levels of the forever chemical in recent decades.

Trifluoroacetate forms when fluorinated gases, such as refrigerants, and fluorinated pesticides partially degrade in the environment. Water passing through air and soil picks up trifluoroacetate, transporting the persistent and mobile compound into groundwater aquifers.

However, potable groundwater sources haven't been widely tested for trifluoroacetate because there isn't a regulatory limit for it beyond the European Environment Agency's (EEA) limit on total PFAS in drinking water of 0.5 parts per billion (ppb). So, Christian Albers and Jürgen Sültenfuss wanted to thoroughly assess groundwater in Denmark for this contaminant, looking for potential changes in the past 60 years.

The researchers collected samples from 113 groundwater monitoring wells around Denmark. They analyzed the samples for trifluoroacetate and, using an established tritium-helium isotope method, calculated how long ago the water entered the underground aquifers. Overall, their data showed a trend of increasing trifluoroacetate concentrations since the 1960s. Specifically, groundwater from:

- Before 1960 had unmeasurable levels.
- 1960 to 1980 contained 0.06 ppb on average.
- 1980 to 2000 contained 0.24 ppb on average.
- 2000 to the 2020s contained 0.6 ppb on average, which exceeds the EEA's total PFAS limit in drinking water.

The researchers attribute concentration differences within time periods

to changing atmospheric deposition, plant uptake and local pesticide application. For example, pesticides that might be precursors for trifluoroacetate have been applied to agricultural areas within Denmark since the late 1960s.

On the basis of those observations, the researchers say that trifluoroacetate concentrations could be used to categorize when groundwater entered aquifers, such as after 1985 or before 2000, rather than using more sophisticated and tedious dating methods that require isotopes.

Additionally, Albers says some particularly high trifluoroacetate concentrations in [groundwater](#) less than 10 years old could suggest local sources have recently become more important, such as fluorinated pesticide applications.

**More information:** A 60-Year Increase in the Ultrashort-Chain PFAS Trifluoroacetate and Its Suitability as a Tracer for Groundwater Age, *Environmental Science & Technology Letters* (2024). DOI: [10.1021/acs.estlett.4c00525](https://doi.org/10.1021/acs.estlett.4c00525).  
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