

Tetradecamethylcycloheptasiloxane— A Common Air Pollutant

Background

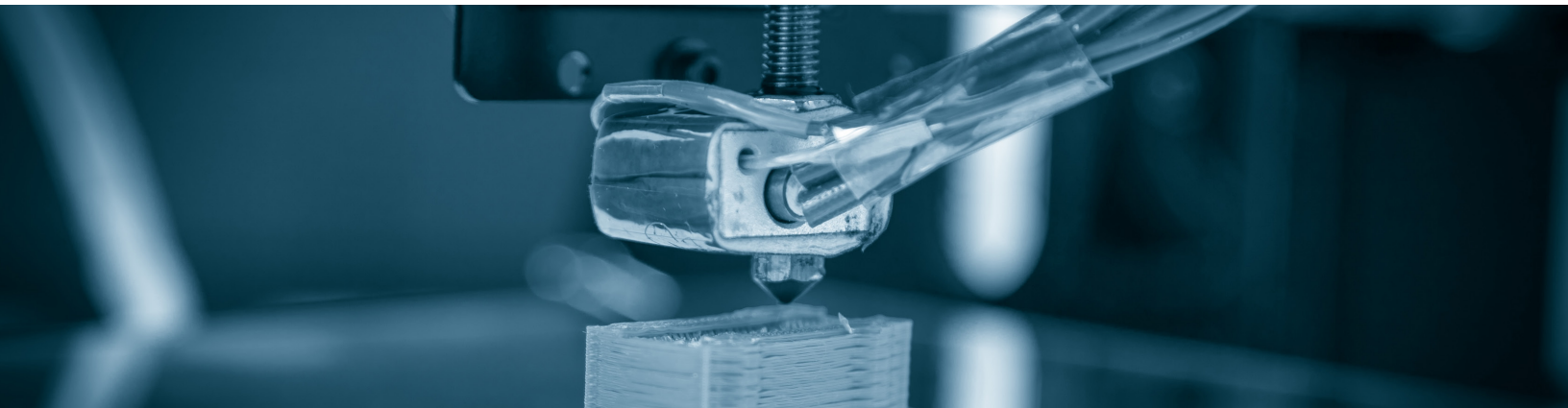
Tetradecamethylcycloheptasiloxane ($C_{14}H_{42}O_7Si_7$, CAS Number 107-50-6) is a synthetic siloxane with 7 dimethyl siloxane groups connected through shared oxygen atoms in a ring structure. It is also known as D7 (seven represents the number of silicone atoms) in the group of cyclic volatile methyl siloxane (cVMS). D7 is frequently detected in air emissions resulting from its use as a surfactant, softening agent and lubricant. Sources primarily include personal care and household products, like pacifiers, cookware, sealants, and adhesives. D7 has been detected in the emissions from 3D printers as well as other operating electronic equipment such as laser printers, copiers, and computers. A series of cyclic siloxanes are commonly found in new and occupied buildings. The three lower molecular weight cyclic volatile methyl siloxanes (cVMS)- octamethylcyclotetrasiloxane (D4), [decamethylcyclopentasiloxane](#) (D5), and dodecamethylcyclohexasiloxane (D6) have been classified as high production volume chemicals by the United States Environmental Protection Agency (U.S. EPA) and the Organization for Economic Cooperation and Development (OECD) due to their widespread use in industrial applications, cosmetics, and personal care products.

These three compounds have also been the subject of research and regulatory scrutiny as their extensive applications could release them to the environment, leading to adverse effects on humans and the ecosystem.

Health Concerns

Human exposure to D7 occurs through inhalation, dermal, and oral routes. Compared to the more extensively studied cVMS such as D4, D5 and D6, there is limited experimental data on toxicity or adverse effects of D7 exposure. Even the toxicity data available for cVMS as a group are modeled only based on two compounds in the group, D4 and D5. There is a significant data gap in the exposure assessment for individual cVMS.

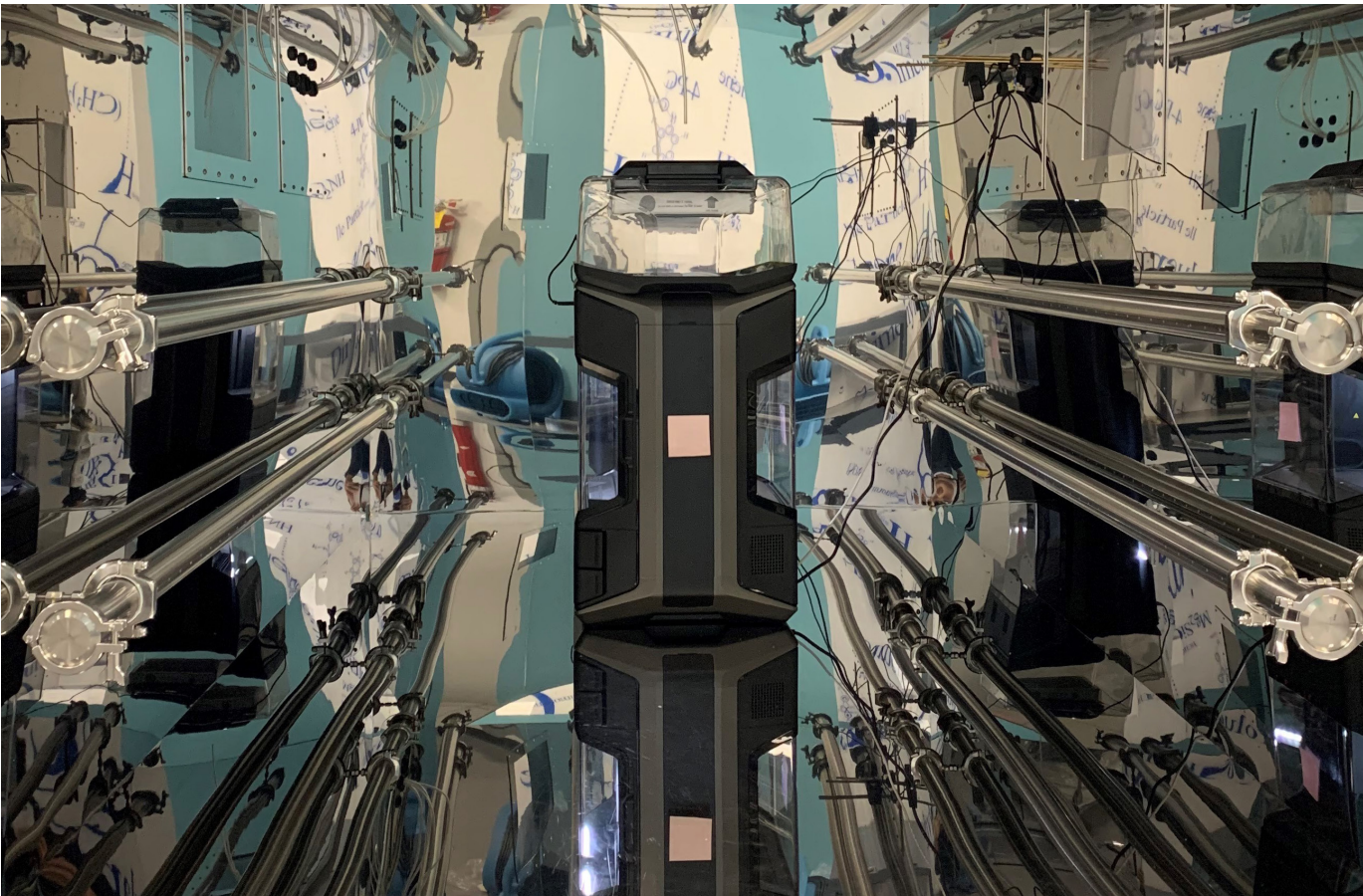
Studies have shown that inhalation exposure to cyclic volatile methyl siloxane (cVMS) causes adverse effects in laboratory animals, mostly in their liver and lungs. When exposed long term through inhalation, they pose a potential cancer hazard. In an exposure simulation study, it was found that at high temperature cVMS in personal care product may release [formaldehyde](#) which can cause eye, nose and throat irritation. Long term exposure to formaldehyde has been shown to cause cancer.



Acceptable Exposure Levels

There are no regulated standards for acceptable indoor levels in nonindustrial environments such as homes, offices, and schools. Below is a list of some U.S. and global organizations with recommended exposure limits/odor thresholds (**Table 1**).

Table 1. Tetradecamethylcyclheptasiloxane (D7) exposure and emission standard			
ORGANIZATION OR STANDARD	APPLICATION	EXPOSURE LIMIT	ADDITIONAL INFORMATION
Ausschuss zur gesundheitlichen Bewertung von Bauprodukten (AgBB) Committee for Health-related Evaluation of Building Products	General air/Indoor air	LCI for D7 is 1200 µg/m³.	AgBB sets Lowest Concentration of Interest (LCI) for VOC emissions from building products on the basis of test chamber measurements.



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