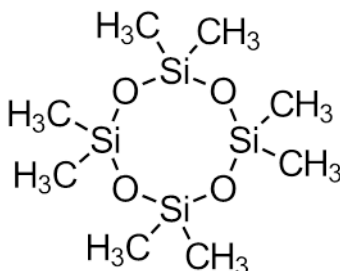


Octamethylcyclotetrasiloxane (D4)

$C_8H_{24}O_4Si_4$



Summary of Health Effects

Octamethylcyclotetrasiloxane (D4) can interfere with the body's hormones. In animals, it can affect the reproductive system.

How is D4 used?

D4 is a high production volume chemical¹ and is often used in personal care products and sunscreens.²

Toxicity: What are its health effects?

D4 is classified as a category 1 endocrine disruptor by the European Commission.^{3,4} A 2018 study commissioned by the Danish EPA identified D4 as an endocrine disruptor.⁵ The Global Harmonized System Label Requirements classified D4 as suspected to produce reproductive toxicity.⁶ D4 was added to the Toxic Substances Control Act work plan due to reproductive toxicity, moderate environmental persistence, and high bioaccumulation potential.⁷

Adverse reproductive effects including estrogenic effects have been observed in rodents.⁸⁻¹⁴ The European Chemicals Agency characterized D4 as a persistent, bioaccumulative, and toxic chemical, and designated D4 as a Substance of Very High Concern.¹⁵

Exposure: How can a person come in contact with it?

A person can come in contact with D4 from skin contact with consumer products, eating contaminated food, drinking contaminated water, or by breathing it in.¹⁶

The Danish Environmental Protection Agency detected D4 in perfume, toys, and children's cosmetics and articles.² D4 has been detected in fish, sediment, indoor dust and air, outdoor air, and drinking and surface water.¹⁶ Biomonitoring studies have also detected D4 in the blood of Norwegian and German adults.^{17,18}

References

1. Organization for Economic Development Environment Directorate (2004). *The 2004 OECD list of high production volume chemicals*. Retrieved from www.oecd.org/chemicalsafety/risk-assessment/33883530.pdf

2. Danish Ministry of the Environment, Environmental Protection Agency (2007). *Survey of chemical substances in consumer products: Report 88, 102, 117, 165, 167*. Retrieved from eng.mst.dk/chemicals/chemicals-in-products/consumers-consumer-products/danish-surveys-on-consumer-products/
3. European Commission DG Environment (2006). *Endocrine disruptor priority list.*: Retrieved from ec.europa.eu/environment/chemicals/endocrine/strategy/substances_en.htm#priority_list
4. DHI Water and Environment (2006). *Study on enhancing the Endocrine Disruptor priority list with a focus on low production volume chemicals*. Retrieved from ec.europa.eu/environment/chemicals/endocrine/strategy/substances_en.htm#priority_list
5. Hass, U., Christiansen, S., Andersen, M., Rosenberg, S., Mandrup, K., Egebjerg, S., & Nikolov, N. (2018). List of endocrine disrupting chemicals: Final report, December 12th, 2017. Danish Center on Endocrine Disruptors. Retrieved from http://cend.dk/files/DK_ED-list-final_2018.pdf
6. European Chemicals Agency (ECHA). *REACH Registration dossier—Octamethylcyclotetrasiloxane*. Retrieved November 9, 2018, from echa.europa.eu/registration-dossier/-/registered-dossier/15289/2/1
7. U.S. Environmental Protection Agency (2014). *TSCA Work plan for chemical assessments: 2014 update*. Retrieved from www.epa.gov/sites/production/files/2015-01/documents/tsca_work_plan_chemicals_2014_update-final.pdf
8. McKim, J.M., Wilga, P.C., Breslin, W.J., Plotzke, K.P., Gallavan, R.H., Meeks, R.G. (2001). Potential estrogenic and androgenic activity of the cyclic siloxane octamethylcyclotetrasiloxane (D4) and the linear siloxane hexamethyldisiloxane (HDMS) in immature rats using the uterotrophic assay. *Toxicological Sciences*, 63, 37-46. doi.org/10.1093/toxsci/63.1.37
9. Quinn, A.L., Regan, J.M., Tobin, J.M., Marinik, B.J., McMAhon, J.M., McNett, D.A., Ssushynski, C.M., Plotzke, K.P. (2007a). In vitro and in vivo evaluation of the estrogenic, androgenic, and progestogenic potential of two cyclic siloxanes. *Toxicological Sciences*, 96(1), 145-53. DOI: 10.1093/toxsci/kfl185
10. Quinn, A.L., Dalu, A., Meeker, L.S. (2007b). Effects of octamethylcyclotetrasiloxane (D4) on the luteinizing hormone (LH) surge and levels of various reproductive hormones in female Sprague-Dawley rats. *Reproductive Toxicology*, 23(4), 532–540. DOI: 10.1016/j.reprotox.2007.02.005
11. Siddiqui, W.H., Stump, D.G., Reynolds, V.L., Plotzke, K.P., Holson, J.F., Meeks, R.G. (2007). A two-generation reproductive toxicity study of octamethylcyclotetrasiloxane (D4) in rats exposed by whole-body vapor inhalation. *Reproductive Toxicology*, 23, 202–15. DOI: 10.1016/j.reprotox.2006.11.011
12. Meeks, R.G., Stump, D.G., Siddiqui, W.H., Holson, J.F., Plotzke, K.P., Reynolds, V.L. (2007). An inhalation reproductive study of octamethylcyclotetrasiloxane (D4) in female rats using multiple and single day exposure regimens. *Reproductive Toxicology*, 23, 192–201. DOI: 10.1016/j.reprotox.2006.12.005
13. He, B., Rhodes-Brower, S., Miller, M.R., Munson, A.E., Germolec, D.R., Walker, V.R., Korach, K.S., Meade, B.J. (2003). Octamethylcyclotetrasiloxane exhibits estrogenic activity in mice via ER alpha. *Toxicology and Applied Pharmacology*, 192(3), 254-61. Retrieved from www.ncbi.nlm.nih.gov/pubmed/14575643
14. Jean, P.A., Slotter, E.D, Plotzke, K.P. (2017). Effects of chronic exposure to octamethylcyclotetrasiloxane and decamethylcyclopentasiloxane in the aging female Fischer 344 rat. *Toxicology Letters*, 20, 279. DOI: 10.1016/j.toxlet.2017.08.016
15. European Chemicals Agency (ECHA) (2018). Member State Committee support document for identification of octamethylcyclotetrasiloxane(d4) as a Substance of Very High Concern because of its PBT and vPVB properties. Retrieved from <https://echa.europa.eu/documents/10162/115f70a9-a387-1525-d49f-b715e84996e4>
16. U.S. National Library of Medicine (2009). *Hazardous Substances Data Bank for octamethylcyclotetrasiloxane (CASRN: 556-67-2)*. Retrieved from toxnet.nlm.nih.gov/newtoxnet/hsdb.htm
17. Fromme, H., Cequier, E., Kim, J.T., Hanssen, L., Hilger, B., Thomsen, C., Chang, Y.S., Volkel, W. (2015). Persistent and emerging pollutants in the blood of German adults: Occurrence of dechloranes, polychlorinated naphthalenes, and siloxanes. *Environment International*, 85, 292-298. DOI: 10.1016/j.envint.2015.09.002

18. Hanssen, L., Warner, N., Braathen, T., Odland, J.O., Lund, E., Nieboer, E., Sandanger, T.M. (2013). Plasma concentrations of cyclic volatile methylsiloxanes (cVMS) in pregnant and postmenopausal Norwegian women and self-reported use of personal care products. *Environment International*, 51, 82-87. DOI: 10.1016/j.envint.2012.10.008