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Administrator Andrew Wheeler
U.S. Environmental Protection Agency
1200 Pennsylvania Ave SW
Washington, DC 20460

Attention: Docket # EPA-HQ-OPPT-2019-0499

Gaps in Clean Air Act leave the Amended Toxic Substances Control Act (TSCA) responsible for Ozone Depletion Risk in the Assessment of Carbon Tetrachloride and Other Chlorinated and Brominated Chemicals Under Evaluation

The Environmental Investigation Agency ("EIA") submits these comments to the U.S. Environmental Protection Agency ("EPA") regarding the draft risk evaluation for carbon tetrachloride (also known as CTC or CCl_4). These comments are equally applicable to other chlorinated and brominated chemicals undergoing risk evaluations under the amended Toxic Substances Control Act ("TSCA"). EIA is an independent campaigning organization based in Washington D.C., working worldwide to protect the global climate, forests and threatened species with intelligence, for the benefit of people and wildlife. We have undertaken groundbreaking investigations into the illegal trade in ozone depleting substances ("ODS") since the mid-1990s, including uncovering widespread illegal use of CFC-11 in China in 2018[1], and have been closely involved in the international ozone and climate negotiations for more than two decades.

These comments are being submitted to assist the TSCA Scientific Advisory Committee on Chemicals (SACC) in its peer review of the draft risk evaluation for carbon tetrachloride. EIA reserves the right to provide additional comments on the draft risk evaluation on or before the comment period deadline of March 27, 2020. EIA requests that these comments be immediately provided to the SACC for its review and consideration.

EIA strongly urges EPA to examine CTC's ongoing *ozone depletion risks* to human health and the environment under TSCA. Emissions of CTC and other chemicals could significantly delay recovery of the ozone layer. NASA scientists first sounded the alarm in 2014 that atmospheric amounts of CTC were not declining as quickly as expected.[2] Global ongoing emissions of CTC are estimated to be 35Gg per year despite its phase out under the Montreal Protocol as an ODS for emissive uses since 2010.[3] If ongoing substantial CTC emissions continue into the future, it will lead to an extra 5% increase in atmospheric chlorine and bromine abundance between 2050–2100 and a corresponding ~3% decrease in Antarctic total column ozone.[4]

Delayed recovery of the ozone layer contributes to higher levels of ultraviolet radiation and poses risks to the environment and human health of the general population. Increased exposure to ultraviolet radiation, and specifically ultraviolet B (UVB) radiation, increases the incidence of ocular pterygium, cataracts, and all three types

[1] See EIA, Preventing Illegal Trade, https://eia-global.org/initiatives/preventing-illegal-trade; See also: NYTimes (June 2018), In a High-Stakes Environmental Whodunit, Many Clues Point to China, https://www.nytimes.com/2018/06/24/world/asia/china-ozone-cfc.html
[2] NASA Press Release: Ozone-Depleting Compound Persists, August 20, 2014: https://www.nasa.gov/press/2014/august/ozone-depleting-compound-persists-nasa-research-shows/#.U_V0l6giQpZ
[3] Sherry, D., McCulloch, A., Liang, Q., Reimann, S., & Newman, P. A. (2018). Current sources of carbon tetrachloride (CCl4) in our atmosphere. Environmental Research Letters, 13(2), https://iopscience.iop.org/article/10.1088/1748-9326/aa9c87/meta
[4] Quing Liang, https://physicsworld.com/a/whats-going-on-with-carbon-tetrachloride/

of skin cancer.[5] Studies have found that for every 1% decrease in ozone, cataracts is expected to rise 0.5%, and for every 1% increase in UVB radiation, there is a corresponding 2% increase in skin cancer incidence.[6] The Montreal Protocol has been found to have successfully prevented a 20% increase in ultraviolet radiation.[7] However, increasing emissions of ozone depleting substances not sufficiently controlled under the Montreal Protocol could significantly delay full recovery of the stratospheric ozone layer to pre-1960 levels.

In the U.S. context specifically, recent research points to emissions of CTC being orders of magnitude higher than those reported to EPA. We are concerned about the potential connection between these unaccounted for emission observations and under-reported emissions from:

1. by-production in chloromethane ("CM") and perchloroethylene ("PCE") plants;
2. increasing use for feedstock in manufacturing of various fluorochemicals;
3. chlor-alkali facilities

In particular, we are concerned by the exemptions afforded to CTC feedstock and processing agents under the Clean Air Act ("CAA") despite the known emissions from these sources, and we urge the EPA to evaluate and subsequently further regulate CTC production and intermediate uses under TSCA to avoid unreasonable risk to human health and the environment. EPA must consider all available scientific information regarding observed global and regional emission trends and concentrations of CTC when considering these risks, and not rely solely on industry reported data.

CTC and thirteen other chlorinated and brominated substances, either undergoing risk evaluation or being prioritized as chemicals for re-evaluation under TSCA (*see Appendix 1*), have potential to contribute to ozone depletion and delay full recovery of the stratospheric ozone layer. Our comments provide information and data to show that CTC is of growing concern to the scientific community in terms of its continued emissions and contribution to ozone depletion. In addition, Title VI CAA regulations intended to limit emissions of ozone depleting substances exempt feedstock and process agents, and thus do not sufficiently monitor and assess the largest use of this ODS. It is thus, a critical responsibility of the EPA TSCA process to assess risks from the production, use, and emission of CTC as feedstock and chemical intermediary.

The following reasons, outlined in further detail in our comments, make it imperative that EPA assess risks of ozone depletion for CTC and other chlorinated and brominated substances under TSCA:

- Scientific observations have shown regional U.S. CTC emissions to be several orders of magnitude greater than releases reported to EPA's Toxics Release Inventory.
- The Clean Air Act does not offer sufficient protection as it exempts production for feedstock and other intermediate uses of ozone depleting substances, risks of which are therefore not being fully assessed.
- There is a remaining 10-15 Gigagram uncertainty gap in estimations between higher top-down emissions derived from atmospheric observations versus reported bottom-up global CTC emissions from known sources.
- Sources of CTC emissions include chlorine production in chlor-alkali plants, chloromethane and perchloroethylene plants, and increasing use as feedstock for various fluorinated chemicals.
- Feedstock and other intermediate uses of CTC and many other chlorinated substances are growing and may be contributing to these concerning emission trends.

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[5] Norval, M., et al. "The effects on human health from stratospheric ozone depletion and its interactions with climate change." *Photochemical & Photobiological Sciences* 6.3 (2007): 232-251.; de Gruijl, Frank, and Jan Leun. "Environment and health: 3. Ozone depletion and ultraviolet radiation." *Cmaj* 163.7 (2000)

[6] de Gruijl, Frank, and Jan Leun. "Environment and health: 3. Ozone depletion and ultraviolet radiation." *Cmaj* 163.7 (2000): 851-855.; Scotto, Joseph, Thomas R. Fears, and Joseph Francis Fraumeni. "Incidence of nonmelanoma skin cancer in the United States." (1983). http://www.ciesin.columbia.edu/docs/001-526/001-526.html

[7] McKenzie et al. "Success of Montreal Protocol Demonstrated by Comparing High-Quality UV Measurements with "World Avoided" Calculations from Two Chemistry-Climate Models." (2019). https://www.nature.com/articles/s41598-019-48625-z

- Unregulated feedstock and intermediate uses of CTC are expected to increase by 50% or more in the near future with increasing production of next generation refrigerants and foam blowing agents.

CTC Emissions and Continued Production and Use for Feedstock

CTC has an ozone depletion potential of 0.87 and a global warming potential of 2110, making it both a potent ozone depleting substance and a greenhouse gas.[8] CTC, is a controlled Class I ODS under the Montreal Protocol and its associated implementation under Title VI of the CAA. However, its production is allowed under the Montreal Protocol and CAA as long as it is subsequently transformed into another substance such as when used as a feedstock or processing agent in production of another chemical.[9] Feedstock and process agent uses are considered 'nondispersive' by the Montreal Protocol and CAA. However, emissions of CTC have not declined as rapidly as expected despite being banned for all emissive uses, indicating that CTC by-production and use as feedstocks and processing agents result in significant releases.[10]

Despite efforts to close a gap between larger top-down estimates of emissions derived from scientific observations and bottom-up estimates derived from reported and calculated industrial emission pathways, there may still be **10-15Gg in unexplained global CTC emissions** that are linked to underestimated emissions from feedstock uses, fugitive emissions from by-production, or other unknown or unreported sources.[11]

CTC is produced as a co-product of PCE production or as a co-product of CM production.[12] PCE is a popular solvent used in numerous applications. Independent of plant capacity, the fugitive emission rate of CTC from a PCE plant is 67 kg per day.[13] In addition, for every megagram of PCE produced .07 Kg CTC is released when control measures are applied, and up to .25 Kg CTC is released when control measures are not applied.[14] CM production encompasses a number of chemical processes including mono-, di-, tri- chloromethanes. In CM plants, CTC is produced at a minimum rate of 4-8% of the total CM yield depending on the equipment's age.[15] Furthermore, CTC contaminates the heavy tars of the CM process and can be distilled and refined from the tars for commercial use.[16] In total the combined emissions of CTC from PCE and CM plants, or unreported non-feedstock uses is 13Gg – representing the largest source of CTC emissions.[17]

CTC remains widely used as a feedstock to manufacture hydrofluorocarbons ("HFCs") and its production and use is expected to expand further to produce their replacements, unsaturated HFCs or hydrofluoroolefines ("HFOs"). CTC production for these so-called 'nondispersive' applications globally totaled ~200 Gg in 2012-2014 based on which bottom up emissions contributions of 2Gg per year from feedstock use have been derived.[18] From the above estimates alone, it is fair to say that ODS feedstock use being 'nondispersive' is a misnomer, as emissions have been derived from feedstock use.

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[8] Scientific Assessment Panel: 20 Questions about the Ozone Layer: 2018 Update, available at: https://ozone.unep.org/science/assessment/sap

[9] 40 CFR § 82.3, Definition of "Production"

[10] Liang, Newman, Reiman, SPARC Report on the Mystery of Carbon Tetrachloride (2016). See also Scientific Assessment Panel 2018 Assessment Report (2018) at ES.34

[11] Id at xii.

[12] Sherry, D., McCulloch, A., Liang, Q., Reimann, S., & Newman, P. A. (2018). Current sources of carbon tetrachloride (CCl4) in our atmosphere. *Environmental Research Letters*, *13*(2), 024004

[13] See p 69-71.https://www3.epa.gov/ttn/chief/le/carbtet.pdf

[14] Id. Note that these numbers may fluctuate by facility.

[15] Sherry, D., McCulloch, A., Liang, Q., Reimann, S., & Newman, P. A. (2018). Current sources of carbon tetrachloride (CCl4) in our atmosphere. *Environmental Research Letters*, *13*(2), 024004

[16] Id.

[17] Id.

[18] Liang, Newman, Reiman, *SPARC Report on the Mystery of Carbon Tetrachloride* (2016).

Alarmingly, **feedstock use of CTC is expected to rise by at least 50% in coming years** as CTC is used as a chemical intermediary in the production of HFOs.[19] HFOs are inorganic refrigerants, often blended with HFCs to form HFC-HFO blend refrigerants with medium global warming potentials (GWP) ranging from 600 – 1,200 GWP. In the coming years, popular HFOs produced with CTC, like HFO-1234yf, will likely be used to replace widely-used HFCs, like R134a – an extremely common refrigerant found in domestic and commercial units and popular HFC blends, as industry introduces these next generation chemicals to phase-out HFCs. In fact, US production and import of CTC has already increased 10% from 129.1 million lbs. in 2012 to 142.6 million lbs. in 2015 according the Chemical Data Reporting database.[20]

Chlor-alkali plants are also sources of CTC production and consumption. Chlor-alkali plants manufacture chlorine – a widely used chemical that accounts for over 60% of all chemical synthesis.[21] Emissions of CTC are linked to chlor-alkali facilities because hydrocarbons chlorinate relatively easily resulting in the production of CTC in many chlorination procedures.[22] CTC is also used as a process agent to eliminate NCl_3, nitrogen trichloride, and increase chlorine recovery from the exhaust, improving the overall safety, quality, and yield of the final product.[23] The production and use of CTC, and thus, potential emissions of CTC in chlor-alkali facilities constitutes up to ~10Gg of emissions each year.[24] Researchers even found that the distribution of U.S. CTC emissions was more heavily determined by the location of industrial facilities like, chlor-alkali plants, than any other use.[25]

Given there is no well recognized alternative to CTC in the chlor-alkali production processes currently, there is no foreseeable end to the use of CTC as a feedstock or chemical intermediary.[26] Estimations currently identify 13 Gg of CTC released from PCE/CM production, 2 Gg from feedstock use, and 10 Gg from chlor-alkali use, totaling a global CTC emissions estimate of 20 Gg yr^{-1} (+/-5) from bottom-up sources. This is significantly less than the 35 Gg yr^{-1} (+/-16) identified from observation-based estimates.[27] This means there is still an undetermined source of CTC emissions, averaging 15 Gg yr^{-1}, and this emissions gap in top-down versus bottom-up emissions continues to persist and is still unknown.[28]

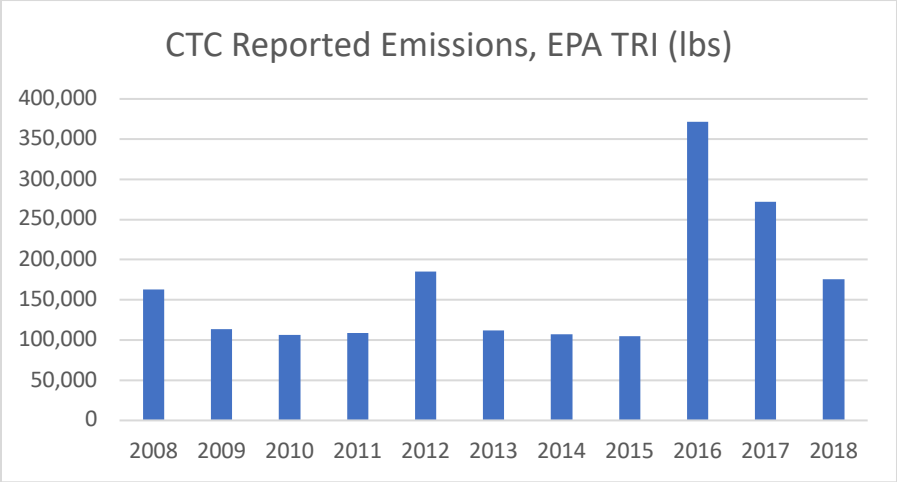
Under-reported CTC Emissions in the United States

Recent scientific findings suggest CTC emissions in the United States might have been grossly under-reported to the EPA's TRI database. A 2016 study estimated annual average US emission of 4.0 (2.0–6.5) Gg during 2008–2012, which is several **orders of magnitude larger than the levels reported to TRI during the same period,**

[19] Id.
[20] EPA CTC Draft Risk Assessment – section 1.2 & table 1-2, p.26.
[21] https://ozone.unep.org/sites/default/files/2019-05/PATF1997.pdf
[22] Sherry, D., McCulloch, A., Liang, Q., Reimann, S., & Newman, P. A. (2018). Current sources of carbon tetrachloride (CCl4) in our atmosphere. *Environmental Research Letters*, *13*(2), 024004. Note that unreported and inadvertent emissions cannot be separated from legacy emissions.
[23] https://ozone.unep.org/sites/default/files/2019-05/PATF1997.pdf
[24] Sherry, D., McCulloch, A., Liang, Q., Reimann, S., & Newman, P. A. (2018). Current sources of carbon tetrachloride (CCl4) in our atmosphere. *Environmental Research Letters*, *13*(2), 024004. Note that unreported and inadvertent emissions cannot be separated from legacy emissions.
[25] Hu, L., Montzka, S. A., Miller, B. R., Andrews, A. E., Miller, J. B., Lehman, S. J., ... & Atlas, E. L. (2016). Continued emissions of carbon tetrachloride from the United States nearly two decades after its phaseout for dispersive uses. *Proceedings of the National Academy of Sciences*, *113*(11), 2880-2885.
[26] https://ozone.unep.org/sites/default/files/2019-05/PATF1997.pdf
[27] Sherry, D., McCulloch, A., Liang, Q., Reimann, S., & Newman, P. A. (2018). Current sources of carbon tetrachloride (CCl4) in our atmosphere. *Environmental Research Letters*, *13*(2), 024004. Note that unreported and inadvertent emissions cannot be separated from legacy emissions.
[28] Id.

which were a mean of 0.06 Gg y^{-1}.[29] In 2016 and 2017, a 200% increase in CTC emissions above 2015 levels was reported, of up to 372,000 pounds which returned to 176,000 pounds in 2018.[30] Per TRI, the sudden spike in emissions reported in 2016-17 came from a facility owned by Dover Chemical Corporation a subsidiary of ICC Industries Inc, in Dover, Ohio, a producer of chlorinated alkanes, flame retardants, and other chemical products. This is the same facility where a large accidental spill of 'chlorinated wax material' containing CTC byproduct and chloroform occurred from a reactor in 2014, leading to concerns about EPA's voluntary reporting program.[31] Reported releases have otherwise remained mostly stable over the last decade (see Figure 1), but a tripling of reported releases from a single facility combined with atmospheric evidence of higher levels calls into question the reliability and accuracy of reported releases for EPA's risk evaluation.

Figure 1: Reported emissions of CTC in EPA Toxic Release Inventory (2008-2018)



(Graph prepared by EIA based on emissions of CTC reported to EPA Toxic Release Inventory for the years 2008 to 2018)

The EPA must consider this glaring inconsistency between reported emissions and the scientifically observed regional emissions, when evaluating sources and risks of CTC emissions in the revised TSCA risk revaluation. In the case of CTC where emissive and consumer uses have been prohibited, CTC's co-production in CM and PCE plants for feedstock and other intermediate uses in chlor-alkali plants and fluorinated refrigerant production are the only known potential sources that could significantly contribute to the higher levels of scientifically observed regional emissions. EPA's scoping document for the risk evaluation of CTC acknowledges that feedstock use is the main use for CTC. EPA should further investigate feedstock and other sources of CTC emissions from chlor-alkali plants and CM/PCE co-production to determine to what extent feedstock use explains the gap in reported versus observed emissions. EPA should also approach risk assessment of other feedstock chemicals, including methylene chloride and other chlorinated and brominated substances, with similar caution and concerns. EIA concerns regarding increase in use and emissions from chemical feedstocks are echoed by other environmental organizations.[32]

[29] Hu, L., Montzka, S. A., Miller, B. R., Andrews, A. E., Miller, J. B., Lehman, S. J., ... & Atlas, E. L. (2016). Continued emissions of carbon tetrachloride from the United States nearly two decades after its phaseout for dispersive uses. *Proceedings of the National Academy of Sciences*, *113*(11), 2880-2885.

[30] EPA, 2018 TRI Reporting: Chemical – Carbon Tetrachloride (Accessed Dec 12, 2019)

[31] https://www.cantonrep.com/article/20140809/NEWS/140809278

[32] Comments submitted on behalf of Safer Chemicals, Healthy Families, Earthjustice, Natural Resources Defense Council, Environment Health Strategy Center on the initial 10 chemicals selected for risk evaluations. See https://www.regulations.gov/document?D=EPA-HQ-OPPT-2016-0742-0073

Illegal Trade and Use of CTC

While the production of CTC continues, the illegal trade and use of CTC is expected to persist. Recent use of CTC as a feedstock has been linked to unexpected emissions of a banned ODS, CFC-11, and its widespread illegal production and use in China.[33] Scientific observations over the same time period, suggest this is also associated with observed concentrations of CTC emissions in the same region of China where the increased emissions of CFC-11 were observed.[34] This strongly suggests a linkage between increased feedstock use and increased emissions, in this case, due to illegal ODS production.

Similarly, the global illegal trade in CTC has continued late into the past decade despite the substance's illegality beginning in 1996.[35] In eastern Europe, Georgia and Armenia have seized illegal CTC entering the EU from Russia. While these incidences were contained cylinders of CTC and in theory nondispersive, illegal dispersive uses of CTC production have also been recorded. In Russia, for instance, CTC contaminated a major oil pipeline, polluting 5 million tons of crude oil in 2019.[36] CTC illegally entered the largest Russian oil pipeline and was used as filler to bulk up various oil products. Consequently, the laced oil was traded, sold, and released without precaution or control throughout Russia and eastern Europe.

Feedstock production of CTC through the CM production process produces usable heavy tars. Heavy tars are thick, sludge-like matter and a common waste product of the production process.[37] However these tars which contain CTC have market value as bitumen thinner and/or sleeper/telegraph pole protection.[38] Due to the economic use and application of tars, it is possible that CTC tars can be illegally traded and sold, as currently there is limited information on how CTC tars are disposed.

Regulatory Gaps in Title VI Clean Air Act Limit Oversight of CTC Feedstock Use

EPA's draft risk evaluation suggests that regulation of CTC under title VI of the CAA or other regulations, is adequate to assess and manage risks posed by CTC to the general population, but this assumption inflates the regulatory purview of the CAA and overlooks regulatory gaps.[39] Significant emissions of CTC outlined in the previous section have continued despite CAA regulations.

The EPA first regulated ODS under TSCA in 1978 due to concerns about ozone depletion, prohibiting production and importation of CFCs for non-essential propellant uses.[40] Subsequent to the ratification of the Montreal Protocol, CAA regulations under Title VI have been cited as reasoning for TSCA's assessment and control of ozone depletion risks being obsolete.[41] **However, Title VI regulations only phased-out production of Class I and Class II ozone depleting substances for emissive uses, not including production for feedstock and other intermediate uses.**[42] New production and consumption of CTC for dispersive uses was phased out by 2000.[43] CTC continues to be legally produced and used under the CAA for 'non-dispersive' uses as feedstocks, despite evidence that chemical manufacturing and feedstock use is dispersive.

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[33] EIA, Blowing It: Illegal Production and Use of CFC-11 in China's Foam Blowing Industry; EIA, Tip of the Iceberg
[34] Lunt et al, Continued emissions of ozone depleting substance carbon tetrachloride from eastern Asia. (2018) Geophysical Research Letters, 45.
[35] https://ozone.unep.org/countries/additional-reported-information/illegal-trade
[36] Reuters (2019). Exclusive: Illegally traded chemical halted Russian oil pipeline, test show
[37] Sherry, D., McCulloch, A., Liang, Q., Reimann, S., & Newman, P. A. (2018). Current sources of carbon tetrachloride (CCl4) in our atmosphere. *Environmental Research Letters*, *13*(2), 024004
[38] Id.
[39] Draft Carbon Tetrachloride Risk Evaluation at p43 & p94.
[40] Fully Halogenated Chlorofluroalkanes, 43 Fed. Reg. 11,318, 11,318 (Mar. 17, 1978)
[41] http://www.complywithtsca.com/tscaonline/pdfs/vol3/chapterC/ChCdoc1.pdf
[42] See EPA, https://www.epa.gov/ods-phaseout/accelerated-phaseout-class-i-ozone-depleting-substances
[43] https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapVI-sec7671c.htm

Conclusion

EPA's draft risk evaluation for CTC fails to assess risks posed by ozone depletion from this potent ODS, presenting unreasonable risk to our ozone layer, climate and human health. EPA must ensure that emissions of CTC and other chlorinated and brominated substances prioritized for risk evaluation (see Appendix I), do not contribute to further ozone depletion or delay full recovery of the ozone layer. TSCA has been previously utilized to address risks from ozone depletion and should at minimum, assess new concerns that are unaddressed by the limited regulatory scope of CAA Title VI.

Inconsistencies between emissions derived from scientifically observed concentrations in the atmosphere and reported releases of CTC suggests that the claims by chemical manufacturing industry that current by-production and feedstock uses are highly controlled processes without significant emissions is not true. Particularly in the case of CTC where emissive and consumer uses have been prohibited, production for feedstock and other intermediate uses or improper disposal are the only known potential sources that could significantly contribute to the higher levels of scientifically observed regional emissions. The recent connection of lack of controls on CTC feedstock contributing to illegal production and use of CFC-11, even if outside United States, is further cause for alarm and caution. It is imperative that risks posed by production and feedstock uses of CTC and other substances for fluorochemical production be assessed and limited where necessary to prevent continued trends of increasing emissions of this ozone depleting substance.

Respectfully Submitted,

Kathrene Garcia, kgarcia@eia-global.org
Christina Starr, cstarr@eia-global.org
Avipsa Mahapatra, amahapatra@eia-global.org

Environmental Investigation Agency
www.eia-global.org

Appendix I: Chlorinated and Brominated Substances Prioritized for Risk Evaluation under Amended TSCA Covered by EIA Comments

	EPA TRI 2018 Releases to Air (lb)[44]	**Regulated under CAA Section 612 (SNAP Program)**[45]	**Known Feedstock Uses**
Carbon Tetrachloride	176,049	No	Feedstock for perchloroethylene, HFOs, HFCs, HCFCs, and CFCs[46]
Methylene Chloride	2,957,712	Yes, acceptable for solvents, integral skin foams, polyolefins, adhesives, coating, inks; Unacceptable in flexible foams	Feedstock for HFC-32[47] and HFOs[48]

[44] Search EPA's TRI Database here.
[45] See SNAP Substitutes by Sector: https://www.epa.gov/snap/snap-substitutes-sector
[46] See p24 & p26: https://ec.europa.eu/clima/sites/clima/files/ozone/docs/feedstock_en.pdf
[47] See p29: https://www.epa.gov/sites/production/files/2017-06/documents/mecl_scope_06-22-17.pdf
[48] Comment submitted by Halogenated Solvents Industry Alliance (2017), Methylene Chloride; TSCA Review and Risk Evaluation, DocID EPA-HQ-OPPT-2016-0742-0019, available at: https://www.regulations.gov/document?D=EPA-HQ-OPPT-2016-0742-0019

p-dichlorobenzene	25,906	No	None known to EIA.
1,2-Dichloroethane	446,480	No	Feedstock for CTC, trichloroethylene, Methyl Chloroform[49]
Trans-1,2-Dichloroethylene	3,786[50]	Yes, acceptable for aerosol solvents, adhesives, coating, inks	None known to EIA.
o-Dichlorobenzene	28,046	No	None known to EIA.
1,1,2-Trichloroethane	46,291	No	Feedstock for 1,1-dichloroethane[51]
1,2-Dichloropropoane	16,725	No	Feedstock for perchloroethylene, tetrachloroethylene, CTC[52]
1,1-Dichloroethane	9,146	No	Feedstock for Methyl Chloroform[53]
Tris(2-chloroethyl) phosphate (TCEP)	N/A	No	None known to EIA.
Ethylene Dibromide	N/A	No	None known to EIA.
Perchloroethylene	910,855	Yes, acceptable for adhesives, coating, inks	Feedstock for HFC-134a, HCFC, & CFCs[54]
Trichloroethylene	1,920,729	Yes, acceptable for adhesives, coating, inks	Feedstock for HFC-134a[55]
1-Bromopropane	776,294	No	None known to EIA.

[49] Id, See p41; See p38: https://archive.epa.gov/epawaste/hazard/web/pdf/final_lb.pdf
[50] Self-calculated 40% of reported TRI emissions of 1,2-dichloroethylene. See Earthjustice's 156-60-6 Trans-1,2-Dichloroethylene: Technical Report on the Conditions and Use p1.
[51] See p1.: https://www.dec.ny.gov/docs/air_pdf/albsouthendapph.pdf
[52] Id, See p4.
[53] https://pubchem.ncbi.nlm.nih.gov/compound/1%2C1-dichloroethane
[54] See p107: https://www.epa.gov/sites/production/files/2018-06/documents/perc_problem_formulation_5-31-2018v3.pdf
[55] See p10: https://www.epa.gov/sites/production/files/2018-06/documents/tce_problem_formulation_05-31-31.pdf