United States
Environmental Protection Agency

Office of Chemical Safety and
Pollution Prevention

Final Risk Evaluation for Perchloroethylene

Systematic Review Supplemental File:

Data Extraction Tables of Environmental Fate and Transport Studies

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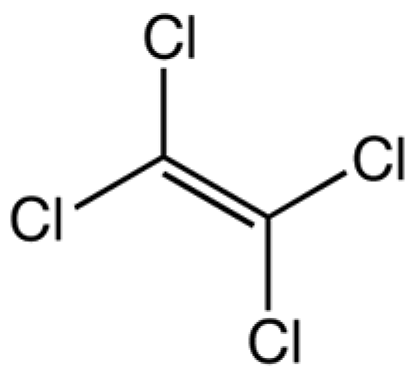

December 2020

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Table 1. Biodegradation Study Summary for Perchloroethylene

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Water								
Aerobic serum bottle test	Aerobic bottle test initial mass = 37 µg	Digested sludge: Preconditioned with methane or phenol bacteria, municipal digester sludge from the batch reactor cultures	aerobic	20 days	Biodegradation parameter: percent removal (based on active bottles and expected mass): Methane culture: 0%/20d (reported as -5%); phenol culture: -15%/20d	The reviewer agreed with this study's overall quality level.	Long et al. (1993)	High
Pure culture aerobic biodegradation	5 mg/L	other: Pure culture: T. versicolor (ATCC#45230); maintained by subculturing on 2% malt extract agar slants (pH 4.5) at room temperature. Subcultures were routinely made every 30 days.	aerobic	9 days	Biodegradation parameter: rate constant: 0.20 to 0.28 nmol h^{-1} mg^{-1} dry weight of biomass/3day	The reviewer agreed with this study's overall quality level.	Marco-Urrea et al. (2006)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Reductive dechlorination in semi-continuous digester using a mixed culture inoculum	50 µmol/L	anaerobic microorganisms: Mixed culture isolated from sludge of urban wastewater treatment plant (Bourg-en-Bresse France); methanogenic, sulfate-reducing, acetogenic bacteria	anaerobic	37 days	Biodegradation parameter: percent dechlorination: 100%/37 days Biodegradation parameter: dechlorination rate: 5.2 nmol/mg protein/day Biodegradation parameter: removal rate: 3.3 µM day^{-1}, calc. during first 9 days; conc. of trichloroethylene increased at the same rate during this time	The reviewer agreed with this study's overall quality level.	Cabirol et al. (1996)	High
Non-guideline; closed system, incubated in the dark at 35°C, inverted to minimize gas leakage	≤200 µg/L	activated sludge, adapted; To the medium was added 10ml/L of a methanogenic mixed culture, grown in a laboratory-scale digester fed waste-activated sludge, xylan and cellulose.	anaerobic	57 days	Biodegradation parameter: concentration (initial concentration: 200 ug/L): 160 µg/L after 19d; <LOD/57 days (<0.1µg/L);	The reviewer agreed with this study's overall quality level.	Bouwer and Mccarty (1983)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					Biodegradation parameter: percent removal: 100%/8w			
Anaerobic serum bottle test	80 µg/L	digested sludge; Municipal anaerobic digester sludge from batch reactor cultures	anaerobic	60 days	Biodegradation parameter: percent removal: 100%/60d	The reviewer agreed with this study's overall quality level.	Long et al. (1993)	High
Removal of chlorinated organic compounds by fixed-film bacteria in a continuous-flow system	10 µg/L	other: Biofilm resulting from primary sewage seed	aerobic	2 years	Biodegradation parameter: test system influent/effluent comparison: -1% Mean concentration; influent = 9.8±3.7 ug/L; effluent = 9.9±3.1 ug/L	The reviewer agreed with this study's overall quality level.	Bouwer and Mccarty (1982)	High
Reductive dechlorination in a semi-continuous reactor with an anaerobic enrichment culture	≥1.63 to ≤10.7 µmol/L	other: First-generation and sixth-generation enrichment culture obtained from semi-continuous reactor, operated at 35°C with digested sludge obtained from anaerobic digester seeded from Ithaca wastewater treatment plant	anaerobic	Sixth generation: Methanol 42 to 110 days; Glucose 25 to 114 days; semi-continuous operation 16-90 days followed by incubation period 7-30 days	Biodegradation parameter: percent removal via dechlorination: >99% (0.15 to 0.81% remaining); Biodegradation parameter: dechlorination products: Ultimate product: ethene; intermediates products: vinyl	The reviewer agreed with this study's overall quality level.	Freedman and Gossett (1989)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					chloride(major), TCE, 1,2-DCEs; Biodegradation parameter: dechlorination rate: after 309 days 36.4 µmol PCE consumed, 4.90 µmol VC and 12.0 µmol ethene remained. Reductive dechlorination was not suitable unless an electron donor was present			
Non-guideline incubation	10 mg/L	other: aquifer material - Traverse City Microcosms	anaerobic	250 days	Biodegradation parameter: transformation rate: -4.43+/-0.95 µM/day. Similar results obtained in the presence of toluene, ethylbenzene or benzoate.	The reviewer agreed with this study's overall quality level.	Edwards et al. (1992)	High
Non-guideline incubation	<10 mg/L	other; aquifer material - Pensacola Microcosms	anaerobic	250 days	Biodegradation parameter: transformation rate: -1.45+/-0.34 µM/day (day 1-40) and -2.16+/-0.34 µM/day (day 116-131). Similar	The reviewer agreed with this study's overall quality level.	Edwards et al. (1992)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					results obtained in the presence of toluene under the same conditions but not when no other organic compounds were present with a stable toluene degrading suspended consortia derived from the Pensacola microcosms.			
Non-guideline incubation	<10 mg/L	other; aquifer material - Tyndall Airforce Base Microcosms	anaerobic	85 days	Biodegradation parameter: transformation rate in toluene amended sample: 0.013+/-0.066 µM/day. PCE not transformed in the presence of benzoate or phenol.	The reviewer agreed with this study's overall quality level.	Edwards et al. (1992)	High
Non-guideline; screening test	6.5 µm	other; Hanford soil microcosms	aerobic	30 hours	Biodegradation parameter: test substance transformation rate: 0.0 µMol/mg total suspended solids/h	The reviewer agreed with this study's overall quality level.	Kim et al. (2000)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Non-guideline anaerobic biodegradation experiment	17-176 µg/mL	other; methanogenic mixed culture grown in a laboratory-scale digester fed waste-activated sludge	anaerobic	16 weeks	Biodegradation parameter: concentration: 56 µg/L after 16w for 176 µg/L initial concentration; 20 µg/L after 16w for 36 µg/L initial concentration; 7 µg/L after 16w for 17 µg/L initial concentration; limited degradation	The reviewer agreed with this study's overall quality level.	Bouwer et al. (1981)	High
Static-culture flask-screening test	5 and 10 mg/L	sewage, domestic, non-adapted; Settled domestic wastewater	aerobic	28 days (includes 7-day static incubation and 3 weekly subcultures)	Biodegradation parameter: percent removal 45%/7d and 87%/28d (5 mg/L initial concentration); 30%/7d and 84%/28d (10 mg/L initial concentration) Significant degradation with rapid adaptation	The reviewer agreed with this study's overall quality level.	Tabak et al. (1981)	High
Granular sludge from USAB reactor treating sugar beet refinery wastewater	1000-1500 nmol/batch	activated sludge, industrial, non-adapted; Granular sludge from USAB reactor treating sugar beet	anaerobic	65 days	Biodegradation parameter: rate constant (first order transformation kinetics): 0.048	The reviewer agreed with this study's overall quality level.	van Eekert et al. (2001)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
		refinery wastewater			day^{-1} g^{-1} volatile suspended solids; Biodegradation parameter: product: trichloroethene; Some disappearance of test substance was seen in presence of autoclaved sludge.			
Other; Static microcosms	4.2 mg/L	natural water/sediment: freshwater; Sediment included muck from vegetation decay and marl (carbonaceous precipitate of algal growth). 4g muck or 6g marl used.	aerobic	16 weeks	Biodegradation parameter: Concentration (ug/L) of degradation products (95% confidence interval in parentheses): Trichloroethene: Week 0 - ND; Week 2 - 510(4,175); Week 16 - Trace. Cis-DCE: Wk 0 - ND, wk 2 - 300(1,360), wk 16 ND. Trans-DCE: Wk 0 - ND, weeks 2 and 4 - trace, wk 16 - ND.	The reviewer agreed with this study's overall quality level.	Parsons et al. (1985)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					Transformation was not observed in nonviable microcosms			
Pure culture anaerobic dehalogenation; isolation of strain and optimization of growth	50-200 mmol/L	anaerobic microorganisms; Pure cultures (strain TT4B) obtained from anaerobic sediments from a stream in Massachusetts contaminated with TCE and toluene	anaerobic	10 days	Biodegradation parameter: percent removal: 100%/10d; Biodegradation parameter: degradation products: trichloroethylene and cis-dichloroethylene. No abiotic dehalogenation was observed.	The reviewer agreed with this study's overall quality level.	Krumholz et al. (1996)	High
Non-guideline	3.33 µg/mL (approx.)	other; muck from the Everglades	anaerobic	30 days	Biodegradation parameter: Half-life: 34 days		Wood et al. (1981)	High
Reductive dechlorination in a semi-continuous reactor with an anaerobic enrichment culture	≥ 3.5 ≤ 55 µmol/L	other; Methanol-PCE Enrichment culture using a methanogenic bacterium and a method reference (HERO2802294)	anaerobic	195 days	Biodegradation parameter: percent removal via dechlorination: 100%/2-4d; Biodegradation parameter: degradation products: ethene with very little or no vinyl chloride and negligible	The reviewer agreed with this study's overall quality level.	DiStefano et al. (1991)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					quantities of trichloroethene and dichloroethene isomers.			
Non-guideline; other		other: Anaerobic mixed culture known to be capable of dechlorinating PCE to ethene seeded with aquifer material from a PCE-contaminated site in Victoria, TX	anaerobic	1 hour	Biodegradation parameter: Dechlorination rate: 77 µM/day	The reviewer agreed with this study's overall quality level.	Haston and Mccarty (1999)	High
Non-guideline; other	6.98 mg/L	activated sludge (adaptation not specified); enrichment cultures from contaminated groundwaters from site former solvent-recycling factor in Germany	aerobic/ anaerobic	14 days	Biodegradation parameter: percent removal: anaerobic: 0%/14d Biodegradation parameter: removal: aerobic changed to anaerobic conditions: some transformation/ 14d; Biodegradation parameter: degradation products: 100% transformation of	The reviewer agreed with this study's overall quality level.	Kästner (1991)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					PCE to cis-1,2-dichloroethylene (cDCE) in aerobically prepared medium with nitrogen atm			
Influents and effluents of 27 Korean WWTPs screened for 22 chemicals		activated sludge, industrial (adaptation not specified); Various treatment processes used: 15 used activated sludge process, remaining used sequencing batch reactors, biological nutrient removal process, chemical coagulation and sedimentation, or contact oxidation.	not specified	3 months	Biodegradation parameter: percent removal (average, estimated from graph): 72% Removal Percentage % (degradation, volatilization, sorption to solids, all included in "removal")	The reviewer agreed with this study's overall quality level.	Lee et al. (2015)	High
Continuous flow column study	110 mg/L	anaerobic microorganisms	anaerobic	2- or 4-days detention time	Biodegradation parameter: percent removal: 99.98% Biodegradation parameter: Degradation products: trichloroethylene, dichloroethylene, vinyl chloride, and carbon	The reviewer downgraded this study's overall quality rating. They noted: Control groups were not reported, limiting study evaluation.	Vogel and Mccarty (1985)	Low

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					dioxide; a stepwise degradation scheme was proposed.			
Continuous-flow column study	0.76 mg/L	anaerobic microorganisms; Methanogenic bacteria	anaerobic	10 and 22 days	Biodegradation parameter: concentration: 300 µg/L to 5 µg/L. Biodegradation parameter: Degradation products: trichloroethylene, dichloroethylene, vinyl chloride, and carbon dioxide; a stepwise degradation scheme was proposed.	The reviewer agreed with this study's overall quality level.	Vogel and Mccarty (1985)	High
		other; Pure cultures: Pseudomonas stutzeri OX1, Luria-Bertani growth medium at 30°C	aerobic	24 hours	Biodegradation parameter: Degradation products: 65% chloride ion generated Initial degradation rates determined by sampling every 7 min for up to 2 hours	The reviewer agreed with this study's overall quality level.	Ryoo et al. (2000)	High

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Non-guideline	91 mg/L	PCE-MeOH enrichment culture, yeast extract	anaerobic	60 days	Biodegradation parameter: reaction conditions: Hydrogen was able to serve as the electron donor in reductive dechlorination of perchloroethylene to vinyl chloride and ethylene over periods of 14-40 days.	The reviewer agreed with this study's overall quality level.	DiStefano et al. (1992)	High
Simulated seasonal field study		natural water: marine; NR	aerobic		Biodegradation parameter: half-lives: 25 d (spring), 14 d (summer), 12 d (winter) Volatilization dominated the loss of test material	The reviewer agreed with this study's overall quality level.	Wakeham et al. (1983)	Medium
Simulated seasonal field study	0.5 to 2 µmol/L	natural water: marine; NR	aerobic	24 hours	Biodegradation parameter: half-lives poisoned with $HgCl_2$ and not poisoned, respectively: 12.1 d and 12.0 d; Based on the half-lives with and without HgCl2	The reviewer agreed with this study's overall quality level.	Wakeham et al. (1983)	Medium

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					poisoning, the loss of test material was determined to be primarily by volatilization.			
Degradation in muck-water	200 µg	natural water; Everglades muck and water collected on Feb 12, 1979	not specified	70 days	Biodegradation parameter: percent removal: 100% / 70 days Biodegradation parameter: half-life: 33.8 days (primary degradation)	The reviewer downgraded this study's overall quality rating. They noted: The starting material had reported impurities.	Dow Chemical (1980)	Medium
The influent and effluent concentrations of several VOCs were measured at two WWTPs and compared to a model developed by the authors that estimated VOC removal by volatilization, adsorption, and biodegradation based on the WWTP operational conditions.		activated sludge, industrial, adapted	aerobic		Biodegradation parameter: predicted DCM biodegradation removal: WWTP #1: 84% (mainly by volatilization); WWTP #2: 83.1% (mainly by volatilization)	The reviewer agreed with this study's overall quality level.	Namkung and Rittmann (1987)	Medium

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Degradation/dechlorination using an enrichment culture	300 and 600 µmol/L	other; Enrichment culture of over 98% Dehalococcoides, obtained in 3 phases; microcosm set up with groundwater from chlorinated ethene-contaminated anaerobic aquifer in Bitterfeld Germany; preparation methods described briefly and referenced	anaerobic	120 days	Biodegradation parameter: percent removal: 100%/110 d; Biodegradation parameter: degradation products: vinyl chloride, ethene	The reviewer agreed with this study's overall quality level.	Cichocka et al. (2010)	Medium
Calculation		not specified	anaerobic		Biodegradation parameter: reduction potential for transformation half-reactions: PCE to TCE ~0.7 volts at 0°C and 100°C.	The reviewer downgraded this study's overall quality rating. They noted: Study reports calculated estimates with limited details for endpoints related to fate (thermodynamic property).	Haas and Shock (1999)	Low

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Anaerobic biodegradation	1.06 mg/L	anaerobic sludge; anaerobic microorganisms from a municipal waste treatment plant	anaerobic	100 days	Biodegradation parameter: percent removal: 100%/40d	The reviewer downgraded this study's overall quality rating. They noted: Due to limited information, evaluation of the reasonableness of the study results was not possible.	Gossett (1985)	Low
Non-guideline aerobic biodegradation experiment	8.8+/-15% and 74+/-15% µg/mL	other; Primary sewage effluent Palo Alto, CA, Water Pollution Control Facility	aerobic	25 weeks	Biodegradation parameter: percent remaining: 120-125% relative to control samples; limited degradation	The reviewer downgraded this study's overall quality rating. They noted: Greater than 100% of test substance was remaining relative to the controls after 25 weeks.	Bouwer et al. (1981)	Low
Pure culture study using anaerobic methanogenic bacteria	≥ 1 to ≤ 3 mg/L	Methanosarcina sp. strain	anaerobic	13 days	Biodegradation parameter: rate constant: 5.7-6.0 nmol/day; Biodegradation parameter: CH4 production rate constant: 180 nmol/day	Species specific biodegradation study excluded.	Fathepure and Boyd (1988)	Unacceptable

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					during the active phase of methanogenesis			
Batch sewage sludge microcosm experiment		digested sludge; digester sludge from several industrial and municipal sewage treatment plants canton de Vaud (Switzerland)	anaerobic		Biodegradation parameter: percent removal in test system: No degradation or loss occurs	Biodegradation results were not reported for Perchloroethylene	Balsiger et al. (2005)	Unacceptable
Anaerobic biodegradation with municipal solid waste (MSW), biowaste, and/or compost	4 to 5 mg/kg	other; Digester filled with MSW, biowaste, or compost; MSW from unsorted waste from households, trade and communities, organic waste from private households of Hamburg, Germany	anaerobic	Not specified; likely >130 days	Biodegradation parameter: degradation rate in test system: PCE was degraded at a low rate under acidic conditions and at a higher rate in the methane phase (however, only very low concentrations of perc initially added were found in the gas phase, attributed to adsorption and rapid decomposition	The study did not include or report control groups to validate the system used.	Deipser and Stegmann (1997)	Unacceptable

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Degradation in open and closed systems	≥ 0.1 to ≤ 1 ppm	natural water: marine; Seawater collected from outside Lysekil on the Swedish Coast	not specified	14 days	Biodegradation parameter: percent removal in open-light, closed-light, and closed-dark systems, respectively: 50%, 40%, 54%	Serious uncertainties or limitations were identified in sampling methods of the outcome of interest. In addition, loss from leaks in valves and open test systems were likely to have a substantial impact on the results, making the study unusable.	Jensen and Rosenberg (1975)	Unacceptable
Non-guideline; Modified shake flask closed bottle biodegradation test		not specified	aerobic		Biodegradation parameter: percent removal: 0%/21d Possibly multiple studies (1) Acclimation period with adaptive transfers after 48 or 72h with and without lactose; (2) No biodegradation after 21d acclimation period in a river die-away study without co-substrate	Testing methods and conditions were not reported, and data provided were insufficient to interpret results in this secondary source; citing HERO ID 18157, Mudder, T. I. and J. L. Musterman (1982).	ECHA (2017b)	Unacceptable

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Inhibition of gas production to anaerobic sludge from an operating municipal sludge digester	1000 mg/L	sewage, domestic (adaptation not specified); Mt Pleasant MI WWTP	anaerobic	48 hours	Parameter: inhibition of gas production: 7.3% inhibition at 10 mg/L; 20% inhibition at 100 mg/L; 36% at 300 mg/L; 50% at 550 mg/L after 48h	Study describes inhibition of gas production not biodegradation rates or transformation pathways.	Dow Chem Co (1977)	Low
Sediment								
Other; Non-guideline	500 µg/L	natural water/sediment: freshwater	aerobic/ anaerobic	436d	Biodegradation parameter: percent removal: 90% on days 338-436; 16% during day 140-337	The reviewer agreed with this study's overall quality level.	Cheng et al. (2010)	High
Static microcosm with muck and surface water in sealed septum bottles	100	sewage, domestic, non-adapted	anaerobic	21 days	Biodegradation parameter: percent removal: 72.2%/21d	The reviewer agreed with this study's overall quality level.	Parsons et al. (1984)	Medium

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Other; Reductive dechlorination in anaerobic sediment; column and batch studies	≥0.6 to ≤9 µmol/L	natural water/ sediment	anaerobic	Continuous-flow column >300 days; batch >44 days	Biodegradation parameter: degradation product: 95-98% PCE was recovered as ethane under steady-state column conditions in the presence of lactate	The reviewer downgraded this study's overall quality rating. They noted: No control groups or validation were reported.	de Bruin et al. (1992)	Low
Anaerobic biodegradation in Ni contaminated sediment	600 µmol/L	Anaerobic, nutrient poor sediment, contaminated with chloroethene and nickel, collected at a depth of 15m near a former metalworking industrial plant in the Netherlands; microbial pop range 10^2-10^3 cells/g of sediment under sulfate reducing conditions	anaerobic	1 year (52 wks)	Biodegradation parameter: degradation products: Ethene/ethane production was observed after 31 weeks; the addition of sulfate and lactate were necessary for microbial activity; approximately 1 mM chloride was detected in the effluent (background from control was 0.5mM)	The reviewer downgraded this study's overall quality rating. They noted: Specific results stating degradation rates and/or half-lives were not reported.	Drzyzga et al. (2002)	Low

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Microbial reductive dechlorination of PCE in sediment microcosms	55 mmol/L	sewage, domestic, non-adapted	anaerobic		Biodegradation parameter: dechlorination products: Reductive dechlorination of PCE in sediments from 3 locations generated more trans-DCE than cis-DCE; sediment from one location generated a lower trans-/cis-DCE ratio	The reviewer downgraded this study's overall quality rating. They noted: Due to limited information, evaluation of the reasonableness of the study results was not possible.	Cheng et al. (2010)	Low
Soil								
Other; Biodegradation in a continuous flow system. Long-term operation of a sand column fed methanol and concentrations of PCE under anaerobic continuous flow conditions.	≥12 to ≤720 µmol/L	Biomass from an anaerobic digester at the Metropolitan Toronto Main Treatment Plant	anaerobic	2.5 years	Biodegradation parameter: removal rates (three different column zones): 1.23-1.60 µmol/(h mg of protein) at 0-15 cm; 0.21-0.26 µMol/(h mg of protein) at 0-30 cm; and 0.11-0.13 µmol/(h mg of protein) at 0-45 cm.	The reviewer downgraded this study's overall quality rating. They noted: Continuous flow reactor with a sand column that's fed PCE and methanol; experiment a treatment system, the study may not be relevant to fate and environmental degradation and	Isalou et al. (1998)	Low

Study Type (year)	Initial Concentration	Inoculum Source	(An)aerobic Status	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
						therefore not applicable to fate assessment.		

Table 2. Bioconcentration Study Summary for Perchloroethylene

Study Type (year)	Initial Concentration	Species	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Bioconcentration in Bluegill sunfish: Aquarium with well-water and modified continuous-flow proportional dilution apparatus for chemical introduction	3.43±1.53 µg/L	Bluegill sunfish (Lepomis macrochirus) 100 per aquarium	Tetrachloroethylene 21 days; Test: 28 days or until equilibrium; water and fish samples collected periodically until apparent equilibrium was reached or the max exposure of 28 days was reached	Bioconcentration parameter: BCF: 49 (bluegill); Bioconcentration parameter: half-life: < 1 day	The reviewer agreed with this study's overall quality level. This study is related to another study, HERO ID 3970785, Echa. Bioaccumulation: aquatic/sediment: Tetrachloroethylene. 2017.	Barrows et al. (1980)	High
Kinetic uptake measured via a ^{13}C method and ECD-GC method	0.22 or 0.50 mg/L	Skeletonema costatum	72 hours	Bioconcentration parameter: BCF D(U): 118 (algae, uptake); Bioconcentration parameter: BCF D(T): 113 (algae); derived from exp data	The reviewer agreed with this study's overall quality level.	Wang et al. (1996)	High

Study Type (year)	**Initial Concentration**	**Species**	**Duration**	**Result**	**Comments**	**Affiliated Reference**	**Data Quality Evaluation Results of Full Study Report**
				for % inhibition and exposure concentration with time			
Kinetic uptake measured via a ^{13}C method and ECD-GC method	0.22 or 0.50 mg/L	Heterosigma akashiwo	72 hours	Bioconcentration parameter: BCF D(U): 312 (algae, uptake); Bioconcentration parameter: BCF D(T): 280 (algae); derived from exp data for % inhibition and exposure concentration with time	The reviewer agreed with this study's overall quality level.	Wang et al. (1996)	High
"Bioaccumulation test of a chemical substance in fish or shellfish" provided in "the Notice on the Test Method Concerning New Chemical Substances"	0.1 and 0.01 ppm	Cyprinus carpio	8 weeks	Bioconcentration parameter: BCF: 25.8-77.1 (high); 28.4-75.7 (low) (carp)	The reviewer agreed with this study's overall quality level. The BCF study is also available from the NITE website.	Kawasaki (1980)	High
Uptake-clearance of a Perc commercial product	0.06121 and 0.650 ppm	Rainbow trout (Salmo gairdneri)	48-hour exposure followed by 144-hour clearance	Bioconcentration parameter: BCF: 39.7 (rainbow trout)	The reviewer agreed with this study's overall quality level.	Dow Chemical (1973)	High
Method described by Branson et al 1974 for determination of BCF in Rainbow trout	Two concentrations an order of magnitude apart	Salmo gairdneri		Bioconcentration parameter: BCF: 39.6 ± 5.5 (rainbow trout)	The reviewer agreed with this study's overall quality level.	Neely et al. (1974)	Medium

Study Type (year)	Initial Concentration	Species	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Not specified		Golden ide (Leuciscus idus)		Bioconcentration parameter: unspecified: 90 (Golden ide)	Limited study information provided (i.e. study controls not reported).	Freitag et al. (1985)	Unacceptable
Monitoring of halogenated hydrocarbons in mollusks and fish and comparison to concentrations in seawater		Bassinum undatum; Modiolus, Pecten maximus; Conger, Gadus morhua, Pollachius birens, Scylliorhinus canicula, Trisopterus luscus		Bioconcentration parameter: monitoring: Relative to their seawater levels these compounds were only slightly enriched; usually by a factor of 2 - 25x (snails, scallops, eels, marine fish) Bioconcentration parameter: concentration in organs: brain>gill>liver>muscle; exceptions were noted	The test substance concentration in seawater was not reported. Results provided are a range of BCF (2-25x) that are not test compound or organism specific.	Dickson and Riley (1976)	Unacceptable
Long term accumulation experiment in apparatus similar to that used for acute tox determination	0.03 and 0.3 mg/L	Dab	10 days and up to 3 months (3-35 days)	Bioconcentration parameter: accumulation factor in organs: 5-9 times for flesh and 200-400 times for liver (dab)	The study did not report crucial details on method, sampling and organisms.	Pearson and McConnell (1975)	Unacceptable
Bioaccumulation; purge-trap method using a Dean-stark apparatus	5 and 100 µg/L	Mytilus edulis	8 and 21 days	Bioconcentration parameter: BAF: 25.7 (mussel)	Foreign language paper with abstract and data tables in English. Full text article review needed when available in English.	Saisho et al. (1994)	Unacceptable

Table 3. Photolysis Study Summary for Perchloroethylene

Study Type (year)	Wavelength Range	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Air						
Other; calculation Atmospheric lifetime in three regimes of the troposphere based on OH Reaction rate constant			Photodegradation parameter: Tropospheric lifetime at 288 K, 263 K, and 260 K, respectively: 80, 119, and 251 days	The reviewer agreed with this study's overall quality level.	U.S. EPA (1987)	High
Other; Test material injected into quartz flask containing air to give concentrations in the range of 10^{-7} to 10^{-4} by mass.	Outdoor light		Photodegradation parameter: direct photolysis half-life: 50%/12 weeks	Testing conditions were not reported, and data provided were very general; concentration of test material not specified. Ambient air used for experiment was not subject to any pretreatment or analysis; climate and conditions were not controlled.	Pearson and McConnell (1975)	Unacceptable
Water						
Direct photolysis in quartz tubes	366 nm	5 days	Photodegradation parameter: direct photolysis: Negligible	The reviewer agreed with this study's overall quality level.	Chodola et al. (1989)	High

Study Type (year)	Wavelength Range	Duration	Result	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Photodegradation in water (indirect photolysis)	185-254 nm	60 minutes	Photodegradation parameter: indirect photolysis rate constants: 0.221 kdeg min^{-1} (oxygenated) and 0.287 kdeg min^{-1} (oxygen free) Photodegradation parameter: indirect photolysis half-lives: 3.75 min (oxygenated) and 3.39 min (oxygen free)	The reviewer agreed with this study's overall quality level.	Shirayama et al. (2001)	High
Nonguideline lab study - direct photolysis	sunlight	1 year	Photodegradation parameter: direct photolysis half-life: 50%/8.8 months	The reviewer agreed with this study's overall quality level. Related HERO ID , Echa. Phototransformation in water: Tetrachloroethylene. 2017.	Dilling et al. (1975)	High
Photoinduced reductive dechlorination in water containing ferrous and/or sulfide ions	Intensity 530±20 lux	33 days	Photodegradation parameter: indirect: reductive dechlorination: No appreciable degradation was observed with any medium with or without photolysis	The reviewer agreed with this study's overall quality level.	Doong and Wu (1992)	High

Table 4. Hydrolysis Study Summary for Perchloroethylene

Study Type (year)	pH	Temperature	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Nonguideline; hydrolysis study	4 and 9.2	4 and 50ºC (at both pH values)	7 days	Hydrolysis parameter: conditions for reaction: Under acidic and basic conditions, the percent difference of areas at 4 and 50ºC ranged between -14% to +1% indicating that the chance for transformation of tetrachloroethylene by hydrolysis under environmentally relevant conditions of temperature and pH is minimal.	The reviewer agreed with this study's overall quality level.	Chodola et al. (1989)	High
Nonguideline lab study in Pyrex tubes with light-proof container, shaken every 2-weeks, water purged with air for 15 min prior to addition of chlorinated compounds		approx. 25ºC	1 year	Hydrolysis parameter: half-life: 50% / 8.8 months	The reviewer agreed with this study's overall quality level.	Dilling et al. (1975)	High

Study Type (year)	pH	Temperature	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Alkaline homogenous hydrolysis experiments; a range of pH and temperature evaluated. Arrhenius temperature dependence assumed.	2-14	130-170ºC	30 min to several days (for all test materials; specific duration for tetrachloroethylene not specified)	Hydrolysis parameter: half-life (pH 7 at 25°C): 50% / 9.9×10^{8} years	The reviewer agreed with this study's overall quality level.	Jeffers et al. (1989)	Medium

Table 5. Sorption Study Summary for Perchloroethylene

Study Type (year)	Sorbent Source	Sorbent Qualities (clay/silt/sand, OC, pH)	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Other; Non-guideline study using bottle-point method for isotherm experiments	Filtrasorb 400 activated carbon at 500 and 1500 µg/L; Background organic matter was treated old municipal landfill leachate in Dover, Delaware	DOC 300 mg/L	2 weeks	Sorption parameter: Kf: MilliQ water: 7.071 ±0.09 (mg/g)/(µg/L) and 1/n = 0.4412 ±0.0061	The reviewer agreed with this study's overall quality level.	Sorial et al. (1994)	High

Study Type (year)	Sorbent Source	Sorbent Qualities (clay/silt/sand, OC, pH)	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
OECD Guideline 106 (Adsorption - Desorption Using a Batch Equilibrium Method)	7 samples of Danish clayey till from three sites at depths of 2.4 to 9.5 m below the surface (4 contaminated; 3 uncontaminated)	foc% 0.02-0.08; % Clay content 23.0-27.0; 4 samples reduced clayey till; 3 samples oxidized clayey till		Sorption parameter: Kd (3 sites, oxidized clay): 1.55±0.08, 1.03±0.02, and 0.84±0.05; Sorption parameter: Kd (4 sites, reduced clay): 2.41±0.07, 2.16±0.05, 2.45±0.08, and 1.81±0.14; Sorption parameter: Kf (oxidized clay): 11.25±3.80; Sorption parameter: Kf (2 sites, reduced clay): 21.30±4.11 and 32.56±14.3	The reviewer agreed with this study's overall quality level.	Lu et al. (2011)	High

Study Type (year)	Sorbent Source	Sorbent Qualities (clay/silt/sand, OC, pH)	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
				Sorption parameter: log Kd (calculated from log Kd = 0.590 log Kow-1.561) (oxidized clay): 3.29, 3.54, and 3.62 Sorption parameter: log Kd (calculated from log Kd = 0.590 log Kow-1.561) (reduced clay): 3.78, 3.86, 3.69, and 3.41			
Other; Non-guideline study	pulverized sediment (5-50 g) with a known volume of synthetic groundwater (5-17 mL) and mass of PCE, from methanol stock solution, was either flame sealed into a	Three samples consisted of sand and gravel and three samples consisted of medium to fine sand.		Sorption parameter: Kd: sand and gravel: 0.82, 1.16, and 1.92 Sorption parameter: Kd: medium to fine sand:	The reviewer agreed with this study's overall quality level.	Wang et al. (2013)	High

Study Type (year)	Sorbent Source	Sorbent Qualities (clay/silt/sand, OC, pH)	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
	glass ampoule or sealed with a PTFE-lined butyl rubber septum into serum vial			0.8, 1.16, and 0.82			
Other; Sorption on wastewater solids (isotherm test)	Wastewater solids collected from three different municipal WWTP near Cincinnati, OH	Mixed-liquor solids, primary sludge, anaerobically digested sludge		Sorption parameter: adsorption coefficient K: primary sludge, mixed-liquor solids and digested, sludge, respectively: 0.60, 0.90, 0.70 Sorption parameter: log Kp: primary sludge, mixed-liquor solids and digested, sludge, respectively: 2.90, 3.01, 3.09	The reviewer agreed with this study's overall quality level.	Dobbs et al. (1989)	High

Study Type (year)	Sorbent Source	Sorbent Qualities (clay/silt/sand, OC, pH)	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Other; Vapor partitioning/adsorption in aquifer solids	Aquifer solids from contaminated aquifers in Livermore Valleys CA with low natural organic matter sediment with sand-sized aggregates in clay and silt	Sand clay and silt: Surface area: 13-29 m^2/g; Organic content 0.0064-0.11%; particle diameter: <75-150 µm; Sand portion: internal porosity 0.54 mL/g; pore diameter: 69 Angstrom		Sorption parameter: Kf: 0.0048 (nonlinear isotherm 1/n = 0.62)	The reviewer agreed with this study's overall quality level.	Farrell and Reinhard (1994)	High
Other; Vapor partitioning/adsorption in aquifer solids	Aquifer solids from contaminated aquifers in Santa Clara CA consisting of fragments of sedimentary rocks (54%), single grains (30%), igneous and metamorphic rock fragments (16%)	Column solids were in equilibrium with 100% relative humidity; desorption isotherms measured with stepwise batch techniques; solids allowed to adsorb PCE vapors at ca. 79% saturation and equilibrated for 1 week, purged and equilibrate for another 1-3 week		Sorption parameter: Kf: 0.0054 (nonlinear isotherm 1/n = 0.43)	The reviewer agreed with this study's overall quality level.	Farrell and Reinhard (1994)	High
Secondary source, based on several experimental studies				Sorption parameter: Koc: 141 (log Koc = 2.15)	The reviewer downgraded this study's overall quality rating. They noted: Limited information reported in this secondary source and unable to	ECHA (2017a)	Unacceptable

Study Type (year)	Sorbent Source	Sorbent Qualities (clay/silt/sand, OC, pH)	Duration	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
					confirm study results with cited reference HEROID 3839195, ECB (2005). European Union risk assessment report: Tetrachloroethylene. Part 1 - Environment. United Kingdom, European Commission – Joint Research Centre Institute for Health and Consumer Protection European Chemicals Bureau. 57.		

Table 6. Other Fate Endpoints Study Summary for Perchloroethylene

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Measured concentrations of tetrachloroethylene in sediments of Scheldt Estuary and water samples from Southern North Sea	Partitioning based on measurements in sediments of Scheldt Estuary and water Southern North Sea	Parameter: log Koc (sw, eq): 1.58 (Log Koc, sw: 0.94, 1.83, 1.99, 2.34; Log Koc 0.92, 1.82, 1.96, 2.26)	The reviewer agreed with this study's overall quality level.	Roose et al. (2001)	High
Experiment was conducted at the H1 wetland at the Tres Rios Demonstration	Volatilization rates and half-lives for VOCs in	Parameter: mass flux to the atmosphere for	The reviewer agreed with this study's overall quality level.	Keefe et al. (2004)	High

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Wetlands, located near the Salt River in Maricopa County, southwest of Phoenix, AZ	constructed wastewater treatment wetlands.	tetrachloroethene: 0.45g/d/ha			
Anaerobic batch fed reactor	digested sludge; Municipal anaerobic digester sludge	Biodegradation parameter: test reactor influent/effluent comparison: _Average reactor influent of Perc = 120 ug/L, average reactor effluent = 3 ug/L	The reviewer agreed with this study's overall quality level.	Long et al. (1993)	High
Aerobic batch fed reactor	digested sludge; Municipal anaerobic digester sludge	Biodegradation parameter: test reactor influent/effluent comparison: Average reactor influent = 160 ug/L; average reactor effluent = 42 ug/L	The reviewer agreed with this study's overall quality level.	Long et al. (1993)	High
Analysis of NYC municipal wastewaters; Influent and effluent samples were collected from 14 Water Pollution Control Plants in New York City	Analysis of NYC municipal wastewaters from 1989-1993	Parameter: WWTP influent/effluent comparison: Tetrachloroethene was detected in 94% of influent samples and 74% of effluent samples; the concentration range detected in influent was 5-78 µg/L and effluent was 1-69 µg/L. Tetrachloroethene was one of five commonly observed volatiles detected; present in at least a third or more of all the samples analyzed.	The reviewer agreed with this study's overall quality level.	Stubin et al. (1996)	High

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
VOCs injected into water line of shower and glass syringes were used to collect air and water samples.		Parameter: percent volatilization at 25°C, 33°C, and 42°C, respectively: 56% +/-7%, 66% +/-7% and 68% +/-7% Parameter: percent volatilization at 42°C by flow rates: 69% +/-7% at flow rate 9.7 L/min and 68% +/-7% at flow rate 13.5 L/min	The reviewer downgraded this study's overall quality rating. They noted: Study investigated volatilization from shower water. Study results may not be relevant to a specific/designated Fate endpoint.	Tancrede et al. (1992)	Low
Desorption profiles obtained from PCE alone and PCE mixed with TCE in sediment	Diffusion/desorption on natural solids	Parameter: Diffusion rate constant of PCE alone and PCE in mix with TCE, respectively: 5.00E-4/min (95%CI: 0.02E-4, initial sorbed mass: 8.1 µg/g) and 7.33E-4/min (95%CI: 0.05E-4, initial sorbed mass: 9.2 µg/g)	The reviewer agreed with this study's overall quality level.	Li and Werth (2004)	High
Modified EPA method 624	Stripping of volatile organics from wastewater	Parameter: WWTP influent/effluent comparison: 88 and 139 µg/m^3 max off gas samples; avg influent and effluent: 0.2µg/L in water and 40 and 43 µg/m3 in off gas at skyway. influent and effluent: 0.3 and 0.2 µg/L in water and 82 and 115 µg/m^3 in off gas at highland creek	The reviewer agreed with this study's overall quality level.	Bell et al. (1993)	High

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
VOC's were measured in water samples between November 2006-June 2008; by comparing STE and post-RO samples matched to plant and date the overall treatment efficiency was calculated as a proportion of the removal	Monitoring of water samples and correlation to treatment efficiency	Parameter: WWTP removal efficiency: The median removal efficiency was 91.2% for tetrachloroethene; STE samples (n=29): 86.2% detections; post-MF samples (n=9): 88.9% detections; post-RO samples (n=27): 14.8% detections	The reviewer agreed with this study's overall quality level.	Rodriguez et al. (2012)	High
Gravimetric measurements by a Mettler H54 balance	evaporation rates of solutes from water	Parameter: volatilization rates at 23.2°C and 3.5°C, respectively: 1.36E5 g/cm^2-s and 4.77E4 g/cm^2-s	The reviewer agreed with this study's overall quality level.	Chiou et al. (1980)	High
Refers to Hill et al.	Volatilization rate study for high-volatility compounds	Parameter: volatilization rate constant ratios kvC/kvo: 0.52 +/- 0.09	The reviewer agreed with this study's overall quality level.	Smith et al. (1980)	High
Concentrations in air, water and sludge phases analyzed under four different operational circumstances evaluating single and combined effects of aeration and sludge addition on phase distributions; sludge added prior to experiments; aeration 3rd-10th hour	Fugacity model approach to VOC fate in WWTP	Parameter: partitioning: The concentrations of the VOCs in the air, water, and sludge phases of the bioreactor were analyzed regularly. Mass distributions indicated that Perc was mainly present in the water phase throughout the four treatment stages; less than 1% of the total mass was subject to biological sorption and/or degradation by the sludge;	The reviewer agreed with this study's overall quality level.	Chen et al. (2014)	High

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
		water aeration resulted in increased partitioning to the air phase with a negative impact on biological removal; Perc mass distribution throughout the 4 stages: ~99% water, ~0.4% air, less than 0.1% sludge			
Reductive dehalogenation measured in static microcosms with 8 mL leachate and 10 mM PCE under 80%-N2: 10%-CO2: 10%-H2 atmosphere with and without organic carbon amendments	Dehalogenation of PCE in landfill leachates with and without organic carbon amendments under anaerobic conditions	Extent of dehalogenation was correlated with the availability of organic carbon; 19% degradation after 14 days in low carbon Cell 8 leachate and almost all PCE and some TCE degradation after 30 days; greater than 75% degradation after 14 days in high car	The reviewer agreed with this study's overall quality level.	Leahy and Shreve (2000)	High
	Concentration in seawater and air	Parameter: seawater to air flux: 0.02-160.4 (mean 34.3) nmol m^{-2} d^{-1}	The reviewer agreed with this study's overall quality level.	He et al. (2013)	High
200 rpm stirring of the solution with a shallow pitch propeller stirrer in still air		Parameter: volatilization half-life: 27.1 min	The reviewer agreed with this study's overall quality level.	Dilling (1977)	High
Transformation study under anaerobic conditions	non-guideline	Parameter: abiotic dechlorination in the presence of iron half-lives at 50°C and 23°C respectively:	The reviewer agreed with this study's overall quality level.	Schreier and Reinhard (1994)	Medium

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
		20d+/-4 and 38d+/-25; dechlorination did not occur in the presence of manganese			
wastewater flow: 41.5, 21, 852, 2390, 499, 110 and 30.5 l/min. Volatile organic loading rate: 14.6, 4.6, 292, 286, 19, 5.29, 0.395 kg/L. Feed ratio: 9.6, 10.5, 28.8, NA, 14.7, 7.1, 1.4 kg/kg for plants A-G respectively	7 steam stripper operations are reported	Parameter: percent removal from steam stripper operations: >99.2 and >99.89 removal from plant C and D, respectively. no removal plants A, B, E-G.	The reviewer agreed with this study's overall quality level.	Blaney (1989)	Medium
Mill Creek, Little Miami River, and Muddy Creek treatment plants		Parameter: 8h TWA in air: 150, 280, 3800, 380 ppb; Parameter: air concentration: 0-20 ppm v/v; Parameter: WW concentration: 0.19-47 µg/L	The reviewer downgraded this study's overall quality rating. They noted: The volatility is reported for 3 sites in open systems.	Dunovant et al. (1986)	Low
Continuous release of chemicals and steady hydrological parameters assumed to develop a steady-state model for estimating concentration in river	Hydrological data and monitoring samples are used to calculate volatilization	Parameter half-life in river: 4-6 d; Perc release from the river is variable with an average value of 0.6%. Mainly removed by volatilization.	The analytical method used for detection of the test substance was not reported.	Brüggemann and Trapp (1988)	Unacceptable
Full scale Wet Air Oxidation (WAO) of solvent still bottoms and general organic waste details are reported by	Wet air oxidation performance data	Parameter: percent removal from test system: 95.35% Effluent concentration solvent still bottoms of	Due to limited information, evaluation of the reasonableness of the study results was not possible.	Matienzo (1989)	Unacceptable

System	Study Type (year)	Results	Comments	Affiliated Reference	Data Quality Evaluation Results of Full Study Report
Radimsky and Shah 1985; parameters used to measure performance were COD, BOD, and DOC; off-gas emissions measured by THC as methane;		tetrachloroethylene = 40 mg/L			
Performance data was collected on full scale batch fractional distillation systems as referenced in the source document	Distillation performance data	Parameter: performance of test system: Mean solvent concentration of distillation residues: tetrachloroethylene 12 reported values, mean concentration = 4; feasible treatment level = 3.0 mg/kg	Due to limited information, evaluation of the reasonableness of the study results was not possible.	Matienzo (1989)	Unacceptable
Samples taken from WWTP to evaluate air stripping and removal of Perc/PCE	Partitioning in activated sludge plant	Parameter: percent removal from WWTP: 78% removal of Perc/ PCE by full scale aeration basin Parameter: gas-liquid phase partition coefficient: avg. 600 (+/-86) and 611 (+/-369) (ng/L)/(µg/L)	Study evaluates removal based on air stripping. The extent of air stripping is a function of the compound p-chem properties and a function of WWTP design and operation.	Parker et al. (1993)	Unacceptable

EPI Suite™ Model Outputs

(U.S. EPA, 2012)

SMILES : C(=C(Cl)Cl)(Cl)Cl
CHEM : TETRACHLOROETHENE
MOL FOR: C2 CL4
MOL WT : 165.83
------------------------------ EPI SUMMARY (v4.11) --------------------------
Physical Property Inputs:
Log Kow (octanol-water): 3.40
Boiling Point (deg C) : 121.30
Melting Point (deg C) : -22.30
Vapor Pressure (mm Hg) : 18.5
Water Solubility (mg/L): 206
Henry LC (atm-m3/mole) : 0.0177

Log Octanol-Water Partition Coef (SRC):
Log Kow (KOWWIN v1.69 estimate) = 2.97
Log Kow (Exper. database match) = 3.40
Exper. Ref: HANSCH,C ET AL. (1995)

Boiling Pt, Melting Pt, Vapor Pressure Estimations (MPBPVP v1.43):
Boiling Pt (deg C): 114.28 (Adapted Stein & Brown method)
Melting Pt (deg C): -60.56 (Mean or Weighted MP)
VP(mm Hg, 25 deg C): 17.8 (Mean VP of Antoine & Grain methods)
VP (Pa, 25 deg C) : 2.37E+003 (Mean VP of Antoine & Grain methods)
MP (exp database): -22.3 deg C
BP (exp database): 121.3 deg C
VP (exp database): 1.85E+01 mm Hg (2.47E+003 Pa) at 25 deg C

Water Solubility Estimate from Log Kow (WSKOW v1.42):
Water Solubility at 25 deg C (mg/L): 134.3
log Kow used: 3.40 (user entered)
melt pt used: -22.30 deg C
Water Sol (Exper. database match) = 206 mg/L (25 deg C)
Exper. Ref: HORVATH,AL ET AL. (1999)

Water Sol Estimate from Fragments:
Wat Sol (v1.01 est) = 247.12 mg/L

ECOSAR Class Program (ECOSAR v1.11):
Class(es) found:
Vinyl/Allyl Halides

Henrys Law Constant (25 deg C) [HENRYWIN v3.20]:
Bond Method : 1.65E-002 atm-m3/mole (1.67E+003 Pa-m3/mole)
Group Method: 1.77E-002 atm-m3/mole (1.80E+003 Pa-m3/mole)
Exper Database: 1.77E-02 atm-m3/mole (1.79E+003 Pa-m3/mole)
For Henry LC Comparison Purposes:
User-Entered Henry LC: 1.770E-002 atm-m3/mole (1.793E+003 Pa-m3/mole)

Henrys LC [via VP/WSol estimate using User-Entered or Estimated values]:
HLC: 1.960E-002 atm-m3/mole (1.986E+003 Pa-m3/mole)
VP: 18.5 mm Hg (source: User-Entered)
WS: 206 mg/L (source: User-Entered)

Log Octanol-Air Partition Coefficient (25 deg C) [KOAWIN v1.10]:
Log Kow used: 3.40 (user entered)
Log Kaw used: -0.140 (user entered)
Log Koa (KOAWIN v1.10 estimate): 3.540
Log Koa (experimental database): 3.480

Probability of Rapid Biodegradation (BIOWIN v4.10):
Biowin1 (Linear Model) : 0.2230
Biowin2 (Non-Linear Model) : 0.0012
Expert Survey Biodegradation Results:
Biowin3 (Ultimate Survey Model): 2.1400 (months)
Biowin4 (Primary Survey Model) : 3.2060 (weeks)
MITI Biodegradation Probability:
Biowin5 (MITI Linear Model) : 0.3626
Biowin6 (MITI Non-Linear Model): 0.0227
Anaerobic Biodegradation Probability:
Biowin7 (Anaerobic Linear Model): 0.7775
Ready Biodegradability Prediction: NO

Hydrocarbon Biodegradation (BioHCwin v1.01):
Structure incompatible with current estimation method!

Sorption to aerosols (25 Deg C)[AEROWIN v1.00]:
Vapor pressure (liquid/subcooled): 2.47E+003 Pa (18.5 mm Hg)
Log Koa (Exp database): 3.480
Kp (particle/gas partition coef. (m3/ug)):
Mackay model : 1.22E-009
Octanol/air (Koa) model: 7.41E-010
Fraction sorbed to airborne particulates (phi):
Junge-Pankow model : 4.39E-008
Mackay model : 9.73E-008
Octanol/air (Koa) model: 5.93E-008

Atmospheric Oxidation (25 deg C) [AopWin v1.92]:
Hydroxyl Radicals Reaction:
OVERALL OH Rate Constant = 0.2139 E-12 cm3/molecule-sec
Half-Life = 49.998 Days (12-hr day; 1.5E6 OH/cm3)
Ozone Reaction:
OVERALL Ozone Rate Constant = 0.000073 E-17 cm3/molecule-sec
Half-Life = 15660.362 Days (at 7E11 mol/cm3)
Fraction sorbed to airborne particulates (phi):
7.06E-008 (Junge-Pankow, Mackay avg)
5.93E-008 (Koa method)
Note: the sorbed fraction may be resistant to atmospheric oxidation

Soil Adsorption Coefficient (KOCWIN v2.00):
Koc : 94.94 L/kg (MCI method)
Log Koc: 1.977 (MCI method)
Koc : 892.2 L/kg (Kow method)
Log Koc: 2.950 (Kow method)
Experimental Log Koc: 2.4 (database)

Aqueous Base/Acid-Catalyzed Hydrolysis (25 deg C) [HYDROWIN v2.00]:
Rate constants can NOT be estimated for this structure!

Bioaccumulation Estimates (BCFBAF v3.01):
Log BCF from regression-based method = 1.910 (BCF = 81.34 L/kg wet-wt)
Log Biotransformation Half-life (HL) = 0.5257 days (HL = 3.355 days)
Log BCF Arnot-Gobas method (upper trophic) = 1.663 (BCF = 46.04)
Log BAF Arnot-Gobas method (upper trophic) = 1.663 (BAF = 46.04)
log Kow used: 3.40 (user entered)

Volatilization from Water:
Henry LC: 0.0177 atm-m3/mole (entered by user)
Half-Life from Model River: 1.357 hours
Half-Life from Model Lake : 122.8 hours (5.116 days)

Removal in Wastewater Treatment:
Total removal: 87.91 percent
Total biodegradation: 0.05 percent
Total sludge adsorption: 6.32 percent
Total to Air: 81.53 percent
(using 10000 hr Bio P,A,S)

Removal in Wastewater Treatment:
Total removal: 88.20 percent
Total biodegradation: 2.12 percent
Total sludge adsorption: 6.29 percent
Total to Air: 79.79 percent
(using Biowin/EPA draft method)

Level III Fugacity Model: (MCI Method)
Mass Amount Half-Life Emissions
(percent) (hr) (kg/hr)
Air 46 1.6e+003 1000
Water 46.8 1.44e+003 1000
Soil 6.87 2.88e+003 1000
Sediment 0.314 1.3e+004 0
Persistence Time: 181 hr

Level III Fugacity Model: (MCI Method with Water percents)
Mass Amount Half-Life Emissions
(percent) (hr) (kg/hr)
Air 46 1.6e+003 1000
Water 46.8 1.44e+003 1000
water (46.8)

biota (0.00587)
suspended sediment (0.00666)
Soil 6.87 2.88e+003 1000
Sediment 0.314 1.3e+004 0
Persistence Time: 181 hr

Level III Fugacity Model: (EQC Default)
Mass Amount Half-Life Emissions
(percent) (hr) (kg/hr)
Air 29.1 1.6e+003 1000
Water 30.4 1.44e+003 1000
water (30.3)
biota (0.00381)
suspended sediment (0.0469)
Soil 38.4 2.88e+003 1000
Sediment 2.03 1.3e+004 0
Persistence Time: 279 hr

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