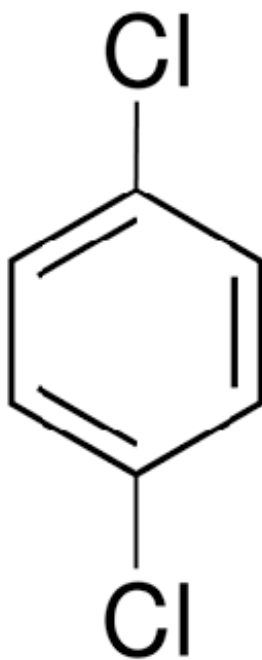

**Draft Data Quality Evaluation and Data Extraction Information for
Environmental Release and Occupational Exposure for
p-Dichlorobenzene**

Systematic Review Support Document for the Draft Risk Evaluation

CASRN: 106-46-7



June 2026

This supplemental file contains information regarding the data extraction and quality evaluation results for data sources that were considered for the *Draft Risk Evaluation for p-Dichlorobenzene (p-DCB)* and that underwent systematic review. EPA conducted data extraction, and quality evaluation based on author-reported descriptions and results; additional analyses (*e.g.*, statistical analyses) potentially conducted by EPA are not contained in this supplemental file. EPA used the TSCA systematic review process described in the *Draft Systematic Review Protocol Supporting TSCA Risk Evaluations for Chemical Substances* (referred to hereafter '2021 Draft Systematic Review Protocol').

Data that met the RESO screening criteria during the full-text screening was extracted by three data types, general facility, occupational exposure, and environmental release, as explained in Section 6.2 of the 2021 Draft Systematic Review Protocol. Five different data quality evaluation forms were used depending on the data type and condition of use (COU), as explained in Appendix M of the 2021 Draft Systematic Review Protocol. All references with data points containing monitoring data (*e.g.*, measured occupational exposures) underwent data quality evaluation as described in Section M.6.1, using the monitoring data quality metrics. All references with data points containing environmental release data (*e.g.*, measured or calculated quantities of chemical release across facility fence line) underwent data quality evaluation as described in Section M.6.2, using the environmental release data quality metrics. All references with data points containing published models for environmental release or occupational exposure (*e.g.*, published models used to calculate occupational exposure or environmental releases) underwent data quality evaluation as described in Section M.6.3, using the published models for environmental release or occupational exposure quality metrics. All references with data points containing completed exposure or risk assessments (*e.g.*, completed exposure or risk assessments containing a broad range of data types) underwent data quality evaluation as described in Section M.6.4, using the completed exposure or risk assessments quality metrics. All references with data points containing reports for data or information other than exposure or release data (*e.g.*, process description) underwent data quality evaluation as described in Section M.6.5, using the reports for data or information other than exposure or release data quality metrics. The extracted data and their data quality evaluation are available in the tables below.

Additionally, each data type and condition of use is evaluated independently within a given study; therefore, each reference may have more than one overall quality determination (OQD) to reflect the quality of each outcome and the exposures and releases more appropriately as described by the study authors. No OQD is determined for each reference, as a whole, if it contains data from more than one evidence stream.

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HERO ID	Reference	Page
Occupational Exposure		
Monitoring Data		
13006361	ACC, (2023). p-Dichlorobenzene (p-DCB) occupational inhalation exposure study conducted during polyphenylene sulfide manufacture and compounding.	14
6558532	Albrecht, W. (1980). Health hazard evaluation report no. HETA 80-082-773, PPG Industries/Natrium Plant, New Martinsville, West Virginia.	17
5160103	ATSDR, (2006). Toxicological profile for dichlorobenzenes.	18
5258934	ATSDR, (1998). Toxicological profile for 1,4-dichlorobenzene (update).	19
1441172	Bakoğlu, M., Karademir, A., Ayberk, S. (2004). An evaluation of the occupational health risks to workers in a hazardous waste incinerator. Journal of Occupational Health 46(2):156-164.	20
6026451	Chin, J. Y. (2011). Characterization of biofuels blends: Emissions, permeation and apportionment of volatile organic compounds.	21
1990090	Chrostek, W. J., Thoburn, T. W. (1976). Health Hazard Evaluation Determination Report No. HHE-74-107-279, General Electric Company, Silicone Products Department, Waterford, New York. NIOSH(HHE-74-107-279):74-107.	22
1067092	Dodson, R. E., Houseman, E. A., Levy, J. I., Spengler, J. D., Shine, J. P., Bennett, D. H. (2007). Measured and modeled personal exposures to and risks from volatile organic compounds. Environmental Science & Technology 41(24):8498-8505.	23
2048380	Dow Chemical, (1984). Comprehensive industrial hygiene survey for monochlorobenzene and the isomers of dichlorobenzene at the Michigan division chlorobenzol plant.	24
4929943	Dow Chemical, (1982). Trichlorobenzene exposure in the chlorobenzol plant.	25
13170985	Exponent, Inc., (2024). Occupational inhalation exposure assessment for p-dichlorobenzene (with supplemental data and clarification letter).	26
6558518	Fannick, N. (1980). Health hazard evaluation determination report no. HETA 77-99-726, Dupont, Chambers Works, Deepwater, NJ.	27
1469610	Fricke, C., Hardy, J. K. (1992). Protective glove material permeation by organic solids. American Industrial Hygiene Association Journal 53(12):745-750.	28
2193490	Ghittori, S., Imbriani, M., Pezzagno, G., Capodaglio, E. (1985). Urinary elimination of p-dichlorobenzene (p-DCB) and weighted exposure concentration. Giornale Italiano di Medicina del Lavoro 7(2-3):59-63.	29
5465465	Gobba, F., Ghittori, S., Imbriani, M., Maestri, L., Capodaglio, E., Cavalleri, A. (1997). The urinary excretion of solvents and gases for the biological monitoring of occupational exposure: A review. Science of the Total Environment 199(1-2):3-12.	30
5544873	Heavner, D. L., Morgan, W. T., Ogden, M. W. (1996). Determination of volatile organic compounds and respirable suspended particulate matter in New Jersey and Pennsylvania homes and workplaces. Environment International 22(2):159-183.	31
3485315	Hill, R. H., Ashley, D. L., Head, S. L., Needham, L. L., Pirkle, J. L. (1995). p-Dichlorobenzene exposure among 1,000 adults in the United States. Archives of Environmental Health 50(4):277-280.	32
3647	Hollingsworth, R. L., Rowe, V. K., Oyen, F., Hoyle, H. R., Spencer, H. C. (1956). Toxicity of paradichlorobenzene: Determinations on experimental animals and human subjects. Archives of Environmental & Occupational Health 14(2):138-147.	33
27010	IARC, (1982). IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans: Some industrial chemicals and dyestuffs. IARC monographs on the evaluation of carcinogenic risks to humans 29:1-398.	34

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4912310	IARC, (1982). Ortho- and para-dichlorobenzenes. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, vol. 29 29:213-238.	35
666726	IARC, (1999). Some chemicals that cause tumours of the kidney or urinary bladder in rodents and some other substances.	36
81628	IPCS, (1991). Chlorobenzenes other than hexachlorobenzene.	37
2627817	Juvancz, Z., Bodane-Kendrovics, R., Beleznav, P., Erdelyi, I., Klujber-Mohr, M. (2010). Determination of 1,4-dichlorobenzene in environmental matrices. Chromatographia 71(1):S125-S128.	38
3873808	Kularatne, A., R.K. (2017). Occurrence of selected volatile organic compounds in a bra cup manufacturing facility. International Journal of Environmental Science and Technology 14(2):315-322.	39
6021395	Namiesnik, J., Zygmunt, B., Kozdron-Zabiegala, B. (1994). Some aspects of indoor air pollution and analysis. Polish Journal of Environmental Studies 3(4):5-19.	40
6629633	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.	41
3222353	Ng, M. G., Tongeren, van, M., Semple, S. (2014). Simulated transfer of liquids and powders from hands and clothing to the mouth. Journal of Occupational and Environmental Hygiene 11(10):633-644.	43
5155557	NICNAS, (2000). Priority existing chemical assessment report No. 13: Para-dichlorobenzene.	44
4912209	NIEHS, (2004). 1,4-Dichlorobenzene. U.S. National Toxicology Program. Report on Carcinogens 11(2004):III85-III87.	45
3859376	NIOSH, (1981). Health Hazard Evaluation report no. HETA 81-065-938, METRO Bus Maintenance Shop, Washington, DC.	46
10182531	NTP, (2021). Report on carcinogens, fifteenth edition.	47
5160105	NTP, (1987). NTP technical report on the toxicology and carcinogenesis studies of 1,4-dichlorobenzene (CAS no. 106-46-7) in F344/N ats and B6C3F1 mice (gavage studies).	48
4930013	Olin Chemicals, (1987). Industrial hygiene sampling for toluene diisocyanate at Olin Moundsville plant.	49
4930031	Olin Chemicals, (1987). Industrial hygiene sampling for toluene diisocyanate at Olin Chemical Moundsville plant.	50
6499659	OSHA, (2019). Chemical exposure health data (CEHD) sampling results: CASRNs 75-34-3, 85-68-7, 84-74-2, 78-87-5, 117-81-7, 106-93-4, 50-00-0, 95-50-1, 85-44-9, 106-46-7, 79-00-5, and 115-86-6.	51
3118964	Pagnotto, L. D., Walkley, J. E. (1965). Urinary dichlorophenol as an index of para-dichlorobenzene exposure. American Industrial Hygiene Association Journal 26(2):137-141.	52
1023024	Rosenberg, C., Nylund, L., Aalto, T., Kontsas, H., Norppa, H., Jäppinen, P., Vainio, H. (1991). Volatile organohalogen compounds from the bleaching of pulp - Occurrence and genotoxic potential in the work environment. Chemosphere 23(11-12):1617-1628.	53
86402	Sapkota, A., Williams, D., Buckley, T. J. (2005). Tollbooth workers and mobile source-related hazardous air pollutants: How protective is the indoor environment?. Environmental Science & Technology 39(9):2936-2943.	54
12190316	SCI Engineering,, Inc., (2024). Paradichlorobenzene occupational exposure: Willert Home Products, 4044 Park Avenue, St. Louis, Missouri.	55
1953674	Stefaniak, A. B., Breyse, P. N., Murray, M., M.P., Rooney, B. C., Schaefer, J. (2000). An evaluation of employee exposure to volatile organic compounds in three photocopy centers. Environmental Research 83(2):162-173.	57
2443191	Tang, J. H., Chan, C. Y., Wang, X. M., Chan, L. Y., Sheng, G. Y., Fu, J. M. (2005). Volatile organic compounds in a multi-storey shopping mall in guangzhou, South China. Atmospheric Environment 39(38):7374-7383.	58
11224653	U.S. EPA, (2013). Updating CEB's method for screening-level estimates of dermal exposure.	59
73618	Wallace, L. A., Pellizzari, E. D., Hartwell, T. D., Sparacino, C., Whitmore, R., Sheldon, L., Zelon, H., Perritt, R. (1987). The TEAM study: Personal exposures to toxic substances in air, drinking water, and breath of 400 residents of New Jersey, North Carolina, and North Dakota. Environmental Research 43(2):290-307.	60

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21711	Wallace, L. A., Pellizzari, E., Hartwell, T., Rosenzweig, M., Erickson, M., Sparacino, C., Zelon, H. (1984). Personal exposure to volatile organic compounds I Direct measurements in breathing-zone air, drinking water, food, and exhaled breath. <i>Environmental Research</i> 35(1):293-319.	61
23126	Wallace, L. A., Pellizzari, E., Leaderer, B., Zelon, H., Sheldon, L. (1987). Emissions of volatile organic compounds from building materials and consumer products. <i>Atmospheric Environment</i> 21(2):385-393.	62
24793	Wallace, L., Pellizzari, E., Hartwell, T., Zelon, H., Sparacino, C., Perritt, R., Whitmore, R. (1986). Concentrations of 20 volatile organic compounds in the air and drinking water of 350 residents of New Jersey compared with concentrations in their exhaled breath. <i>Journal of Occupational Medicine</i> 28(8):603-608.	63
5550004	Wang, D., Yu, H., Shao, X., Yu, H., Nie, L. (2018). Direct and potential risk assessment of exposure to volatile organic compounds for primary receptor associated with solvent consumption. <i>Environmental Pollution</i> 233:501-509.	64
4697151	Xing, L., Wang, L., Zhang, R. (2018). Characteristics and health risk assessment of volatile organic compounds emitted from interior materials in vehicles: a case study from Nanjing, China. <i>Environmental Science and Pollution Research</i> 25(15):14789-14798.	65
1335671	York., Wehran-New, Inc., (1990). Risk assessment for Buffalo Color area D.	66
Published Models for Exposures or Releases		
32206	Fiserova-Bergerova, V., Pierce, J. T., Droz, P. O. (1990). Dermal absorption potential of industrial chemicals: Criteria for skin notation. <i>American Journal of Industrial Medicine</i> 17(5):617-635.	67
Completed Exposure or Risk Assessments		
449472	Aronson, D. B., Bosch, S., Gray, D. A., Howard, P. H., Guiney, P. D. (2007). A comparative human health risk assessment of p-dichlorobenzene-based toilet rimblock products versus fragrance/surfactant-based alternatives. <i>Journal of Toxicology and Environmental Health, Part B: Critical Reviews</i> 10(7):467-526.	68
824309	Chang, E. E., Wang, W. C., Zeng, L. X., Chiang, H. L. (2010). Health risk assessment of exposure to selected volatile organic compounds emitted from an integrated iron and steel plant. <i>Inhalation Toxicology</i> 22 (Suppl. 2)(SUPPL. 2):117-125.	69
2536230	Du, Z., Mo, J., Zhang, Y. (2014). Risk assessment of population inhalation exposure to volatile organic compounds and carbonyls in urban China. <i>Environment International</i> 73:33-45.	70
5017839	ECHA, (2004). European Union risk assessment report: 1,4-dichlorobenzene.	71
3827300	OECD, (2013). Emission scenario document on the industrial use of adhesives for substrate bonding.	72
3827416	OECD, (2004). Emission scenario document on lubricants and lubricant additives.	73
6385735	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.	74
10480466	U.S. EPA, (2023). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).	75
11182966	U.S. EPA, (2022). Chemical repackaging - Generic scenario for estimating occupational exposures and environmental releases (revised draft).	76
11203977	U.S. EPA, (2021). Use of chemicals in fuels and related products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).	77
6311218	U.S. EPA, (2004). Additives in plastics processing (compounding) – generic scenario for estimating occupational exposures and environmental release – Draft.	79
8726954	U.S. EPA, (1992). Generic scenario document for lube oil additives.	80
Reports for Data or Information Other than Exposure or Release Data		
1997907	Bauer, A. (2013). Contact dermatitis in the cleaning industry. <i>Current Opinion in Allergy and Clinical Immunology</i> 13(5):521-524.	83

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7309849	Bender, H. F., Eisenbarth, P. (2007). Occupational safety and health at the workplace: Sections 6.1–6.8. :147-256.	84
12034026	Bonner, E. M., Poutasse, C. M., Haddock, C. K., Poston, C., W.S., Jahnke, S. A., Tidwell, L. G., Anderson, K. A. (2024). Addressing the need for individual-level exposure monitoring for firefighters using silicone samplers.	85
628645	CalEPA, (2008). TSD for noncancer RELs - Appendix D.3 Chronic RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines (OEHHA 1999).	87
664488	CDC, (2009). Fourth national report on human exposure to environmental chemicals.	88
4930963	Cherrie, J. W. (1998). Selecting an adequate respiratory protective device: The choice between a respirator and breathing apparatus. Annals of Occupational Hygiene 42(2):91-95.	89
7978648	CPA, (2005). Letter to OPPT Document Control Office, USEPA, from Lynne Jones, Manager, Chlorobenzene Producers Association, re: Study entitled "p-Dichlorobenzene: In Vitro Dermal Absorption Rate Testing".	90
1618719	Fasano, W. J., McDougal, J. N. (2008). In vitro dermal absorption rate testing of certain chemicals of interest to the Occupational Safety and Health Administration: Summary and evaluation of USEPA's mandated testing. Regulatory Toxicology and Pharmacology 51(2):181-194.	91
4931409	Hsiao, P. K., Lin, Y. C., Shih, T. S., Chiung, Y. M. (2009). Effects of occupational exposure to 1,4-dichlorobenzene on hematologic, kidney, and liver functions. International Archives of Occupational and Environmental Health 82(9):1077-1085.	92
18474	IARC, (1999). Hexachlorobutadiene. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 73 73:277-294.	93
4912333	Leong, K. J., Dowd, G. F., Macfarland, H. N. (1964). P-dichlorobenzene (1, 4-dichlorobenzene). American Industrial Hygiene Association Journal 25(3):323-325.	94
4929935	(1982). Investigation of exposure to paradow at the new rolling mill. :Order this.	95
192177	NIOSH, (2007). NIOSH pocket guide to chemical hazards.	96
7978675	NIOSH, (2006). Letter to Catherine Roman, USEPA, re: Review of "Chlorobenzene - In Vitro Dermal Absorption Rate Testing" and "p-dichlorobenzene - In Vitro Dermal Absorption Rate Testing".	97
8408530	NIOSH, (1978). Occupational health guideline for p-dichlorobenzene.	98
6294050	Products, Convenience (2016). Safety Data Sheet (SDS): Touch 'n Foam Mouse Shield.	99
11138808	U.S. BLS, (2023). U.S. Census Bureau of Labor Statistics Data from 2021.	100
10366189	U.S. EPA, (2020). 2020 CDR: Commercial and consumer use.	101
13246149	U.S. EPA, (2026). Chemical Data Reporting (CDR): Reporting year 2024.	103
6275311	U.S. EPA, (2020). 2020 CDR data.	104
5489562	Zaman, R. (1992). Solving air emissions problems from metal cleaning operations. The National Environmental Journal 2(4):44.	105
Environmental Releases		
Environmental Release Data		
7303021	AS,, COWI (2018). Screening programme 2017: Suspected PBT compounds.	106
3572863	Atasoy, E., Döğeroğlu, T., Kara, S. (2004). The estimation of NMVOC emissions from an urban-scale wastewater treatment plant. Water Research 38(14-15):3265-3274.	107
5160103	ATSDR, (2006). Toxicological profile for dichlorobenzenes.	108
5258934	ATSDR, (1998). Toxicological profile for 1,4-dichlorobenzene (update).	110

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5251828	Brown, S. L., Chan, F. Y., Jones, J. L., Liu, D. H., Mccaleb, K. E. (1975). Research program on hazard priority ranking of manufactured chemicals (Chemicals 21-40).	111
5155646	CalEPA, (1997). Public health goal for 1,4-dichlorobenzene in drinking water.	112
628645	CalEPA, (2008). TSD for noncancer RELs - Appendix D.3 Chronic RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines (OEHHA 1999).	113
6026451	Chin, J. Y. (2011). Characterization of biofuels blends: Emissions, permeation and apportionment of volatile organic compounds.	114
1335586	Clement Associates,, Inc. (1989). Human health risk assessment for the Ciba-Geigy St Gabriel, LA incineration project with cover letter dated 042789. 890000189:#86-890000189.	115
6026136	Cordova-Orellana, C. (2017). Air toxic emissions and associated health risks in Cook County, IL.	116
1487499	Cudahy, J. J. (1998). Low waste feed concentrations and destruction removal efficiency. Waste Management 18(6-8):453-459.	117
10385015	Earthjustice, (2020). Exhibit 1 to comments of rubbertown emergency action et al., re: TSCA risk evaluations for high-priority substances and substances undergoing manufacturer-requested risk evaluations.	118
6311590	Ecology and Environment, (1992). Site investigation and evaluation of remedial measures report Howard Hughes properties plant site, Los Angeles, California.	119
1481756	ENSR, (1991). Ab 2588 Health Risk Assessment for Kern River and Racetrack Oil Fields, Bakersfield, California with attachments and cover letter dated 090591.	120
7349020	ERG, (1998). Air emissions inventories, volume 2: Point sources: Chapter 11: Preferred and alternative methods for estimating air emissions from plastic products manufacturing.	121
2048411	Gullett, B. K., Oudejans, L., Tabor, D., Touati, A., Ryan, S. (2012). Near-real-time combustion monitoring for PCDD/PCDF indicators by GC-REMPI-TOFMS. Environmental Science & Technology 46(2):923-928.	122
5245498	Harkov, R., Gianti, S. J., Bozzelli, J. W., Laregina, J. E. (1985). Monitoring volatile organic compounds at hazardous and sanitary landfills in New Jersey. Journal of Environmental Science and Health, Part A: Environmental Science and Engineering 20(5):491-502.	123
658817	Hart, J. R. (1994). Comparison of emissions from burning hazardous waste in a dry-process cement kiln with emission from burning conventional fossil fuels. Hazardous Waste and Hazardous Materials 11(1):193-199.	124
18474	IARC, (1999). Hexachlorobutadiene. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 73 73:277-294.	125
27010	IARC, (1982). IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans: Some industrial chemicals and dyestuffs. IARC monographs on the evaluation of carcinogenic risks to humans 29:1-398.	126
4912310	IARC, (1982). Ortho- and para-dichlorobenzenes. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, vol. 29 29:213-238.	127
666726	IARC, (1999). Some chemicals that cause tumours of the kidney or urinary bladder in rodents and some other substances.	129
81628	IPCS, (1991). Chlorobenzenes other than hexachlorobenzene.	130
5443237	Luin, Van, A. B., Starkenburg, Van, W. (1985). Hazardous Substances in Waste Water. Water Science and Technology 17(6-7):843–853.	131
660263	Macleod, M., Mackay, D. (1999). An assessment of the environmental fate and exposure of benzene and the chlorobenzenes in Canada. Chemosphere 38(8):1777-1796.	132
87136	Middleton, P., Sockwell, R., Carter, L., W.P. (1990). Aggregation and analysis of volatile organic compound emissions for regional modeling. Atmospheric Environment, Part A: General Topics 24(5):1107-1133.	133
1269556	Midwest Research Institute, (1984). Performance evaluation of full-scale hazardous waste incinerators - Volume I (excutive summary) contract no. 68-02-3177 (43).	134

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11360398	Milbrandt, A., Coney, K., Badgett, A., Beckham, G. T. (2022). Quantification and evaluation of plastic waste in the United States. Resources, Conservation and Recycling 183:106363.	135
5705544	Miller, C., Srivastava, R. K., Ryan, J. V. (1994). Emissions of organic hazardous air pollutants from the combustion of pulverized coal in a small-scale combustor. Environmental Science & Technology 28(6):1150.	137
1025153	Nakamura, J., Azuma, N., Kameya, T., Kobayashi, T., Urano, K. (2008). Analysis of the toxicity-weighted release amount ranking of PRTR chemicals in Japan. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 43(5):452-459.	138
6021395	Namiesnik, J., Zygmunt, B., Kozdron-Zabiegala, B. (1994). Some aspects of indoor air pollution and analysis. Polish Journal of Environmental Studies 3(4):5-19.	139
1998192	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).	140
6629633	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.	144
5155557	NICNAS, (2000). Priority existing chemical assessment report No. 13: Para-dichlorobenzene.	145
4912209	NIEHS, (2004). 1,4-Dichlorobenzene. U.S. National Toxicology Program. Report on Carcinogens 11(2004):III85-III87.	146
5079084	OECD, (2009). Emission scenario document on plastic additives.	147
6306753	OECD, (2011). Emission scenario document on the chemical industry.	148
4930031	Olin Chemicals, (1987). Industrial hygiene sampling for toluene diisocyanate at Olin Chemical Moundsville plant.	149
1481749	Radian Corp, (1991). Letter from Chevron Corporation to USEPA submitting enclosed submission of four Chevron USA oil production facility risk assessment facilities in California with attachments.	150
5159927	RIVM, (1991). Integrated criteria document chlorobenzenes. :281.	151
2310704	Tansel, B., Eyma, R. R. (1999). Volatile organic contaminant emissions from wastewater treatment plants during secondary treatment. Water, Air, and Soil Pollution 112(3-4):3-4.	152
13243354	U.S. EPA, (2020). National Emissions Inventory (NEI): p-Dichlorobenzene (pDCB), reporting years 2017 and 2020.	153
13243355	U.S. EPA, (2023). Discharge Monitoring Report (DMR) data: p-Dichlorobenzene (pDCB), reporting years 2019-2023.	154
13243358	U.S. EPA, (2023). Toxics Release Inventory (TRI) data: p-Dichlorobenzene (pDCB), reporting years 2019-2023.	155
46492	U.S. EPA, (1995). AP-42: Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition.	156
6535959	U.S. EPA, (2019). National Emissions Inventory (NEI) [database]: CASRNs 79-00-5, 75-34-3, 107-06-2, 78-87-5, 84-61-7, 106-99-0, 106-93-4, 50-00-0, 85-44-9, 106-46-7, 85-68-7, 84-74-2, and 115-86-6.	157
7315841	U.S. EPA, (1995). Ap-42: Chapter 4.12 - Manufacture of rubber products.	158
8347325	U.S. EPA, (2021). National analysis TRI dataset (TRI): Data used for TSCA risk evaluations, reporting year 2019.	159
8784984	U.S. EPA, (2019). TRI on-site and off-site reported disposed of or otherwise released (in pounds), for all industries.	160
23126	Wallace, L. A., Pellizzari, E., Leaderer, B., Zelon, H., Sheldon, L. (1987). Emissions of volatile organic compounds from building materials and consumer products. Atmospheric Environment 21(2):385-393.	161
5252426	Zuraimi, Tham, K. W., Sekhar, S. C. (2004). A study on the identification and quantification of sources of VOCs in 5 air-conditioned Singapore office buildings. Building and Environment 39(2):165.	162
Completed Exposure or Risk Assessments		
5017839	ECHA, (2004). European Union risk assessment report: 1,4-dichlorobenzene.	163

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3827416	OECD, (2004). Emission scenario document on lubricants and lubricant additives.	165
6385735	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.	166
6393282	OECD, (2009). Emission scenario document on transport and storage of chemicals.	167
10480466	U.S. EPA, (2023). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).	168
11182966	U.S. EPA, (2022). Chemical repackaging - Generic scenario for estimating occupational exposures and environmental releases (revised draft).	169
11203977	U.S. EPA, (2021). Use of chemicals in fuels and related products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).	170
6311218	U.S. EPA, (2004). Additives in plastics processing (compounding) – generic scenario for estimating occupational exposures and environmental release – Draft.	172
8726954	U.S. EPA, (1992). Generic scenario document for lube oil additives.	173
Reports for Data or Information Other than Exposure or Release Data		
5251382	Anonymous, (1987). Chemical review: 1,4-dichlorobenzene. Dangerous Properties of Industrial Materials Report 7(4):7-25.	176
3585789	Clapp, L. W., Talarczyk, M. R., Park, J. K., Boyle, W. C. (1994). Performance comparison between activated-sludge and fixed-film processes for priority pollutant removals. Water Environment Research 66(2):153-160.	177
659922	Dempsey, C. R. (1993). A comparison of organic emissions from hazardous waste incinerators versus the 1990 toxics release inventory air releases. Journal of the Air and Waste Management Association 43(10):1374-1379.	178
4728647	Deng, Y., Bonilla, M., Ren, H., Zhang, Y. (2018). Health risk assessment of reclaimed wastewater: A case study of a conventional water reclamation plant in Nanjing, China. Environment International 112:235-242.	179
7681885	EC, (1987). Guidelines for Canadian drinking water quality: Guideline technical document – Dichlorobenzenes.	180
63834	Ifeadi, C. N. (1975). Screening study to develop background information and determine the significance of air contaminant emissions from pesticide plants.	181
5255836	Love, O. T., Jr, Miltner, R. J., Eilers, R. G., Fronk-Leist, C. A. (1983). Treatment of volatile organic compounds in drinking water.	182
3828879	Marshall, K. A., Pottenger, L. H. (2016). Chlorocarbons and chlorohydrocarbons. :1-29.	183
8408530	NIOSH, (1978). Occupational health guideline for p-dichlorobenzene.	184
4912307	Ware, G. W. (1988). Ortho-, meta-, and para-dichlorobenzene. Reviews of Environmental Contamination and Toxicology 106:51-68.	185
General Engineering Assessment		
Completed Exposure or Risk Assessments		
5017839	ECHA, (2004). European Union risk assessment report: 1,4-dichlorobenzene.	186
3827300	OECD, (2013). Emission scenario document on the industrial use of adhesives for substrate bonding.	187
3827416	OECD, (2004). Emission scenario document on lubricants and lubricant additives.	188
6385735	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.	189
6393282	OECD, (2009). Emission scenario document on transport and storage of chemicals.	190

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10480466	U.S. EPA, (2023). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).	191
11182966	U.S. EPA, (2022). Chemical repackaging - Generic scenario for estimating occupational exposures and environmental releases (revised draft).	192
11203977	U.S. EPA, (2021). Use of chemicals in fuels and related products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).	193
6311218	U.S. EPA, (2004). Additives in plastics processing (compounding) – generic scenario for estimating occupational exposures and environmental release – Draft.	194
8726954	U.S. EPA, (1992). Generic scenario document for lube oil additives.	195
Reports for Data or Information Other than Exposure or Release Data		
13006361	ACC, (2023). p-Dichlorobenzene (p-DCB) occupational inhalation exposure study conducted during polyphenylene sulfide manufacture and compounding.	198
2529471	Anonymous (1996). No additional spent solvent listings proposed. Hazardous Waste Consultant 14(7):B7-B11.	200
5251382	Anonymous, (1987). Chemical review: 1,4-dichlorobenzene. Dangerous Properties of Industrial Materials Report 7(4):7-25.	201
11360400	APR, (2020). U.S. post-consumer plastic recycling data.	202
10139648	Aragón-González, G., Barragán-Santiago, I., Cano-Blanco, M., León-Galicia, A., Morales-Gómez, J. R. (2019). Automatic tablet machine. Journal of Physics: Conference Series 1221(1):012030.	203
449472	Aronson, D. B., Bosch, S., Gray, D. A., Howard, P. H., Guiney, P. D. (2007). A comparative human health risk assessment of p-dichlorobenzene-based toilet rimblock products versus fragrance/surfactant-based alternatives. Journal of Toxicology and Environmental Health, Part B: Critical Reviews 10(7):467-526.	204
5160103	ATSDR, (2006). Toxicological profile for dichlorobenzenes.	205
5258934	ATSDR, (1998). Toxicological profile for 1,4-dichlorobenzene (update).	207
1441172	Bakoğlu, M., Karademir, A., Ayberk, S. (2004). An evaluation of the occupational health risks to workers in a hazardous waste incinerator. Journal of Occupational Health 46(2):156-164.	210
8486216	Betts, W. D. (2000). Tar and pitch. :1-31.	211
5251828	Brown, S. L., Chan, F. Y., Jones, J. L., Liu, D. H., Mccaleb, K. E. (1975). Research program on hazard priority ranking of manufactured chemicals (Chemicals 21-40).	212
5155646	CalEPA, (1997). Public health goal for 1,4-dichlorobenzene in drinking water.	213
664488	CDC, (2009). Fourth national report on human exposure to environmental chemicals.	214
6026451	Chin, J. Y. (2011). Characterization of biofuels blends: Emissions, permeation and apportionment of volatile organic compounds.	215
1335586	Clement Associates,, Inc, (1989). Human health risk assessment for the Ciba-Geigy St Gabriel, LA incineration project with cover letter dated 042789. 890000189:#86-890000189.	216
3464314	Csiszar, S. A., Meyer, D. E., Dionisio, K. L., Egeghy, P., Isaacs, K. K., Price, P. S., Scanlon, K. A., Tan, Y. M., Thomas, K., Vallero, D., Bare, J. C. (2016). Conceptual framework to extend life cycle assessment using near-field human exposure modeling and high-throughput tools for chemicals. Environmental Science & Technology 50(21):11922-11934.	217
4728647	Deng, Y., Bonilla, M., Ren, H., Zhang, Y. (2018). Health risk assessment of reclaimed wastewater: A case study of a conventional water reclamation plant in Nanjing, China. Environment International 112:235-242.	218
10385015	Earthjustice, (2020). Exhibit 1 to comments of rubbertown emergency action et al., re: TSCA risk evaluations for high-priority substances and substances undergoing manufacturer-requested risk evaluations.	219

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1487387	Eklund, B., Anderson, E. P., Walker, B. L., Burrows, D. B. (1998). Characterization of landfill gas composition at the Fresh Kills municipal solid-waste landfill. <i>Environmental Science & Technology</i> 32(15):2233-2237.	220
11360395	ENF, (2024). Plastic recycling plants in the United States.	221
7349020	ERG, (1998). Air emissions inventories, volume 2: Point sources: Chapter 11: Preferred and alternative methods for estimating air emissions from plastic products manufacturing.	222
13170985	Exponent,, Inc., (2024). Occupational inhalation exposure assessment for p-dichlorobenzene (with supplemental data and clarification letter).	223
659539	Fishbein, L. (1979). Potential halogenated industrial carcinogenic and mutagenic chemicals. IV. Halogenated aryl derivatives. <i>Science of the Total Environment</i> 11(3):259-278.	224
4915094	Gamble, M. H. (1979). Para-dichlorobenzene. <i>Chemistry in Britain</i> 15(1):12.	225
8486226	Garbassi, F., Po, R. (2001). Engineering thermoplastics. :168-228.	226
8486224	Geibel, J., Leland, J. (2000). Polymers containing sulfur, poly(phenylene sulfide).	227
1010267	Hansen, J., Schneider, T., Olsen, J. H., Laursen, B. (1993). Availability of data on humans potentially exposed to suspected carcinogens in the Danish working environment. <i>Pharmacology & Toxicology</i> 72(Supplement 1):77-85.	228
3485315	Hill, R. H., Ashley, D. L., Head, S. L., Needham, L. L., Pirkle, J. L. (1995). p-Dichlorobenzene exposure among 1,000 adults in the United States. <i>Archives of Environmental Health</i> 50(4):277-280.	229
4931409	Hsiao, P. K., Lin, Y. C., Shih, T. S., Chiung, Y. M. (2009). Effects of occupational exposure to 1,4-dichlorobenzene on hematologic, kidney, and liver functions. <i>International Archives of Occupational and Environmental Health</i> 82(9):1077-1085.	230
18474	IARC, (1999). Hexachlorobutadiene. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 73 73:277-294.	231
27010	IARC, (1982). IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans: Some industrial chemicals and dyestuffs. IARC monographs on the evaluation of carcinogenic risks to humans 29:1-398.	232
4912310	IARC, (1982). Ortho- and para-dichlorobenzenes. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, vol. 29 29:213-238.	233
666726	IARC, (1999). Some chemicals that cause tumours of the kidney or urinary bladder in rodents and some other substances.	234
63834	Ifeadi, C. N. (1975). Screening study to develop background information and determine the significance of air contaminant emissions from pesticide plants.	235
81628	IPCS, (1991). Chlorobenzenes other than hexachlorobenzene.	236
2627817	Juvancz, Z., Bodane-Kendrovics, R., Beleznyay, P., Erdelyi, I., Klujber-Mohr, M. (2010). Determination of 1,4-dichlorobenzene in environmental matrices. <i>Chromatographia</i> 71(1):S125-S128.	237
5177139	Krishnamurti, R. (2001). Chlorinated benzenes.	238
3491065	Lim, H. H., Shin, H. S. (2017). Sensitive Determination of Volatile Organic Compounds and Aldehydes in Tattoo Inks. <i>Journal of Chromatographic Science</i> 55(2):109-116.	241
2161460	Liu, W., Zheng, M., Wang, D., Xing, Y., Zhao, X., Ma, X., Qian, Y. (2004). Formation of PCDD/Fs and PCBs in the process of production of 1,4-dichlorobenzene. <i>Chemosphere</i> 57(10):1317-1323.	242
3828879	Marshall, K. A., Pottenger, L. H. (2016). Chlorocarbons and chlorohydrocarbons. :1-29.	243
1269556	Midwest Research Institute, (1984). Performance evaluation of full-scale hazardous waste incinerators - Volume I (excutive summary) contract no. 68-02-3177 (43).	244
11360398	Milbrandt, A., Coney, K., Badgett, A., Beckham, G. T. (2022). Quantification and evaluation of plastic waste in the United States. <i>Resources, Conservation and Recycling</i> 183:106363.	245

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1998192	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).	247
4929935	(1982). Investigation of exposure to paradow at the new rolling mill. :Order this.	250
6629633	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.	251
5155557	NICNAS, (2000). Priority existing chemical assessment report No. 13: Para-dichlorobenzene.	255
4912209	NIEHS, (2004). 1,4-Dichlorobenzene. U.S. National Toxicology Program. Report on Carcinogens 11(2004):III85-III87.	256
8408530	NIOSH, (1978). Occupational health guideline for p-dichlorobenzene.	257
10182531	NTP, (2021). Report on carcinogens, fifteenth edition.	258
5160105	NTP, (1987). NTP technical report on the toxicology and carcinogenesis studies of 1,4-dichlorobenzene (CAS no. 106-46-7) in F344/N ats and B6C3F1 mice (gavage studies).	263
6306753	OECD, (2011). Emission scenario document on the chemical industry.	264
6294050	Products, Convenience (2016). Safety Data Sheet (SDS): Touch 'n Foam Mouse Shield.	265
4912589	Ren, Z., Lu, Y., Li, Q., Sun, Y., Wu, C., Ding, Q. (2018). Occurrence and characteristics of PCDD/Fs formed from chlorobenzenes production in China. Chemosphere 205:267-274.	266
5159927	RIVM, (1991). Integrated criteria document chlorobenzenes. :281.	267
12190316	SCI Engineering,, Inc., (2024). Paradichlorobenzene occupational exposure: Willert Home Products, 4044 Park Avenue, St. Louis, Missouri.	268
659430	Stangroom, S. J., Collins, C. D., Lester, J. N. (1998). Sources of organic micropollutants to lowland rivers. Environmental Technology 19(7):643-666.	269
13172198	Supelco, (2022). Certificate of Analysis - Certified Reference Material: EPA 502/524 Volatiles Organic Calibration Mix (without gases).	270
13172384	Supelco, (2025). Safety Data Sheet (SDS): EPA 502/524 Volatiles Organic Calibration Mix (without gases).	271
11138808	U.S. BLS, (2023). U.S. Census Bureau of Labor Statistics Data from 2021.	272
10366189	U.S. EPA, (2020). 2020 CDR: Commercial and consumer use.	273
13246149	U.S. EPA, (2026). Chemical Data Reporting (CDR): Reporting year 2024.	274
46492	U.S. EPA, (1995). AP-42: Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition.	275
6275311	U.S. EPA, (2020). 2020 CDR data.	276
7315841	U.S. EPA, (1995). Ap-42: Chapter 4.12 - Manufacture of rubber products.	277
8347325	U.S. EPA, (2021). National analysis TRI dataset (TRI): Data used for TSCA risk evaluations, reporting year 2019.	278
3108349	Vonrumker, R., Lawleww, E. W., Meiners, A. F. (1974). Production, distribution, use and environmental impact potential of selected pesticides.	279
5253127	Wallace, L. (1990). Major sources of exposure to benzene and other volatile organic chemicals. Risk Analysis 10(1):59-64.	280
1482637	Wallace, L. A. (1989). The total exposure assessment methodology (TEAM) study: an analysis of exposures, sources, and risks associated with four volatile organic chemicals. Journal of the American College of Toxicology 8(5):883-895.	281
4912307	Ware, G. W. (1988). Ortho-, meta-, and para-dichlorobenzene. Reviews of Environmental Contamination and Toxicology 106:51-68.	282

5489562	Zaman, R. (1992). Solving air emissions problems from metal cleaning operations. The National Environmental Journal 2(4):44.	283
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Study Citation:	ACC, (2023). p-Dichlorobenzene (p-DCB) occupational inhalation exposure study conducted during polyphenylene sulfide manufacture and compounding.			
HERO ID:	13006361			
Conditions of Use:	Processing as a Reactant			
EXTRACTION				
Parameter	Data			
Worker activity description:	Lasks listed on page 4. Page 6 has worker and ONU activities in a PPS resin manufacturing facility. Does not include maintenance (but described in supplement PDF)PDF Pg. 8”Material HandlersUnloading trucks, tanker cars, tanker trailers and ISO containers to storage tanks and other general material handling activities; Unloading and loading activities (connecting/disconnecting)Process Field OperatorsGeneral production activities including collecting process and slurry samples (not involved with unloading material); Process samplingLab TechniciansCollecting field samples, sample preparation and analysisONUBoard operator; shift team leader; shift supervisor; DCS engineer; office/non-process personnel; Packaging/Warehousing; Warehouse Technician			
Exposure route:	Inhalation			
Physical form:	Liquid (page 5)			
Personal sampling data:	PBZ sampling data is given in Tables 1 and 2 (Excel attachment - ”13006361_IH Data”). Data includes 105 total samples ranging in concentration from 0.0041-1.7 ppm.			
Exposure duration:	Task activities vary from 0.2-12 hours per Table 2.			
Exposure frequency:	PDF Pg. 4”The manufacturing units operate 24/7, year round.”			
Number of workers:	PDF Pg. 5Celanese Wilmington: ”2-3 workers per shift and 1 lab tech per shift out of >100 site workers are in potential exposure areas.”Solvay Borger: number not listed, just demographic %s.			
Personal protective equipment:	PDF Pg. 6-7”Typical PPEincludes:• Material Handlers- flame resistant clothing (FRC), Chem. Jacket, safety glasses, faceshield, steel toe shoes, gloves, hearing protection• Process Field Operators- FRC, hard hat, safety glasses, steel toe shoes, gloves, faceshield, hearing protection• Lab Technicians- flame resistant clothing, lab coat, safety glasses, steel toe shoes, glovesONU- Depends on role (see report)Workers wear chemically resistant gloves with specific application training, a protection factor of 20 according to the ECETOC TRA Version 3.2”			
Engineering control:	PDF Pg. 4 describes lab PPE. Celanese’s laboratory facilities are used for process samples. Chemical samples are handled inhoods with face velocities meeting OSHA Laboratory Standards of 60-100 lfm in 29 CFR 1910.1450. Solvay’s laboratory facilities are located at another location a few miles from the facility. Chemical samples are handled in hoods and the internal Standard Operating Procedure (SOP) requires the hoods to be between 80-120 lfm per the ANSI/AIHA Z9.5 Standard and ACGIH Industrial Ventilation Manual.Facilities are open air (page 2)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Sampling and Analytical Methodology	High	Sampling/analytical methodology is an approved NIOSH method.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Data are from the U.S.	
	Metric 3: Applicability	High	Data are for process as a reactant, an in-scope occupational scenario.	
	Metric 4: Temporal Representativeness	High	Monitoring data are no more than 10 years old. [2023]	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All metadata provided.	
Domain 4: Variability and Uncertainty				
Continued on next page ...				

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Study Citation:		ACC, (2023). p-Dichlorobenzene (p-DCB) occupational inhalation exposure study conducted during polyphenylene sulfide manufacture and compounding.		
HERO ID:		13006361		
Conditions of Use:		Processing as a Reactant		
Domain		Metric	EVALUATION	
			Rating	Comments
Metric 7:		Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling multiple worker activities at multiple facilities.
Overall Quality Determination			High	

Study Citation:	ACC, (2023). p-Dichlorobenzene (p-DCB) occupational inhalation exposure study conducted during polyphenylene sulfide manufacture and compounding.			
HERO ID:	13006361			
Conditions of Use:	Plastic compounding			
EXTRACTION				
Parameter	Data			
Worker activity description:	PDF Pg. 8CompoundingProcess Expert- Extrusion Operator”			
Exposure route:	Inhalation			
Physical form:	solid (page 5)			
Personal sampling data:	PBZ sampling data is given in Tables 1 and 2 (Excel attachment - ”13006361_IH Data”). Data includes 7 samples for compounding activities.			
Exposure duration:	12 hours (Table 2)			
Exposure frequency:	PDF Pg. 4”The manufacturing units operate 24/7, year round.”			
Number of workers:	PDF Pg. 5Compounding: ”Three (3) compounding machines are run 24/7, with one operator per machine. >100 operators are qualified in this role, and assignments vary regularly.”			
Personal protective equipment:	PDF Pg. 6-7”Typical PPEincludes:• Compounding- Hard hat, safety glasses, gloves, steel toe shoes, hearing protectionONU- Depends on role (see report)Workers wear chemically resistant gloves with specific application training, a protection factor of 20 according to the ECETOC TRA Version 3.2”			
Engineering control:	PDF Pg. 5”Extruders have individual exhaust ventilation over the die heads.”			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Sampling/analytical methodology is an approved NIOSH method.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for plastic compounding, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Monitoring data are no more than 10 years old. [2023]
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All metadata provided.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling multiple worker activities at multiple facilities.
Overall Quality Determination		High		

Study Citation:	Albrecht, W. (1980). Health hazard evaluation report no. HETA 80-082-773, PPG Industries/Natrium Plant, New Martinsville, West Virginia.			
HERO ID:	6558532			
Conditions of Use:	manufacture			
EXTRACTION				
Parameter	Data			
Worker activity description:	drumming operation			
Exposure route:	inhalation			
Personal sampling data:	pDCB measured for extra operator-loader in p-DCB drumming area: 32.5 mg/m3			
Area sampling data:	pDCB concentration in p-DCB drumming area: (a) Scales: 52.1 mg/m3; (b) in front of filling toward booth: 30.7 mg/m3.			
Number of workers:	2			
Personal protective equipment:	disposal gloves, respiratory protection when engaged in measuring tank volume and other associated tasks			
Engineering control:	The local exhaust ventilation intake could be greatly improved by the addition of a circular flange on the duct.			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	methodology is approved and well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	the data is greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include sampling type and exposure type and worker activity only.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	ATSDR, (2006). Toxicological profile for dichlorobenzenes.			
HERO ID:	5160103			
Conditions of Use:	Processing			
EXTRACTION				
Parameter	Data			
Exposure route:	Inhalation			
Area sampling data:	Workplace air levels of 1,4-DCB ranging up to 4,350 mg/m3 (724 ppm) were measured at facilities producing or using the compound (IARC 1982). Levels of 1,4-DCB detected in workplace air: in Monochlorobenzene manufacturing plant - range - 5.4 - 8.7 ppm, in abrasive-wheel plant - range - 8 - 11.5 ppm, in mothball manufacturing plant - range - 9 - 25 ppm, chlorobenzene manufacturing plant - range - 24 - 34 ppm, in 1,4-DCB manufacturing plant - range - 12 - 548 ppm, in monochlorobenzene and dichlorobenzene manufacturing plant - max - 724 ppm			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	Sampling or analytical methodology is not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	contains only critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	ATSDR, (1998). Toxicological profile for 1,4-dichlorobenzene (update).			
HERO ID:	5258934			
Conditions of Use:	Process as reactant;Incorporation into formulation			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation			
Physical form:	colorless or white solid			
Personal sampling data:	the median concentration detected from personal air monitoring of 1,650 individuals was 0.416 ppb (Shah and Heyerdahl 1988).			
Area sampling data:	median indoor air concentration of 1,4-dichlorobenzene detected at 2,121 sites was 0.283 ppb (mean 3.988 ppb). concentrations ranged from 33-52 mg/m3 (5.4-8.7 ppm) detected in air sampled at a monochlorobenzene manufacturing facility to 4,350 mg/m3 (724 ppm) detected in air sampled at a plant manufacturing monochlorobenzene and dichlorobenzene; air of factories that make orprocess 1,4-dichlorobenzene products have ranged from 5.6 to 748 ppm of air. Table 5-5 contains monitoring amounts per occupation.			
Number of workers:	35,000 workers in US; depends on the study			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	Methodology for monitoring data is not specified in this report.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for occupational scenarios within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5:	Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data does indicate type of sampling and occupation but lacks additional meta-data
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty in monitoring results.
Overall Quality Determination		Medium		

Study Citation:	Bakoğlu, M., Karademir, A., Ayberk, S. (2004). An evaluation of the occupational health risks to workers in a hazardous waste incinerator. Journal of Occupational Health 46(2):156-164.			
HERO ID:	1441172			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Worker activity description:	incinerator workers at IZAYDAS incinerator			
Exposure route:	inhalation			
Area sampling data:	Concentrations (ppb) at sampling point 1 - 1.46 and at sampling point 2 - 1.83. Exposure limit values - 75 x 10^3 ppb			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Sampling or analytical methodology is an approved OSHA or NIOSH method
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	Data is from Turkey (OECD country)
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	data is between 10 and 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include most critical metadata,
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The monitoring study provides only limited discussion of the variability in the determinants of exposure for the sampled site or sector. The monitoring study provides only limited discussion of the uncertainty in the exposure estimates.
Overall Quality Determination		Medium		

Study Citation:	Chin, J. Y. (2011). Characterization of biofuels blends: Emissions, permeation and apportionment of volatile organic compounds.			
HERO ID:	6026451			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Worker activity description:	Fuel-related			
Exposure route:	inhalation and dermal exposures			
Area sampling data:	Mean concentration - 0.45 +/- 0.67 ug/m3, range - 0.03 - 6.04 ug/m3			
Dermal exposure data:	modeled/assumed			
Exposure duration:	modeled/assumed			
Personal protective equipment:	Viton gloves provided excellent protection for gasoline. Both Viton and nitrile Sol-Vex materials gave good protection for diesel and B20, and neoprene gave acceptable protection			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	methodology well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	data is less than 10 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion on uncertainty
Overall Quality Determination		High		

Study Citation:	Chrostek, W. J., Thoburn, T. W. (1976). Health Hazard Evaluation Determination Report No. HHE-74-107-279, General Electric Company, Silicone Products Department, Waterford, New York. NIOSH(HHE-74-107-279):74-107.
HERO ID:	1990090
Conditions of Use:	Processing or Industrial Use in the manufacture of silicone products.

EXTRACTION	
Parameter	Data
Worker activity description:	Working in silane reactor plant of the General Electric plant in Waterford, N.Y.
Exposure route:	inhalation
Physical form:	gaseous form
Personal sampling data:	10 personal and general air samples were collected from the silane reactor area and analyzed for dichlorobenzene. All samples were below 0.005 mg/m3 which is the lower limit of sensitivity for p-DCB. The 8-hr TWA for p-DCB is 450 mg/m3.
Area sampling data:	see above. Dichlorobenzene concentrations in the samples were less than 0.005 mg/m3.
Personal protective equipment:	no specific PPE was indicated for the silane reactor area.

		EVALUATION		
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	approved OSHA method
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	Data greater than 20 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include sample type (e.g., personal breathing zone) and exposure type (vapor) but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	does not address variability or uncertainty.

Overall Quality Determination	High
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Study Citation:	Dodson, R. E., Houseman, E. A., Levy, J. I., Spengler, J. D., Shine, J. P., Bennett, D. H. (2007). Measured and modeled personal exposures to and risks from volatile organic compounds. Environmental Science & Technology 41(24):8498-8505.
HERO ID:	1067092
Conditions of Use:	consumer and commercial use-roomdeodorizers or mothballs

EXTRACTION	
Parameter	Data
Worker activity description:	teachers and office workers
Exposure route:	inhalation
Personal sampling data:	mean - 3.4 ug/m3; median - 0.54 ug/m3; SD - 14 ug/m3
Area sampling data:	Office concentrations: mean - 1.1 ug/m3; median - 0.27 ug/m3; SD - 2.8 ug/m3. School concentrations: mean - 1.31 ug/m3; median - 0.2 ug/m3; SD - 2.51 ug/m3.
Number of workers:	a total of 55 nonsmoking participants living in and around Boston, Massachusetts, across two seasons (summer and winter), with 34 participants included in both seasons on the basis of availability, for a total of 89 sampling visits.

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	methodology is an approved OSHA or NIOSH method or is welldescribed
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer
	Metric 4:	Temporal Representativeness	Medium	data is between 10 to 20 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The monitoring study addresses variability in the determinants of exposure for the sampled site or sector. The monitoring study addresses uncertainty in the exposure estimates or uncertainty canbe determined from the sampling and analytical method.

Overall Quality Determination	High
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Study Citation:	Dow Chemical, (1984). Comprehensive industrial hygiene survey for monochlorobenzene and the isomers of dichlorobenzene at the Michigan division chlorobenzol plant.
HERO ID:	2048380
Conditions of Use:	Manufacture

EXTRACTION	
Parameter	Data
Worker activity description:	manufacturing process operator (badger operator, chlorinator operator, tritetrachlor operator, still operator, chlorobenzol operator, plant mechanic, transfer man)
Personal sampling data:	Table 4 contains the following summary of range of TWA breathing zone concentration by job classification: 0.05-0.27 ppm for badger operator, to 0.25 for chlorinator operator, 0.12-0.43 for tri-tetrachlor operator, 0.6-3.2 for still operator, to 0.32 for chlorobenzol operator, 0.04-0.33 for plant mechanic, 0.07-0.12 for transfer man. This table also includes ranges for job classifications that have apparently been redacted. Table 1 includes exposure concentrations for salaried employees but the text is not clear.
Area sampling data:	concentrations range between ND to 43.2 ppm in the control room (Table 6)
Number of workers:	38
Comments:	This data source contains occupational exposure information pertaining to Dow Chlorobenzol plant. Whether or not p-DCB is manufactured at this plant is not explicitly stated in the data source. However, according to a different data source, which has HERO ID 4929943, p-DCB was manufactured at this plant. Furthermore, the occupational exposure information pertaining to p-DCB stated in this data source are implied to be associated with the manufacture of p-DCB.

EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Sampling and Analytical Methodology	High	approved method
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	data are for an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old
	Metric 5: Sample Size	Medium	a range of values is given but uncertain statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	The study includes critical met data, but other meta are not clearly provided.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Variability of exposure by job classification is clearly presented. Some information related to uncertainty is given.

Overall Quality Determination	High
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Study Citation:	Dow Chemical, (1982). Trichlorobenzene exposure in the chlorobenzol plant.				
HERO ID:	4929943				
Conditions of Use:	Manufacture				
EXTRACTION					
Parameter	Data				
Worker activity description:	foreman, transfer man, plant mechanic, operator, tetrachlor operator, still operator, clerk, and, handyman				
Personal sampling data:	2.1 ppm of pDCB for the tetrachlor operator				
Comments:	This data source contains occupational information pertaining to a Dow plant in which p-DCB and other chlorobenzenes were manufactured. The job classifications mentioned above are implied in the data source to be associated the with manufacture of trichlorobenzene. Workers associated with these job classifications are also exposed to p-DCB. Whether or not these job classifications also pertain to the manufacture of p-DCB is not clear. Hence, at the minimum, the exposure concentration mentioned above may be considered ONU exposure.				
EVALUATION					
Domain	Metric	Rating			Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	not specified	
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data	
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old	
	Metric 5:	Sample Size	Low	no statistics	
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	no metadata	
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.	
Overall Quality Determination			Low		

Study Citation:	Exponent,, Inc., (2024). Occupational inhalation exposure assessment for p-dichlorobenzene (with supplemental data and clarification letter).			
HERO ID:	13170985			
Conditions of Use:	Processing as a reactant			
EXTRACTION				
Parameter	Data			
Worker activity description:	VCM Unit Operators (OW), Shift Supervisor (ONU), Maintenance Workers/Instrument Technicians (ONU), Per-Tri Unit Operators (OW), WTU Operators, Supervisory Staff (ONU), Tankerman (OW), Lab Technician (OW). Full descriptions of these SEGs are in Appendix B.			
Exposure route:	Test order is for inhalation data.			
Physical form:	Liquid			
Personal sampling data:	Full, granular results for all personal monitoring data are presented in Appendix C, and an attached Excel worksheet.			
Exposure duration:	8 or 12 hours/day (pg.8)			
Exposure frequency:	5 days/week (pg. 6)			
Number of workers:	VCM Unit: 16 workers, 17 ONUs. Per-Tri Unit: 20 workers, 10 ONUs. Waste treatment: 24 workers, 4 ONUs. Shipping: 8 workers, 0 ONUs. Lab: 13 workers, 0 ONUs. (Appendix B)			
Personal protective equipment:	Nitrile gloves, safety glasses, fire-resistant clothing, ear protection, safety boots, a hard hat, and an escape respirator. For Tankermen, full-face respirator or a half-mask respirator and face shield, chemical splash apron are worn in addition.			
Engineering control:	General ventilation; lab hood			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Test order uses NIOSH Method 1003.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	The collected data are representative of the occupational scenarios being evaluated within the scope of the risk evaluation for which the Test Order was issued.
	Metric 4:	Temporal Representativeness	High	Data are from 2024.
	Metric 5:	Sample Size	High	All discrete data are presented in Appendix C.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	The monitoring data include all associated metadata, including sample types, exposure types, sample durations, exposure durations, worker activities, and exposure frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The availability of all associated metadata within the monitoring study allows for the determination of uncertainty from the sampling and analytical methods and of the variability in the determinants of exposure.
Overall Quality Determination		High		

Study Citation:	Fannick, N. (1980). Health hazard evaluation determination report no. HETA 77-99-726, Dupont, Chambers Works, Deepwater, NJ.			
HERO ID:	6558518			
Conditions of Use:	manufacture			
EXTRACTION				
Parameter	Data			
Personal sampling data:	pDCB was non-detect. The limit of detection is 0.01 mg/sample (Table III)			
Exposure duration:	Ambient air concentrations of pDCB at the site ranges from 12 to 1240 ng/m3. These are not presented in the data source as area worker exposure concentrations.			
Personal protective equipment:	Most production employees are protected by respirators, protective clothing and shower after each shift.			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	methodology is approved
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include most critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	Fricker, C., Hardy, J. K. (1992). Protective glove material permeation by organic solids. American Industrial Hygiene Association Journal 53(12):745-750.			
HERO ID:	1469610			
Conditions of Use:	Commercial use			
EXTRACTION				
Parameter	Data			
Dermal exposure data:	p-DCB breakthrough time (Table 1) and steady state permeation rate (Table III) associated with contact of solid and vapor p-DCB with multiple glove material are reported.			
Personal protective equipment:	Natural rubber (latex), PVC, urethane, nitrile, and neoprene membranes with a nominal thickness of 5 mil were evaluated as gloves.			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Analytical method is well described.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	The data is 11 years old.
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The monitoring study provides only limited discussion of the variability in the determinants of exposure for the sampled site or sector. The monitoring study provides only limited discussion of the uncertainty in the exposure estimates.
Overall Quality Determination		High		

Study Citation:	Ghittori, S., Imbriani, M., Pezzagno, G., Capodaglio, E. (1985). Urinary elimination of p-dichlorobenzene (p-DCB) and weighted exposure concentration. Giornale Italiano di Medicina del Lavoro 7(2-3):59-63.
HERO ID:	2193490
Conditions of Use:	Unknow Chemical Factory-Exposure p-dcb

EXTRACTION	
Parameter	Data
Worker activity description:	workers in a chemical factory
Exposure route:	Inhalation, oral
Physical form:	colorless or white crystals, vapor
Personal sampling data:	The mean value for the environmental concentration in breathing zone is 44.72 mg/m ³
Exposure duration:	8 hours
Exposure frequency:	working week
Number of workers:	4

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	method well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Medium	uncertain statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	does not address variability or uncertainty

Overall Quality Determination	Medium
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Study Citation:	Gobba, F., Ghittori, S., Imbriani, M., Maestri, L., Capodaglio, E., Cavalleri, A. (1997). The urinary excretion of solvents and gases for the biological monitoring of occupational exposure: A review. Science of the Total Environment 199(1-2):3-12.			
HERO ID:	5465465			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation			
Physical form:	solution			
Personal sampling data:	no information provided			
Area sampling data:	Relation between concentrations of p-DCB in air (x) and in urine (y): y = 19.6 x + 106.1			
Number of workers:	20			
Comments:	"In the field" occupational exposure assumptions			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	analytical methodology is well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Monitoring data include sample type but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	monitoring study addresses variability and uncertainty
Overall Quality Determination			High	

Study Citation:	Heavner, D. L., Morgan, W. T., Ogden, M. W. (1996). Determination of volatile organic compounds and respirable suspended particulate matter in New Jersey and Pennsylvania homes and workplaces. Environment International 22(2):159-183.			
HERO ID:	5544873			
Conditions of Use:	Consumer and Commercial Use			
EXTRACTION				
Parameter	Data			
Worker activity description:	Smoking or non smoking workplaces			
Exposure route:	inhalation			
Area sampling data:	pDCB in a non-smoking work environment: median = 0.55 ug/m3, max = 23.44 ug/m3, mean = 1.46 +/- 3.35 ug/m3. pDCB in a smoking work environment: median = 1.08 ug/m3, max = 136 ug/m3, mean = 10.73 +/- 27.84 ug/m3.			
Number of workers:	99			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	well described and found to be equivalent to approved OSHA or NIOSH methods
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Model approach, equations, and choice of parameter values are transparent and clear and can be evaluated
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	only limited discussion of the uncertainty in the exposure estimates
Overall Quality Determination		High		

Study Citation:	Hill, R. H., Ashley, D. L., Head, S. L., Needham, L. L., Pirkle, J. L. (1995). p-Dichlorobenzene exposure among 1,000 adults in the United States. Archives of Environmental Health 50(4):277-280.			
HERO ID:	3485315			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Personal sampling data:	concentrations of p-DCB in personal air samples ranged from 0.02 to 2,600 ug/m3.			
Comments:	Pellizzari ED, Perritt K, Hartwell TD, et al. Total exposure assessment methodology (TEAM) study: Elizabeth and Bayonne, NewJersey; Devil’s Lake, North Dakota; and Greensboro, North Carolina. Vol. II (Section 8 and References), Final Report, Part 11, EPAReport No. EPA/600/6-87/002b. Washington, D.C.: Environmental Protection Agency, June 1987			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	approved method
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Monitoring data include sample type (personal sampling data) but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	Hollingsworth, R. L., Rowe, V. K., Oyen, F., Hoyle, H. R., Spencer, H. C. (1956). Toxicity of paradichlorobenzene: Determinations on experimental animals and human subjects. Archives of Environmental & Occupational Health 14(2):138-147.			
HERO ID:	3647			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation			
Physical form:	vapor			
Area sampling data:	1st survey - Results of analyses of 62 air samples showed concentrations ranging from 10 to 550 ppm, with an average of 85 ppm of pDCB. 2nd survey - 15 air samples collected under these conditions showed concentrations ranging from 100 to 725 ppm, with an average of 380 ppm of pDCB. 32 air samples obtained showed concentrations ranging from 5 to 275 ppm, with an average of 90 ppm. 3rd survey conducted after changes to operating procedures and engineering controls - 21 air samples were collected showed concentrations ranging from 50 to 170 ppm, with an average of 105 ppm. 25 air samples were collected showed concentrations ranging from 15 to 85 ppm, with an average of 45 ppm.			
Exposure duration:	8 hr/day			
Exposure frequency:	5 days/week; 8 months to 25 years with an average of 4.75 years			
Number of workers:	58			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	analytical methodology not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Medium	Data presented as range with uncertain statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include most critical metadata, such as sample type and exposure type, but lacks additional metadata, such as sample durations, exposure durations, exposure frequency, and/or worker activities
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion of the variability. Does not discuss uncertainty.
Overall Quality Determination		Medium		

Study Citation:	IARC, (1982). IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans: Some industrial chemicals and dyestuffs. IARC monographs on the evaluation of carcinogenic risks to humans 29:1-398.			
HERO ID:	27010			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Worker activity description:	Handling of pDCB; shovelling and centrifuging operations; pulverizing and packaging operations			
Physical form:	pDCB is available in the US as technical grades of unusually high purity: 100% in crystalline form and 99.92% in liquid form (on an anhydrous basis).			
Area sampling data:	The following levels of dichlorobenzenes have been found in factories where mono and dichlorobenzenes are manufactured: concentrations of pDCB were reported: up to 4350 mg/m3 of pDCB in a factory where it was being made or handled; 42-288 mg/m3 near shovelling and centrifuging operations; and 108-204 mg/m3 during pulverizing and packaging operations (USEPA, 1980). In a monochlorobenzene manufacturing plant, pDCB was detected in workplace air at levels of 32.5-52.1 mg/m3 (Albrecht, 1980). The air in a chlorobenzene factory was found to contain 24-34 ppm [144- 204 mg/m3] pDCB. The air in a factory where moth cakes were made contained 9- 25 ppm [54-150 mg/m3] of pDCB; and that in. an abrasive-wheel facility using pDCB in the manufacturing process was 8-11.5 ppm [48-99 mg/m3]. (USEPA 1980). pDCB also detected in drinking water, groundwater, surface water.			
Number of workers:	Workers exposed to pDCB was estimated to be 1,000,000 during production, processing into space deodorants and use as an intermediate (USEPA 1980)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	Sampling or analytical methodology is not specified
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Minimal meta data reported.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	There is a limited discussion of variability (e.g., ranges of values are reported)
Overall Quality Determination		Medium		

Study Citation:	IARC, (1982). Ortho- and para-dichlorobenzenes. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, vol. 29:213-238.			
HERO ID:	4912310			
Conditions of Use:	Manufacturing/Processing as a Reactant			
EXTRACTION				
Parameter	Data			
Area sampling data:	The following levels of dichlorobenzenes have been found in factories where mono and dichlorobenzenes are manufactured: up to 4350 mg/m3 of para-dichlorobenzene in a factory where it was being made or handled; 42-288 mg/m3 near shovelling and centrifuging operations; and 108-204 mg/m3 during pulverizing and packaging operations (US Environmental Protection Agency, 1980d). In a monochlorobenzene manufacturing plant, para-dichlorobenzene was detected in workplace air at levels of 32.5-52.1 mg/m3 (Albrecht, 1980). The air in a chlorobenzene factory was found to contain 24-34 ppm [144- 204 mg/m3] para-dichlorobenzene. The air in a factory where moth cakes were made contained 9- 25 ppm [54-150 mg/m3] of para-dichlorobenzene; and that in. an abrasive-wheel facility using para-dichlorobenzene in the manufacturing process was 8-11 .5 ppm [48-99 mg/m3]. Concentrations ranging from 12-550 ppm [72-3300 mg/m3] of unspecified airborne dichlorobenzenes were found in 1940 in work areas of a para-dichlorobenzene plant (US Environmental Protection Agency, 1980c).			
Number of workers:	1,000,000 (during production, processing into space deodorants and use as an intermediate) (US Environmental Protection Agency, 1980c).			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	Sampling or analytical methodology is not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	U.S. data
	Metric 3:	Applicability	High	Data contains scenarios within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	More than 20 years old.
	Metric 5:	Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Monitoring data include sample type (e.g., personal breathing zone) but no other meta-data.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	IARC, (1999). Some chemicals that cause tumours of the kidney or urinary bladder in rodents and some other substances.			
HERO ID:	666726			
Conditions of Use:	Consumer/commercial use			
EXTRACTION				
Parameter	Data			
Worker activity description:	janitors and cleaners, mortuary employees and workers in pest control			
Exposure route:	Occupational exposure to para-dichlorobenzene may occur by inhalation and ocular or dermal contact during its manufacture, formulation and use as an insecticide, a moth control agent, a fumigant, a deodorant and in organic syntheses for preparation of dye intermediates (National Institute for Occupational Safety and Health, 1978b).			
Physical form:	Volatile crystals with a characteristic penetrating odour (Budavari, 1996)			
Personal sampling data:	in chemical factory - 44.7 mg/m3 (geometric mean.) Additional data are presented in Table 2 of page 231.			
Area sampling data:	Mean air concentration in manufacturing plans - 144 - 204 mg/m3; in household product packaging plants - 54 - 150 mg/m3; in abrasive wheel manufacturing plants - 48 - 69 mg/m3; in hardwood bleaching plants - 0.15 x 10^-3 mg/m3. See Table 2 on page 225 for complete data.			
Number of workers:	approximately 34 000 workers in the United States were potentially exposed to para-dichlorobenzene; most of these were janitors and cleaners, mortuary employees and workers in pest control			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	Sampling or analytical methods are not reported but references pertaining to the reported monitoring data which may contain this information are mentioned.
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	The location associated with the data is not reported although references pertaining to the data which may contain such information are mentioned.
	Metric 3:	Applicability	High	for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include most critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The monitoring study provides only limited discussion of the variability in the determinants of exposure for the sampled site or sector.
Overall Quality Determination		Medium		

Study Citation:	IPCS, (1991). Chlorobenzenes other than hexachlorobenzene.			
HERO ID:	81628			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Physical form:	white crystalline solids at room temperature			
Area sampling data:	In one manufacturing plant, concentrations of 1,4-DCB ranged from 42 to 288 mg/m3, the average being 204 mg/m3 (Ware & West, 1977). Trace of 1,4-DCB have been found in office air. Workers can be exposed to levels as high as 29.1 mg/kg body weight for 1,4-DCB.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	Sampling or analytical methodology is not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The monitoring data pertains to manufacturing
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Monitoring data include sample type but no other metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination			Low	

Study Citation:	Juvancz, Z., Bodane-Kendrovics, R., Beleznay, P., Erdelyi, I., Klujber-Mohr, M. (2010). Determination of 1,4-dichlorobenzene in environmental matrices. Chromatographia 71(1):S125-S128.			
HERO ID:	2627817			
Conditions of Use:	commercial use-air fresheners (including toilet/urinal deodorizers/fresheners)			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation			
Physical form:	typically comes as blocks of DCB that are placed directly into the urinal			
Area sampling data:	concentration of DCB in air of toilet - 21.5 mg/m3 (range 5 to 50 mg/m3)			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	method well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	data is 10 to 20 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	most critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion on uncertainty
Overall Quality Determination			High	

Study Citation:	Kularatne, A., R.K. (2017). Occurrence of selected volatile organic compounds in a bra cup manufacturing facility. International Journal of Environmental Science and Technology 14(2):315-322.			
HERO ID:	3873808			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Worker activity description:	workers in laminating and injection molding sections of bra cup manufacturing facility			
Area sampling data:	Laminating section: 1.34 x 10^-4 mg/m3 in 2013 but ND in 2012, 2014, and 2015; Injection molding section: 8.4 x 10^-5 mg/m3 in 2013, but ND in 2012, 2014, and 2015			
Exposure duration:	8h/day			
Exposure frequency:	6 days/week			
Comments:	working hours are 48 h per week, and an average lifetime of people is 70 years-6 days a week for a period of 8 h per day			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Approved methodology. VOC results presented were obtained as per ASTM D3687/USEPA TO-17 methods (i.e., sampling by means of using SKC Personal sampling pumps connected to activated carbon adsorbing tubes) with analysis by Gas Chromatography Mass Spectrometry (GC-MS).
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	non-OECD country
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	High	data is less than 10 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	contains some metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	monitoring study does not address variability or uncertainty
Overall Quality Determination			Medium	

Study Citation:	Namiesnik, J., Zygmunt, B., Kozdron-Zabiegala, B. (1994). Some aspects of indoor air pollution and analysis. Polish Journal of Environmental Studies 3(4):5-19.			
HERO ID:	6021395			
Conditions of Use:	commercial use-building materials			
EXTRACTION				
Parameter	Data			
Worker activity description:	office worker			
Exposure route:	inhalation			
Physical form:	included in building and renovation materials an furnishings			
Area sampling data:	Average daily indoor concentration of pDCB from 2121 measurements is 3.988 ppb			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	methods well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Medium	uncertain statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	include some critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.
HERO ID:	6629633
Conditions of Use:	Processing

EXTRACTION	
Parameter	Data
Exposure route:	Workers that use 1,4-dichlorobenzene may breathe in mists or have direct skin contact. (Page 2 and 46 of 89)
Physical form:	white or colorless crystalline solid, or mist (page 2 of 89)
Personal sampling data:	2 ug/m3 max observed breathing zone measurements from 8 solid waste composting facilities (page 46 of 89)See page 4 of 89 for excerpts and links to exposure studies, including dermal exposures.
Area sampling data:	32.5-52.1 mg/m3 of pDCB in workplace air of a monochlorobenzene manufacturing plant (page 46 or 89). 95.7 ug/m3 for tollbooth workers (mean) (page 46-47 of 89)See page 4 of 89 for excerpts and links to exposure studies.
Dermal exposure data:	See page 4 of 89 for excerpts and links to exposure studies, including dermal exposures. "The dichlorobenzenes may be absorbed through the lungs, gastrointestinal tract, and the intact skin" (Page 41 of 89 for this reference)
Number of workers:	the number of persons reasonably likely to be exposed in the manufacturing, processing, or use of 1,4-dichlorobenzene in the United States may be as low as 10 workers up to the range of 100 workers per plant; the data may be greatly underestimated due to confidential business information (CBI) or unknown values. (page 46 of 89)NIOSH (NOES Survey 1981-1983) has statistically estimated that 32,978 workers (9,412 of these were female) were potentially exposed to 1,4-dichlorobenzene in the US (page 46 of 89)
Personal protective equipment:	See pages 64 to 66 for preventive measures
Engineering control:	See pages 64 to 66 for preventive measures

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	This document is a compilation of studies, each one referenced in the text.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	Operations, equipment, and worker activities are expected to be reasonably representative of current conditions. The monitoring data were collected after the most recent PEL establishment or update but are generally more than 10 years old. This document includes a compilation of studies from various times.
	Metric 5:	Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Document sites various reputable studies.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	Document sites various reputable studies.

Continued on next page ...

p-Dichlorobenzene

Occupational Exposure

HERO ID: 6629633 Table: 1 of 1

...continued from previous page			
Study Citation:	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.		
HERO ID:	6629633		
Conditions of Use:	Processing		
Domain	Metric	EVALUATION Rating	Comments
Overall Quality Determination		High	

Study Citation:	Ng, M. G., Tongeren, van, M., Semple, S. (2014). Simulated transfer of liquids and powders from hands and clothing to the mouth. Journal of Occupational and Environmental Hygiene 11(10):633-644.			
HERO ID:	3222353			
Conditions of Use:	Manufacturing/Processing			
EXTRACTION				
Parameter	Data			
Exposure route:	Dermal, Ingestion			
Dermal exposure data:	p-DCB is not mentioned specifically, but this study captures transfer rate of liquids and powders from hands and clothes to mouth. See tables IV-VI for summary tables of transfer from the experiments, and page 10 of 13 for discussion on the material properties that may impact oral exposure. "This study has provided evidence that transfer of chemicals from the hands or objects to the mouth is influenced by parameters including physical state, chemical/physical properties, and use of protective clothing. These findings may have implications for exposure modeling and exposure control. This work was preliminary in nature and additional study is required to obtain a greater understanding of the parameters that can affect transfer and the possible interactions between them." (page 12 of 13)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Medium	This experiment was preliminary in nature, and without a specified approved method, except for the analytical methods which used a modification of OSHA ID121
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	From the UK
	Metric 3:	Applicability	Low	relevant to p-DCB COUs in which solid substance would be handled but not chemical-specific, also not specific to occupational exposure
	Metric 4:	Temporal Representativeness	High	From 2014
	Metric 5:	Sample Size	Low	Only 4 volunteers used in the study
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata, including sample types, exposure types, sample durations, exposure durations worker activities, and exposure frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	Discussion, and data, of variability and uncertainty included
Overall Quality Determination			Medium	

Study Citation:	NICNAS, (2000). Priority existing chemical assessment report No. 13: Para-dichlorobenzene.			
HERO ID:	5155557			
Conditions of Use:	manufacture			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation and dermal			
Area sampling data:	Only one company provided monitoring data. This company is the major importer and formulator of p-DCB products in Australia. The company recorded an airborne concentration of 19 ppm of p-DCB in the general work area, 34 ppm near a feed hopper and the maximum concentration reached was 59 ppm of p-DCB in the bagging area; the data were for April, 1981. More recent data were provided by the company for August, 1998 which indicated an upper concentration range during processing of 10 to 15 ppm near a discharge chute and a position near an exhaust chute in the bagging area gave a level of 6 to 8 ppm. The data were obtained with an air temperature of 22oC and using Dräger tubes (Chlorobenzene 5/a) which provides an approximate measurement only.			
Exposure duration:	Assumed 8 hours since data was compared to model: ”These exposure levels are in general agreement with data predicted by the UK EASE model which estimated airborne concentrations of 10 to 50 ppm (8 hour TWA) under conditions of 25oC with a non-dispersive pattern of use and with dilution ventilation.”			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	approved methodology
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	no metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	NIEHS, (2004). 1,4-Dichlorobenzene. U.S. National Toxicology Program. Report on Carcinogens 11(2004):III85-III87.			
HERO ID:	4912209			
Conditions of Use:	Use			
EXTRACTION				
Parameter	Data			
Exposure route:	Inhalation			
Area sampling data:	Indoor air concentrations exceed outdoor concentrations by at least an order of magnitude. Concentrations of 1,4-dichlorobenzene in urban areas and in the vicinity of hazardous waste sites generally average less than 25.2 μg/m3, but indoor air concentrations may be one to three orders of magnitude higher where it is used as a space deodorizer or moth repellent. Concentrations of up to 4,350 mg/m3 have been measured in the air for various factory operations.			
Number of workers:	In 1980, EPA reported that about 1 million workers in the United States were exposed to 1,4-dichlorobenzene, primarily by inhalation, whereas an industry survey from the same year reported that fewer than 1,000 workers were exposed during production, captive use, and shipment of 1,4-dichlorobenzene from producers (NTP 1987). The National Occupational Exposure Survey (conducted from 1981 to 1983) estimated that 33,978 workers, including 9,412 women, potentially were exposed to 1,4-dichlorobenzene (NIOSH 1990).			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	Sampling methodology is not specified
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	U.S. data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	Report is between 10 to 20 years old.
	Metric 5:	Sample Size	Low	Data is characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Monitoring data include sample type (e.g., area) but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	the monitoring data does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	NIOSH, (1981). Health Hazard Evaluation report no. HETA 81-065-938, METRO Bus Maintenance Shop, Washington, DC.			
HERO ID:	3859376			
Conditions of Use:	commercial use-paint			
EXTRACTION				
Parameter	Data			
Worker activity description:	METRO Bus maintenance shop in Washington, D.C. - Painting			
Exposure route:	Inhalation			
Area sampling data:	Non-detectable on a sample of 409 liters			
Exposure duration:	8 or 10/day			
Exposure frequency:	normal working lifetime			
Number of workers:	17			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	methodology is approved (P&CAM 127)
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	contains essential metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty
Overall Quality Determination		Medium		

Study Citation:	NTP, (2021). Report on carcinogens, fifteenth edition.			
HERO ID:	10182531			
Conditions of Use:	”Various factory operations”			
EXTRACTION				
Parameter	Data			
Exposure route:	”People are exposed to 1,4-dichlorobenzene mainly by breathing contaminated air inside their homes or workplaces, but they can also be exposed by ingestion or contact with the skin (ATSDR 2006).” page 1 of PDF.			
Area sampling data:	PDF Pg. 2”Concentrations of up to 4,350 mg/m3 have been measured in the air for various factory operations.”			
Number of workers:	PDF Pg. 2”Occupational exposure to 1,4-dichlorobenzene occurs during its manufacture, its conversion to polyphenylene sulfide, and its other industrial uses. 1980, EPA reported that about 1 million workers in the United States were exposed to 1,4-dichlorobenzene, primarily by inhalation, whereas an industry survey from the same year reported that fewer than 1,000 workers were exposed during production, captive use, and shipment of 1,4-dichlorobenzene from producers (NTP 1987). The National Occupational Exposure Survey (conducted from 1981 to 1983) estimated that 33,978 workers, including 9,412 women, potentially were exposed to 1,4-dichlorobenzene (NIOSH 1990).”			
Comments:	To access, go to ”profiles” folder and then ”dichlorobenzene” folder			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	Sampling/analytical methodology is not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for various occupational uses of p-DCB.
	Metric 4:	Temporal Representativeness	Low	Monitoring data are greater than 20 years old. [1980-1987]
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (maximum) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Sample type and exposure type provided but missing exposure frequency, exposure duration, worker activity, PPE, engineering controls.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.
Overall Quality Determination		Medium		

Study Citation:	NTP, (1987). NTP technical report on the toxicology and carcinogenesis studies of 1,4-dichlorobenzene (CAS no. 106-46-7) in F344/N ats and B6C3F1 mice (gavage studies).			
HERO ID:	5160105			
Conditions of Use:	Manufacture			
EXTRACTION				
Parameter	Data			
Worker activity description:	production, captive use, and shipment from producers			
Exposure route:	inhalation			
Area sampling data:	Levels of 42-4,350 mg/m3 have been measured in various factory operations (USEPA, 1980a,b).			
Number of workers:	As reported in 1980, approximately 1 million workers in the United States are occupationally exposed to 1,4-dichlorobenzene			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Sampling methodology is well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	no metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	Olin Chemicals, (1987). Industrial hygiene sampling for toluene diisocyanate at Olin Moundsville plant.			
HERO ID:	4930013			
Conditions of Use:	Industrial use			
EXTRACTION				
Parameter	Data			
Area sampling data: Amount of p-DCB – 3.327 ug/sample equivalent to 0.22 ppm. Total volume sampled – 2.4 liters.				
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Sampling methodology is an approved NIOSH method, TENAX
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	more than 20 years old
	Metric 5:	Sample Size	Low	characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Monitoring data include sample type but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	Olin Chemicals, (1987). Industrial hygiene sampling for toluene diisocyanate at Olin Chemical Moundsville plant.			
HERO ID:	4930031			
Conditions of Use:	industrial use			
EXTRACTION				
Parameter	Data			
Area sampling data:	Amount of p-DCB – Not detected/sample (Limit of detection – 1.5 ug/sample). Total volume sampled – 2.4 liters.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Sampling methodology is an approved NIOSH method (TENAX)
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	more than 20 years old
	Metric 5:	Sample Size	Low	characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Monitoring data include sample type but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	OSHA, (2019). Chemical exposure health data (CEHD) sampling results: CASRNs 75-34-3, 85-68-7, 84-74-2, 78-87-5, 117-81-7, 106-93-4, 50-00-0, 95-50-1, 85-44-9, 106-46-7, 79-00-5, and 115-86-6.			
HERO ID:	6499659			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Personal sampling data:	Average concentration = 15.3 +/- 16 ppm			
Area sampling data:	Average concentration - 8.75 +/- 1.2 ppm			
Comments:	Check concentrations reported here against values calculated from data.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	method well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	data is associated with the period of 1984 to 2009.
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.
Overall Quality Determination			High	

p-Dichlorobenzene

Occupational Exposure

HERO ID: 3118964 Table: 1 of 1

Study Citation:	Pagnotto, L. D., Walkley, J. E. (1965). Urinary dichlorophenol as an index of para-dichlorobenzene exposure. American Industrial Hygiene Association Journal 26(2):137-141.				
HERO ID:	3118964				
Conditions of Use:	manufacturing				
EXTRACTION					
Parameter	Data				
Worker activity description:	washing, shoveling and centrifuging, crushing and sizing				
Exposure route:	inhalation				
Physical form:	solid				
Area sampling data:	washing - 7-48 ppm with average of 34 ppm; shoveling and centrifuging - 10-49 ppm with average of 33 ppm, crushing and sizing - 8-46 ppm and average of 24 ppm				
EVALUATION					
Domain	Metric	Rating		Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	approved method	
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data	
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation	
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old	
	Metric 5:	Sample Size	Medium	uncertain statistics	
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	contains critical metadata only	
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	uncertainty not discussed	
Overall Quality Determination			High		

Study Citation:	Rosenberg, C., Nylund, L., Aalto, T., Kontsas, H., Norppa, H., Jäppinen, P., Vainio, H. (1991). Volatile organohalogen compounds from the bleaching of pulp - Occurrence and genotoxic potential in the work environment. Chemosphere 23(11-12):1617-1628.			
HERO ID:	1023024			
Conditions of Use:	Hardwood bleaching plant			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation			
Personal sampling data:	Concentrations detected at a hardwood bleaching plant in breathing zone air samples - none detected			
Area sampling data:	Concentrations detected at a hardwood bleaching plant in general air samples - 0.06 - 0.8 ug/m3; median value - 0.15 ug/m3 (n = 34)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Sampling or analytical methodology is an approved OSHA or NIOSH method or is well described and found to be equivalent to approved OSHA or NIOSH methods.
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	Data is from Finland
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	Data mroe than 20 years old
	Metric 5:	Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include most critical metadata, such as sample type and exposure type, but lacks additional metadata, such as sample durations, exposure durations, exposure frequency, and/orworker activities.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion on uncertainty
Overall Quality Determination			Medium	

Study Citation:	Sapkota, A., Williams, D., Buckley, T. J. (2005). Tollbooth workers and mobile source-related hazardous air pollutants: How protective is the indoor environment?. Environmental Science & Technology 39(9):2936-2943.			
HERO ID:	86402			
Conditions of Use:	commercial use resulting in indoor air care products emissions such as Building and construction products and			
EXTRACTION				
Parameter	Data			
Life cycle description:	commercial Use resulting in indoor air contamination such as air fresheners and mothballs and construction material.			
Worker activity description:	tollbooth workers			
Exposure route:	inhalation			
Area sampling data:	Complete distribution given in Table 1. Inside tollbooth concentration - 95.7 ug/m3; outside tollbooth concentration - 4.36 ug/m3. Meian indoor/outdoor ratios observed at the BHT tollbooth facility for pDCB was 21.9.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	well described and found to be equivalent to approved OSHA or NIOSH methods
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Medium	data collected between 10 to 20 years
	Metric 5:	Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata, including sample types, exposure types, sample durations, exposure durations worker activities, and exposure frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	only limited discussion of the uncertainty in the exposure estimates
Overall Quality Determination			High	

Study Citation:	SCI Engineering,, Inc., (2024). Paradichlorobenzene occupational exposure: Willert Home Products, 4044 Park Avenue, St. Louis, Missouri.			
HERO ID:	12190316			
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product			
EXTRACTION				
Parameter	Data			
Worker activity description:	Cleaning, handling p-DCB, inventory tools for manufacturing p-DCB, maintenance, manufacturing, moving merchandise, moving raw materials, office work, transporting materials in semi truck. Some descriptions on page 17, and through some of the pictures shared in Appendix A. Appendix B has many thorough worker activities that individuals performed throughout their shift.			
Exposure route:	Inhalation			
Physical form:	Solid			
Personal sampling data:	Sampling data given in Appendix E attachment (Excel format). Includes 242 PBZ samples at concentrations of 0.09-36ppm.			
Area sampling data:	Sampling data given in Appendix E attachment (Excel format). Includes 16 area samples at concentrations of <0.12-4.2 ppm.			
Exposure duration:	0.25-10.5 hours/day			
Exposure frequency:	1-5 days/week			
Number of workers:	96 total workers. Worker counts broken up by SEG in Attachment 3.1 on PDF Pg. 170.			
Personal protective equipment:	PDF Pg. 10”Production area employees PPE consisted of closed toe shoes/boots, disposable gloves, safety glasses, hearing protection, coveralls, lab coats, medical masks, and hairnets. Mixers wore N95 masks and heavy-duty chemical gloves.”			
Engineering control:	PDF Pg. 9-10”Various exposure controls were observed throughout the facility. Typical HVAC air circulation was observed in the main office areas throughout the facility. Fans were observed in the production east and west areas to help air movement. An air filtration system and exhaust vent fans were observed in the production west areas, as well as a vacuum system observed in areas where employees dumped raw p-DCB. The Bluewater production area had air circulation fans and an exhaust fan on the first floor and two exhaust fans on the second floor. A vacuum system was observed in dumping areas to control dust, with filters changed as needed. Garage doors were also opened as needed to help with air flow.”			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Sampling/analytical methodology is an approved NIOSH method.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data ae from the U.S.
	Metric 3:	Applicability	High	Data are for air care products, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Monitoring data are no more than 10 years old. [2024]
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Metadata included
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by collecting samples from multiple workers in multiple areas of the plant.
Continued on next page ...				

p-Dichlorobenzene

Occupational Exposure

HERO ID: 12190316 Table: 1 of 1

...continued from previous page			
Study Citation:	SCI Engineering,, Inc., (2024). Paradichlorobenzene occupational exposure: Willert Home Products, 4044 Park Avenue, St. Louis, Missouri.		
HERO ID:	12190316		
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product		
Domain	Metric	EVALUATION Rating	Comments
Overall Quality Determination		High	

Study Citation:	Stefaniak, A. B., Breyse, P. N., Murray, M., M.P., Rooney, B. C., Schaefer, J. (2000). An evaluation of employee exposure to volatile organic compounds in three photocopy centers. Environmental Research 83(2):162-173.			
HERO ID:	1953674			
Conditions of Use:	commercial use-ink			
EXTRACTION				
Parameter	Data			
Worker activity description:	person working at copy centers			
Exposure route:	inhalation			
Personal sampling data:	Copy center 1 - 3.7 ppb; Copy Center 2 - 0.1 ppb; Copy Center 3 - 0.2 ppb			
Area sampling data:	Concentration of pDCB at each copy center are as follows: Copy center 1 - Day 1 - 5-6.9 ppb; Day 2 - 0.6 - 2.3 ppb. Copy center 2 - Day 1 - <0.1-0.2 ppb; Day 2 - 0.3 ppb. Copy center 3 - Day 1 - 0.7-1.3 ppb; Day 2 - 0.2 - 0.3 ppb.			
Exposure duration:	Sample collected are full shift (7-8h)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	methodology well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited uncertainty discussion
Overall Quality Determination		High		

Study Citation:	Tang, J. H., Chan, C. Y., Wang, X. M., Chan, L. Y., Sheng, G. Y., Fu, J. M. (2005). Volatile organic compounds in a multi-storey shopping mall in guangzhou, South China. Atmospheric Environment 39(38):7374-7383.			
HERO ID:	2443191			
Conditions of Use:	Commercial use			
EXTRACTION				
Parameter	Data			
Life cycle description:	mostly used to clean carpets and is also applied in moth crystals and air fresheners.			
Worker activity description:	retail workers			
Exposure route:	Inhalation			
Area sampling data:	pDCB concentrations (ug/m3) indoors: mean - 12.3, SD - 12, Med - 8.0, Min - 0.3, Max - 44.3; pDCB concentrations (ug/m3) outdoors: mean - 0.5, SD - 0.4, Med - 0.3, Min - 0.2, Max - 1.2; Indoor/Outdoor ratio - 24.6			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	methodology well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	not an OECD country
	Metric 3:	Applicability	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Medium	data is between 10 and 20 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include most critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discuss on uncertainty
Overall Quality Determination		Medium		

Study Citation:	U.S. EPA, (2013). Updating CEB’s method for screening-level estimates of dermal exposure.			
HERO ID:	11224653			
Conditions of Use:	All			
EXTRACTION				
Parameter	Data			
Worker activity description:	typical worker activity examples in table (pg. 2)			
Exposure route:	dermal types of contact (pg. 2)			
Dermal exposure data:	a surface area parameter default value for two hands of 1,070 cm2 and a surface area parameter default value for one hand of 535 cm2 (pg. 1)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Dermal data are for in-scope occupational scenarios.
	Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old and industry conditions that are expected to be outdated.
	Metric 5:	Sample Size	Medium	Characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Variability addressed by providing a range of potential values. Uncertainty not addressed.
Overall Quality Determination		High		

Study Citation:	Wallace, L. A., Pellizzari, E. D., Hartwell, T. D., Sparacino, C., Whitmore, R., Sheldon, L., Zelon, H., Perritt, R. (1987). The TEAM study: Personal exposures to toxic substances in air, drinking water, and breath of 400 residents of New Jersey, North Carolina, and North Dakota. Environmental Research 43(2):290-307.			
HERO ID:	73618			
Conditions of Use:	commercial use			
EXTRACTION				
Parameter	Data			
Worker activity description:	Hospital workers, garage workers, home pesticide treatment workers, taxi/truck drivers			
Exposure route:	inhalation			
Personal sampling data:	Daytime personal air pDCB and ODCB exposures: hospital workers are likely to be e^2.96 (19.3) times of control population; e^-1.18 (0.3) for garage workers; e^0.38 (1.5) for home pesticide treatment workers; e^-0.87 (0.4) for taxi/truck drivers. Overnight personal air pDCB exposure: hospital workers are likely to be e^3.49 (32.8) times of control population.			
Number of workers:	6 hospital workers, 12 garage workers; 162 home pesticide treatment workers; 15 taxi/truck drivers			
Comments:	The techniques employed did not allow unambiguous determination of the meta and para isomers of xylene and dichlorobenzene; thus, the magnitudes of the two isomers were summed and theresults are presented as m,p-xylene and m,p-dichlorobenzene			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	well described and found to be equivalent to approved OSHA or NIOSH methods
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	Low	The data are for an occupational scenario within the scope of the risk evaluation but the data pertains to both pDCB and oDCB.
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include most critical metadata, such as sample type and exposure type, but lacks additional metadata, such as sample durations, exposure durations, exposure frequency, and/or worker activity
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	only limited discussion of the uncertainty in the exposure estimates
Overall Quality Determination		Medium		

Study Citation:	Wallace, L. A., Pellizzari, E., Hartwell, T., Rosenzweig, M., Erickson, M., Sparacino, C., Zelon, H. (1984). Personal exposure to volatile organic compounds I Direct measurements in breathing-zone air, drinking water, food, and exhaled breath. Environmental Research 35(1):293-319.
HERO ID:	21711
Conditions of Use:	Commercial Use

EXTRACTION	
Parameter	Data
Worker activity description:	chemical and oil company worker; sewage treatment plant operator;
Exposure route:	inhalation
Personal sampling data:	Out of 18 breath samples collected from NJ volunteers and analyzed for DCBs, none showed DCBs above detection limit. Out of 5 breath samples collected from NC volunteers and analyzed for m- and p-DCBs, one was below the detection limit, and m- and p-DCBs ranged between 0.09 and 0.76 ug/m3 in the remaining 4 samples.
Number of workers:	workers - 5; additional 7 were not occupationally exposed
Comments:	See (Pellizzari et al., 1982; Sparacino et al. 1982a, 1982b) for all study aspects.

		EVALUATION	
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High
			Sampling or analytical methodology is an approved OSHA or NIOSH method or is well described and found to be equivalent to approved OSHA or NIOSH methods.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High
	Metric 3:	Applicability	Medium
	Metric 4:	Temporal Representativeness	Low
	Metric 5:	Sample Size	High
			Statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High
			Monitoring data include all associated metadata, including sample types, exposure types, sample durations, exposure durations worker activities, and exposure frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium
			limited discussion of the uncertainty in the exposure estimates

Overall Quality Determination	High
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Study Citation:	Wallace, L. A., Pellizzari, E., Leaderer, B., Zelon, H., Sheldon, L. (1987). Emissions of volatile organic compounds from building materials and consumer products. Atmospheric Environment 21(2):385-393.			
HERO ID:	23126			
Conditions of Use:	Commercial use - Building materials (cleansers and polishes, glues, floor and wall coverings)			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation			
Area sampling data:	1 micro gram per m# in new office building before and after occupancy			
Comments:	A reference was provided but not other information.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	Low	A reference was provided but not other information.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	Data more than 20 years old
	Metric 5:	Sample Size	Low	A reference was provided but not other information.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	A reference was provided but not other information.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	A reference was provided but not other information.
Overall Quality Determination			Low	

Study Citation:	Wallace, L., Pellizzari, E., Hartwell, T., Zelon, H., Sparacino, C., Perritt, R., Whitmore, R. (1986). Concentrations of 20 volatile organic compounds in the air and drinking water of 350 residents of New Jersey compared with concentrations in their exhaled breath. Journal of Occupational Medicine 28(8):603-608.			
HERO ID:	24793			
Conditions of Use:	consumer and commercial uses			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation			
Personal sampling data:	breath sample concentration is reported and the correlation of this data to personal sampling is also reported.			
Number of workers:	350 NJ residents that include an unknown number of workers			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	Low	The occupational scenarios are not reported.
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Low	monitoring data is not reported and instead a correlation of monitoring data and measured concentration in breath is reported.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Monitoring data include sample type (e.g., personal breathing zone) but no other meta-data.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	only limited discussion of the uncertainty in the exposure estimates
Overall Quality Determination		Medium		

Study Citation:	Wang, D., Yu, H., Shao, X., Yu, H., Nie, L. (2018). Direct and potential risk assessment of exposure to volatile organic compounds for primary receptor associated with solvent consumption. Environmental Pollution 233:501-509.			
HERO ID:	5550004			
Conditions of Use:	commercial use-paint			
EXTRACTION				
Parameter	Data			
Worker activity description:	painting			
Personal sampling data:	pDCB exposure concentrations in water-based paint (ug/m3): 1) Paint 1 - mean - 83.8 +/- 50.2, median - 77.2, max - 163; 2) Paint 2 - mean - 21.8 +/- 15, median - 21.2, max - 46.3; 3) Paint 3 - mean - 47.3 +/- 46.9, median - 19.6, max - 151			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	well described methods
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	non-OECD country
	Metric 3:	Applicability	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer
	Metric 4:	Temporal Representativeness	High	data less than 10 years
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion on uncertainty
Overall Quality Determination		High		

Study Citation:	Xing, L., Wang, L., Zhang, R. (2018). Characteristics and health risk assessment of volatile organic compounds emitted from interior materials in vehicles: a case study from Nanjing, China. Environmental Science and Pollution Research 25(15):14789-14798.			
HERO ID:	4697151			
Conditions of Use:	Use			
EXTRACTION				
Parameter	Data			
Life cycle description:	Interiors of 23 vehicles			
Worker activity description:	Vehicle Use			
Exposure route:	Inhalation			
Area sampling data:	Concentrations of 1,4-Dichlorobenzene (ug/m3): range - ND to 424.98, median - 32.25, mean - 102.99, detection rate - 52.17			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	non-OECD country
	Metric 3:	Applicability	Medium	Data is not for an in-scope use, but may be applicable for an in-scope occupational scenario
	Metric 4:	Temporal Representativeness	High	Monitoring data were collected after the most recent PEL and no more than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (min, max, mean) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Monitoring data include all associated metadata, including sample types, exposure types, sample durations, exposure durations worker activities, and exposure frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	Uncertainty is well characterized
Overall Quality Determination		High		

Study Citation:	York., Wehran-New, Inc., (1990). Risk assessment for Buffalo Color area D.			
HERO ID:	1335671			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Exposure route:	dermal and inhalation			
Area sampling data:	inhalation potency factor - 2.4 x 10^-2 (mg/kg/day)^-1 USEPA 1989			
Dermal exposure data:	Dermal contact data due to contact with on-site materials: pDCB - river water concentration - 7.67 x 10^-3 ug/L; hazard index - 9 x 10^-2 mg/kg/day			
Comments:	Human poisoning have been report at levels of 800-1020mg/m^3 in occupational settings			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Sampling and Analytical Methodology	High	method well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	no metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	limited discussion on variability and uncertainty
Overall Quality Determination		Medium		

Study Citation:	Fiserova-Bergerova, V., Pierce, J. T., Droz, P. O. (1990). Dermal absorption potential of industrial chemicals: Criteria for skin notation. American Journal of Industrial Medicine 17(5):617-635.			
HERO ID:	32206			
Conditions of Use:	Any dermal occupational exposure scenario			
EXTRACTION				
Parameter	Data			
Exposure route:	dermal			
Physical form:	liquid			
Dermal exposure data:	A math model for calculating dermal flux			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The model is free of mathematical errors and is based on scientifically sound approaches or methods.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The model can be appropriately applied to an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	High	TLV is the most recent value
Domain 3: Accessibility/ Clarity	Metric 5:	Metadata Completeness	High	Model approach, equations, and choice of parameter values are transparent and clear and can be evaluated
Domain 4: Variability and Uncertainty	Metric 6:	Metadata Completeness	Low	The model does not characterize variability or uncertainty.
Overall Quality Determination			High	

Study Citation:	Aronson, D. B., Bosch, S., Gray, D. A., Howard, P. H., Guiney, P. D. (2007). A comparative human health risk assessment of p-dichlorobenzene-based toilet rimblock products versus fragrance/surfactant-based alternatives. Journal of Toxicology and Environmental Health, Part B: Critical Reviews 10(7):467-526.			
HERO ID:	449472			
Conditions of Use:	Commercial and Consumer Use - odor masking product			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation			
Physical form:	Toilet rimblock products are generally manufactured as solid cakes.			
Personal sampling data:	Table 5 includes pDCB personal air concentrations without any indication of whether these data pertain to workers.			
Area sampling data:	Table 3 includes pDCB concentrations measured in indoor air offices. Concentrations of pDCB in indoor air may be more than 10-fold higher than that reported in outdoor air. Exposure concentration for workers ranged between 15 to 160 ppm (Hollingsworth et al., 1956). Page 479 contains emission rates of pDCB from consumer products.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	uses data from published sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	High	The data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data collected is more than 20 years old
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The assessment provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination		Medium		

Study Citation:	Chang, E. E., Wang, W. C., Zeng, L. X., Chiang, H. L. (2010). Health risk assessment of exposure to selected volatile organic compounds emitted from an integrated iron and steel plant. Inhalation Toxicology 22 (Suppl. 2)(SUPPL. 2):117-125.
HERO ID:	824309
Conditions of Use:	Commercial use

EXTRACTION	
Parameter	Data
Worker activity description:	iron and steel industry worker involved in sintering, cokemaking, and hot and cold forming processes
Exposure route:	inhalation
Physical form:	gas
Personal sampling data:	inhalation reference dose (RfDi, mg/kg-day) for p-DCB is (2.29×10^{-1}) . TCE, DCB, CHCl ₃ , and 1,1,1-TCA were detectable in the sintering process at concentrations ranging from 5.6 to 50 ppb. During the cokemaking process, the concentrations of the halogenated VOC species was less than 60 ppb, and TCE, DCB, CHCl ₃ , CB, and TCA were the ma in species. The detectable halogenated VOC species, including CCl ₄ , CB, TCE, tetrachloroethylene, and DCB, in the cold forming process work place were measured at concentrations higher than 25 ppb.
Exposure duration:	s 5h for the sintering process, 7h for cokemaking, and 1h for both hot forming and cold forming.
Comments:	Based on the VOC data in this study, an exposure assessment was conducted to evaluate the potential VOC uptake by inhalation. According to the questionnaire survey

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	methodology well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data is from the United States
	Metric 3:	Applicability	High	the data is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	Data collected between 10-20 years
	Metric 5:	Sample Size	Low	No statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Include sample type but no other metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	does not address variability or uncertainty

Overall Quality Determination	Medium
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Study Citation:	Du, Z., Mo, J., Zhang, Y. (2014). Risk assessment of population inhalation exposure to volatile organic compounds and carbonyls in urban China. Environment International 73:33-45.			
HERO ID:	2536230			
Conditions of Use:	commercial and consumer use			
EXTRACTION				
Parameter	Data			
Personal sampling data:	1,4-DCB exposure for female (ug/m3): mean - 16.7(+/-3.6), median - 16.2; 1,4-DCB exposure for male (ug/m3): mean - 16.0(+/-4.1), median - 15.3			
Area sampling data:	concentrations of 1,4-DCB in different microenvironments (μg/m3): home - 20.6(+/-3.7), office - 10.2(+/-17.8), 3.9(+/-1.6), 3.1(+/-1.7)			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	method well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	non-OECD country
	Metric 3:	Applicability	High	data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	no more than 10 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The assessment addresses variability and uncertainty in the results.
Overall Quality Determination			High	

Study Citation:	ECHA, (2004). European Union risk assessment report: 1,4-dichlorobenzene.			
HERO ID:	5017839			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Worker activity description:	Exposure to 1,4-dichlorobenzene may arise during its manufacture, its use in synthesis, its incorporation into various products and from their use.			
Exposure route:	Occupational exposure may occur by inhalation, skin contact and oral route. Inhalation of vapour is the predominant route of exposure. Dust exposure may arise but is likely to be minimal because of the physical state of the substance (flake). Dermal exposure from the solid (flake) is expected to be low. Oral exposure is not considered to be a significant route under normal working practices.			
Physical form:	solid, colourless or white crystals (flakes/granular)			
Personal sampling data:	From 1979 to 1985, US EPA conducted the TEAM study (Total Exposure Assessment Methodology) to measure exposure to 20 VOC. Each participant carried a personal sampler during normal daily activities for two consecutive 12-hour periods. The range was 1) 0.08-1,500 µg/m3 (arithmetic mean 56 µg/m3, 95th percentile: 260 µg/m3, 99th percentile: 1,200 µg/m3) for the overnight personal air concentrations, 2) 0.11-790 µg/m3 (arithmetic mean 35.1 µg/m3, 95th percentile: 210 µg/m3, 99th percentile: 490 µg/m3) for the daytime personal air concentrations.			
Area sampling data:	In a 1,4-DCB plant in USA - production plant exposure data - 7-49 ppm (1965 data). Plant handling 1,4-DCB - concentrations ranged between 10 to 550 ppm with an average of 85 ppm (1956 data). in a plant for 1,4-DCB drumming operation, concentrations ranged between 5 and 37 ppm. Measurements made by the US Occupational Safety and Health Administration (OSHA) between 1981 and 1986 show numerous instances of workers exposed to concentrations greater than 8 ppm (ATSDR, 1989). Based on US EPA study from 1988, 1,4-dichlorobenzene was detected at 2,121 sites. The mean, median, lower- and upper-quartile were 23.9, 1.7, 0.3 and 5.6 µg/m3, respectively. The 1979 to 1985 TEAM study by US EPA showed the range was 1) 0.07-13.0 µg/m3 (arithmetic mean 1.54 µg/m3, 95th percentile: 4 µg/m3, 99th percentile: 13 µg/m3) for the overnight outdoor air concentrations, 2) 0.10-57.0 µg/m3 (arithmetic mean 1.94 µg/m3, 95th percentile: 5.4 µg/m3, 99th percentile: 5 µg/m3) for the daytime outdoor air concentrations.			
Engineering control:	In a 1,4-DCB plant in USA - workroom ventilation was provided by blowers.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	analytical methodology is well described	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data	
	Metric 3: Applicability	High	data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Low	data is greater than 20 years old	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	included critical metadata	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	limited discussion on uncertainty	
Overall Quality Determination		High		

Study Citation:	OECD, (2013). Emission scenario document on the industrial use of adhesives for substrate bonding.			
HERO ID:	3827300			
Conditions of Use:	Use of adhesive/sealant			
EXTRACTION				
Parameter	Data			
Worker activity description:	unloading, container cleaning, adhesive application, equipment cleaning, curing/drying			
Exposure route:	dermal and inhalation			
Exposure frequency:	50-250 days/yr			
Number of workers:	26-106 workers/site			
Personal protective equipment:	chemical-resistant gloves and safety glasses. Heat-resistant gloves are used when applying hot-melt adhesives			
Engineering control:	spray booths			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	U.S. data	
	Metric 3: Applicability	Medium	Report covers industrial use of adhesive which may be similar to use of sealant.	
	Metric 4: Temporal Representativeness	Medium	Assessment is generally based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions.	
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering various chemical functions, types of adhesives, and end use markets.	
Overall Quality Determination		High		

Study Citation:	OECD, (2004). Emission scenario document on lubricants and lubricant additives.		
HERO ID:	3827416		
Conditions of Use:	Use of Lubricants and Functional Fluids		
EXTRACTION			
Parameter	Data		
Exposure route:	inhalation (31/119) dermal (40/119)		
Physical form:	mainly liquid (40/119), mists and vapors (58/119)		
Personal sampling data:	Emissions are covered by the COSHH monitoring described earlier in section 5.2.1.1, i.e. plant and personal monitoring exercises confirm that the levels of vapour involved are extremely low (59/119)		
Exposure duration:	Standards: 5 mg/m3 (8 hour Time Weighted Average) and 10 mg/m3 (10 minute TWA) (89/119)		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	Data are from OECD.
	Metric 3: Applicability	High	Data are for Use of Lubricants and Functional Fluids, an in-scope occupational scenario.
	Metric 4: Temporal Representativeness	Low	Assessment is based on data greater than 20 years old and industry conditions that are expected to be outdated.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Variability addressed with ranges. Uncertainty not addressed.
Overall Quality Determination		High	

Study Citation:	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.			
HERO ID:	6385735			
Conditions of Use:	Processing and Use - Formulation and Use of Automotive Lubricants			
EXTRACTION				
Parameter	Data			
Worker activity description:	PROC: unloading, container cleaning, formulation, sampling, equipment cleaning, loading USE: Unloading, container cleaning			
Exposure route:	dermal and inhalation			
Exposure frequency:	Exposure Frequency - Processing: 203-360 days/yr Use: 253 days/yr			
Number of workers:	PROC: 22 workers/site USE: 4 workers/site			
Personal protective equipment:	PROC: Respirators, gloves, safety glasses USE: gloves, protective footwear, protective headwear, dust masks or respirators			
Engineering control:	LEV			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	This ESD was developed by EPA based on U.S. data	
	Metric 3: Applicability	Medium	Data is for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.	
	Metric 4: Temporal Representativeness	High	Assessment is based on current industry conditions and data no more than 10 years old.	
	Metric 5: Sample Size	Low	Model results characterized by no statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple additive types.	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (2023). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).			
HERO ID:	10480466			
Conditions of Use:	Use - Laboratory Chemicals			
EXTRACTION				
Parameter	Data			
Worker activity description:	container unloading (liquids and solids), container cleaning, equipment cleaning, laboratory analyses, disposal of laboratory chemicals			
Exposure route:	Dermal, inhalation			
Physical form:	liquid or solid			
Exposure duration:	8-12 hr/day			
Exposure frequency:	250 days/yr			
Number of workers:	3 workers/facility and 3 ONUs/facility			
Personal protective equipment:	Basic PPE includes wearing long sleeves (lab coats), long pants, closed-toe shoes, safety glasses or goggles, and gloves during the use of laboratory chemicals. Additional PPE may be worn depending on the level of hazard or specifics of the process.			
Engineering control:	fume hood			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Assessment uses high quality information/data from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	This GS is based on U.S. data
	Metric 3:	Applicability	Medium	Data is for an in-scope occupational scenario; however, data is general and not specific to a chemical.
	Metric 4:	Temporal Representativeness	High	Assessment is based on current industry conditions and data no more than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (2022). Chemical repackaging - Generic scenario for estimating occupational exposures and environmental releases (revised draft).			
HERO ID:	11182966			
Conditions of Use:	Repackaging			
EXTRACTION				
Parameter	Data			
Worker activity description:	worker involved in repackaging operations (pg 35 of 116). As per pg 37 of 116, includes construction trade workers, and others as per Table 5-2			
Exposure route:	Potential routes of exposure (e.g., inhalation, dermal)Table 5-1 (pg 35 of 116) provides the exposure route for different activities. Exposure can be both inhalation and dermal.			
Physical form:	Physical form of the chemical(s) of interest for each exposure route (e.g., liquid, vapor, mist) and activity.			
Exposure duration:	Per the U.S. BLS website, operating duration for each NAICS code is assumed as a ‘year-round, full-time’ hours figure of 2,080 hours (U.S. BLS, 2020). Therefore, dividing this time by an assumed working duration of 8-12 hours/day yields TIMEoperating_days of 174-260 days/year. In the absence of chemical-specific data, EPA recommends assuming a shift length 8 hours/day as default estimate, which results in a default TIMEoperating_days of 260 days/yr (pg 15 of 116)			
Number of workers:	Table 5-3 provides the number of potentially exposed employees. total number of workers is 46,970.			
Personal protective equipment:	Limited information was found regarding typical personal protective equipment (PPE) workers used during repackaging processes. One chemical wholesaler website indicated that commonly used PPE includes safety glasses, face shields, aprons, and gloves (CJB Industries, 2021). (pg 36 of 116)			
Engineering control:	Engineering controls at another site include vacuum system and centrifugal degassing (pg 36 of 116)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The assessment does not address variability or uncertainty.
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (2021). Use of chemicals in fuels and related products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).			
HERO ID:	11203977			
Conditions of Use:	Use in Fuels and related Products			
EXTRACTION				
Parameter	Data			
Worker activity description:	Table 5-2 (pg 38 of 76) shows the worker activities			
Exposure route:	Table 5-1 (pg 36 of 76) shows the summary of occupational exposures. Include dermal exposure and inhalation exposure.			
Physical form:	Table 5-1 (pg 36 of 76) shows the summary of physical forms associated with activities			
Dermal exposure data:	Dermal exposure to liquid is expected for workers involved in operations at fueling stations. (pg 40 of 76). To assess dermal exposure to volatile liquids during all activities, the Dermal Exposure to Volatile Liquids Model can be used (pg 41 of 76)			
Exposure duration:	Consistent with the Operating Hours, up to 8 hr/day (pg 49 of 76)			
Exposure frequency:	The number of days during which workers may be exposed is dependent on the frequency of worker activities. EPA did not find industry-specific information on the frequency of the worker activities discussed below. Generally, the number of exposure days is less than or equal to the number of operating days and can be estimated by multiplying the number of operating days (TIMEoperating_days) by the fraction of operating days during which there is worker exposure (F_exposure). In the absence of industry-specific information, EPA assumes that workers are potentially exposed up to 250 days/year. Because the default number of operating days is 365 days/yr (See Section 3.2), the default for (F_exposure) is 0.685 (= 250/365) day of exposure/day of operation. (pg 39 of 76)			
Number of workers:	70,286 (Table 5-3 on pg 39 of 76)			
Personal protective equipment:	Limited information was found regarding typical personal protective equipment (PPE) workers used during handling of fuels and related products (pg 37 of 76)			
Engineering control:	OSHA recommends that exposures to gasoline and diesel exhaust can be controlled by performing routine maintenance, installing engine filters, prohibiting idling, installing exhaust vents, and wearing respiratory protection (OSHA, 2012). (pg 37 of 76)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Continued on next page ...				

p-Dichlorobenzene

Occupational Exposure

HERO ID: 11203977 Table: 1 of 1

...continued from previous page

Study Citation:	U.S. EPA, (2021). Use of chemicals in fuels and related products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).		
HERO ID:	11203977		
Conditions of Use:	Use in Fuels and related Products		
Domain	Metric	EVALUATION Rating	Comments
Overall Quality Determination		High	

Study Citation:	U.S. EPA, (2004). Additives in plastics processing (compounding) – generic scenario for estimating occupational exposures and environmental release – Draft.
HERO ID:	6311218
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product -

EXTRACTION

Parameter	Data
Worker activity description:	Exposure to solid or liquids during unloading of additives from transport container and charging additives to operation; Exposure to liquids during equipment cleaning of compounding equipment; Exposure to solids during filling containers with compounded plastic resin (page 10 of 18)
Exposure route:	inhalation and dermal (page 15 of 18)
Personal sampling data:	Inhalation: Provides methods for modeling exposures to both solids and volatile liquids (page 15-17 of 18)
Dermal exposure data:	dermal: Provides methods for modeling exposures to both solids and non-volatile liquids (page 15-17 of 18)
Exposure frequency:	250 days/yr (page 11 of 18)
Number of workers:	24 workers/site (page 15 of 18)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	This GS is based on U.S. data
	Metric 3: Applicability	Medium	Data are for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
	Metric 4: Temporal Representativeness	Medium	Assessment is generally based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple plastic and additive types.

Overall Quality Determination

High

Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.			
HERO ID:	8726954			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Worker activity description:	Transfer procedures may result in incidental contact, 2 hands, 100% PMN concentration. Assume 50% of plant workers are exposed (page 2 of 20)			
Exposure route:	Dermal. Inhalation is negligible due to low vapor pressure. (page 2 of 20)			
Dermal exposure data:	3,900 mg/day (page 2 of 20)			
Exposure frequency:	250 days/year (page 2 of 20)			
Number of workers:	45 workers (page 2 of 20)			
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	USA
	Metric 3:	Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs
	Metric 4:	Temporal Representativeness	Low	1992
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.		
HERO ID:	8726954		
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product		
EXTRACTION			
Parameter	Data		
Worker activity description:	Transfer procedures may result in incidental contact, 2 hands, 10% PMN concentration. Assume 50% of plant workers are exposed. (page 3 of 20)		
Exposure route:	Dermal. Inhalation is negligible due to low vapor pressure. (page 3 of 20)		
Dermal exposure data:	390 mg/day (page 3 of 20)		
Exposure frequency:	250 days/year (page 3 of 20)		
Number of workers:	30 workers (page 3 of 20)		
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source
Domain 2: Representativeness	Metric 2: Geographic Scope	High	USA
	Metric 3: Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs
	Metric 4: Temporal Representativeness	Low	1992
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.
Overall Quality Determination		High	

Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.			
HERO ID:	8726954			
Conditions of Use:	Commercial Use - Lubricants and greases			
EXTRACTION				
Parameter	Data			
Worker activity description:	Workers drain out oil from automobiles and add fresh oil. Used oil is collected and recycled. (page 4 of 20)			
Exposure route:	Dermal. Inhalation is negligible due to low vapor pressure (page 4 of 20)			
Dermal exposure data:	At pure quick lube 91 mg/day due to routine emersion, 2 hands, 1% PMN concentration, 7mg/cm^2 typically remaining on skin. At general auto 65 mg/day. Routine emersion, 2 hands, 1% PMN concentration, 5 mg/cm^2 typically remaining on skin, as per OTS guidelines (page 4 of 20)			
Exposure frequency:	250 days/year (page 4 of 20)			
Number of workers:	At pure quick lube, 190 workers and at general auto 1851 workers (page 4 of 20)			
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	USA	
	Metric 3: Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs	
	Metric 4: Temporal Representativeness	Low	1992	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.	
Overall Quality Determination		High		

Study Citation:	Bauer, A. (2013). Contact dermatitis in the cleaning industry. Current Opinion in Allergy and Clinical Immunology 13(5):521-524.			
HERO ID:	1997907			
Conditions of Use:	commercial use			
EXTRACTION				
Parameter	Data			
Worker activity description:	cleaning outdoors, cleaning common areas of residential buildings, schools and cleaning building sites			
Exposure route:	dermal			
Personal protective equipment:	Employees in cleaning often use single-use medical examination gloves with a limited material thickness of approximately 0.1–0.18mm for cleaning and disinfection tasks. These gloves are not resistant to chemicals, which break through the gloves within a few minutes up to hours, depending on the material and the thickness of the gloves.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	Provide sources of the data
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	though not specifically mentioned, the data can be for Europe, as the author is from Germany
	Metric 3:	Applicability	Medium	The data pertain to workers involved in cleaning commercial or institutional sites. This is an occupational scenario that is deemed to be similar to the COU of commercial use of air care products/cleaning uses.
	Metric 4:	Temporal Representativeness	Medium	data may be between 10 and 20 years old
	Metric 5:	Sample Size	Medium	Data not statistically characterized although a reference to the original source of the data is given.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	N/A	This metric is deemed not applicable in the case of PPE used.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	no discussion on uncertainty although a reference to the original source of the data is given.
Overall Quality Determination		Medium		

Study Citation:	Bender, H. F., Eisenbarth, P. (2007). Occupational safety and health at the workplace: Sections 6.1–6.8. :147-256.			
HERO ID:	7309849			
Conditions of Use:	Use as a processing aid			
EXTRACTION				
Parameter	Data			
Personal protective equipment:	pg 11 of 110: The typical personal protection equipment is: respirators gloves spectacles or goggles face shields chemical protection suitspg 61 of 110: Depending on the different parts of the human body to be protected against chemicals,it is important to distinguish between the following types of personal protectiveequipment (PPE): eye protection (protection of the eyes) face protection (protection of the face) hand protection (skin protection of the hands and forearms) breathing protection (protection of the respiratory tract) body protection (protection of the body using protective clothing)			
Engineering control:	Typical engineering controls include the following: (pg 37 of 110):Regarding technical requirements, the employer has to ensurethat the whole process is suitably designed such that the technology used corresponds with the state of art and engineering controls. Most other principles listed above concern organizational measures, for example the minimization of amounts of materials and the number of workers likely to be exposed. Local ventilationor extraction is used quite often in operations which in principle are designed as closed systems but include single, mostly short-term openings for sampling, inspections, changing of filters, or other necessary working steps.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	Low	The data, data sources, and/or techniques or methods used in the assessment or report are not specified.	
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	The data are from a non-OECD country	
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Medium	The report is generally more than 10 years but no more than 20 years old.	
	Metric 5: Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The report does not address variability or uncertainty.	
Overall Quality Determination		Low		

Study Citation:	Bonner, E. M., Poutasse, C. M., Haddock, C. K., Poston, C., W.S., Jahnke, S. A., Tidwell, L. G., Anderson, K. A. (2024). Addressing the need for individual-level exposure monitoring for firefighters using silicone samplers.
HERO ID:	12034026
Conditions of Use:	Firefighting Activities

EXTRACTION	
Parameter	Data
Worker activity description:	Fire response, emergency response (firefighters). Despite structural firefighters wearing personal protective equipment(PPE) to mitigate these hazards, organic chemicals in smokeinfiltrate PPE and can be absorbed dermally, or inhaled when theself-contained breathing apparatus is removed. Even after afire is extinguished, firefighters are exposed to chemicals throughmultiple pathways, including off-gassing from the fireground andcross-contaminated gear, truck cabs, and fire stations (page 2 of 16)
Exposure route:	Inhalation, dermal
Personal sampling data:	No sample results provided, but below is a description of the findings:”VOCs. Twenty-one VOCs were detected in at least one sample. Bymolar mass, VOCs were approximately ten times more prevalentthan any other chemical category (Fig. 1A) at both departments inon- and off-duty tags. Straight-chain alkanes were the mostfrequently detected category of VOC, with the greatest proportionof mass overall, followed by trimethylbenzenes (Fig. S1).At the high-call volume department, the number of detectionsin on-duty tags was greater than in off-duty tags for 11 of the 13VOCs detected in the tags of at least six different firefighters. Thistrend is not evident at the low call volume department. Paradichlorobenzene was detected in 11 on-duty tags at the low call volume department, but only in one sampler at the high callvolume department (Table 2). Differences in concentrations ofVOCs between on-and off-duty tags are highly variable amongindividuals; some firefighters have greater sum VOC exposuresand detection frequencies while on-duty, but others have greaterexposure while off-duty (Fig. S2).”Table 2 on page 8 of 16 does indicate some detections of p-DCB (for high call volume stations there were 0 detects for off-duty, and one detect for on-duty. At low call volume stations there was 10 off-duty detections and 11 on-duty detections) but this does not provide the concentration.
Number of workers:	Study consisted of 56 firefighters from two fire departments in the Kansas City metropolitan area.
Personal protective equipment:	PDF Pg. 182Turnouts and hoods (GXTREME 3.0, Globe Manufacturing Company, LLC, Pittsfield, NH, USA; Quest Particle Barrier Hoods, Quest Fire Apparel Inc., Saratoga Springs, NY, USA)
Comments:	No physical form given and no sample results given for p-dichlorobenzene. Table 2 only presents percent change from off-duty to on-duty samples.

EVALUATION				
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	Medium	Data are for firefighting, which may be similar or involve exposures associated with other OES such as the use of paints/coatings.
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old. [2024]
	Metric 5:	Sample Size	N/A	N/A - no sample results presented.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty				

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Study Citation:	Bonner, E. M., Poutasse, C. M., Haddock, C. K., Poston, C., W.S., Jahnke, S. A., Tidwell, L. G., Anderson, K. A. (2024). Addressing the need for individual-level exposure monitoring for firefighters using silicone samplers.		
HERO ID:	12034026		
Conditions of Use:	Firefighting Activities		
Domain		EVALUATION	
Metric		Rating	
Metric 7: Metadata Completeness		N/A N/A - no sample results presented.	
Overall Quality Determination		High	

Study Citation:	CalEPA, (2008). TSD for noncancer RELs - Appendix D.3 Chronic RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines (OEHHA 1999).		
HERO ID:	628645		
Conditions of Use:	Commercial and Consumer Use - intermediate in the synthesis of various organics, dyes and pharmaceuticals; used as a space or garbage deodorizer for odor control; as an insecticide and germicide to control fruit borers and ants, moths, blue mold in tobacco seed beds, and mildew and mold on leather or fabrics		
EXTRACTION			
Parameter	Data		
Exposure route:	inhalation		
Physical form:	As a solution in solvent or oil suspension; or as crystalline material pressed into various forms (HSDB, 1997).		
Area sampling data:	In 1996, the latest year tabulated, the statewide mean outdoor monitored concentration of 1,4-DCB was approximately 0.15 ppb (CARB, 1999).		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	uses data from published sources
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US Data
	Metric 3: Applicability	Uninformative	The reported monitoring data pertain to the general population and not to an occupational scenario.
	Metric 4: Temporal Representativeness	Low	data collected is more than 20 years old
	Metric 5: Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The report does not address variability or uncertainty.
Overall Quality Determination		Uninformative	

Study Citation:	CDC, (2009). Fourth national report on human exposure to environmental chemicals.			
HERO ID:	664488			
Conditions of Use:	Commercial use			
EXTRACTION				
Parameter	Data			
Exposure route:	Inhalation			
Physical form:	Vapor			
Area sampling data:	Indoor air levels of 1,4-DCB may exceed outdoor levels when moth repellents or deodorizers.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States	
	Metric 3: Applicability	Low	The report is for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation	
	Metric 4: Temporal Representativeness	Medium	The report is generally more than 10 years but no more than 20 years old.	
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The report does not address variability or uncertainty.	
Overall Quality Determination		Medium		

Study Citation:	Cherrie, J. W. (1998). Selecting an adequate respiratory protective device: The choice between a respirator and breathing apparatus. Annals of Occupational Hygiene 42(2):91-95.			
HERO ID:	4930963			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Personal protective equipment:	respirators			
Engineering control:	IDLH and STEL. The median ratio of the IDLH level to the STEL was 10 for gases and vapors. It is concluded that the published IDLH concentrations are, on their own, an insufficient basis for selecting breathing apparatus over a filtering respirator. It is equally important to consider the likelihood that a filtering device may fail catastrophically since this determines the risk from wearing a respirator in an IDLH atmosphere.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	the article is greater than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metadata
Overall Quality Determination			High	

Study Citation:	CPA, (2005). Letter to OPPT Document Control Office, USEPA, from Lynne Jones, Manager, Chlorobenzene Producers Association, re: Study entitled ”p-Dichlorobenzene: In Vitro Dermal Absorption Rate Testing”.			
HERO ID:	7978648			
Conditions of Use:	All			
EXTRACTION				
Parameter	Data			
Physical form:	Colorless crystals (page 8 of 98)			
Dermal exposure data:	Permeability coefficient: 1.31 x 10-4 cm/hr (page 17 of 98)10 minute penetration rate: 36.9 ug equiv/cm2/h (page 18 of 98)60 min penetration rate: 15.3 ug equiv/cm2/h (page 18 of 98)			
EVALUATION				
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	The assessment or report uses high quality data and/or techniques or sound methods that are not from a frequently used source and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	The report captures operations, equipment, and worker activities that are expected to be reasonably representative of current conditions. The report is more than 10 years but no more than 20 years old.
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The report addresses variability and uncertainty in the results. Uncertainty is well characterized.
Overall Quality Determination			High	

Study Citation:	Fasano, W. J., McDougal, J. N. (2008). In vitro dermal absorption rate testing of certain chemicals of interest to the Occupational Safety and Health Administration: Summary and evaluation of USEPA’s mandated testing. Regulatory Toxicology and Pharmacology 51(2):181-194.			
HERO ID:	1618719			
Conditions of Use:	Lab Use (in vitro dermal kinetic experiment)			
EXTRACTION				
Parameter	Data			
Exposure route:	dermal			
Physical form:	in solution			
Dermal exposure data:	Table 2 contains the permeability coefficients (Kp), fluxes and application volumes for chemicals applied in water, isopropyl myristate (IPM) and neat			
Exposure duration:	10 an 60 mins (simulated exposure periods)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources (e.g., European Union or OECD reports, NIOSH HHEs, journal articles, Kirk-Othmer) and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The report is for Lab Use, which is an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	The source is over 10 yrs old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions. (Final Rule is published in the Federal Register)
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The study addresses variability in the determinants of exposure for the sampled site or sector. The study addresses uncertainty in the exposure estimates or uncertainty can be determined from the sampling and analytical method.
Overall Quality Determination			High	

Study Citation:	Hsiao, P. K., Lin, Y. C., Shih, T. S., Chiung, Y. M. (2009). Effects of occupational exposure to 1,4-dichlorobenzene on hematologic, kidney, and liver functions. International Archives of Occupational and Environmental Health 82(9):1077-1085.			
HERO ID:	4931409			
Conditions of Use:	Manufacture			
EXTRACTION				
Parameter	Data			
Worker activity description:	workers involved in the manufacture of 1,4-DCB-containing mothballs			
Exposure route:	Inhalation			
Number of workers:	study included 75 subjects (46 in the exposed group and 29 in non-exposed group)			
Personal protective equipment:	masks, gloves, and protective body suits			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data	
Domain 2: Representativeness	Metric 2: Geographic Scope	Low	non-OECD country	
	Metric 3: Applicability	High	report is for an occupational scenario within the scope of the risk evaluation	
	Metric 4: Temporal Representativeness	Medium	information is between 10 and 20 years old	
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources, assessment methods, results, and assumptions	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A - information not dependent on metadata	
Overall Quality Determination		High		

Study Citation:	IARC, (1999). Hexachlorobutadiene. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 73 73:277-294.		
HERO ID:	18474		
Conditions of Use:	Formulation and use		
EXTRACTION			
Parameter	Data		
Worker activity description:	janitors and cleaners, mortuary employees and workers in pest control		
Exposure route:	inhalation and ocular or dermal contact during its manufacture, formulation and use as an insecticide, a moth control agent, a fumigant, a deodorant and in organic syntheses for preparation of dye intermediates .		
Personal sampling data:	in chemical factory - 25 - 78 mg/m3 (8 hr); in toilet block manufacturing plants - 30 - 487 (1-3, 5 hour)		
Area sampling data:	Sampling type not reported: in manufacturing plant (washing, shovelling and centrifuging, crushing and sizing) - 42 - 294 mg/m3, household product packaging (pulverizing, moth cake line, dumping crystals, crystal line)- 42-204mg/m3, abrasive wheel manufacturing plant - 42 - 87 mg/m3; Area monitoring: hardwood bleaching plant - (0.06 - 0.8) x 10^-3 mg/m3; Area and Personal: Monochlorobenzene manufacturing (drumming para-dichlorobenzene)- 30.7-52.1 mg/m3		
Number of workers:	approximately 34 000 workers in the United States were potentially exposed to para-dichlorobenzene; most of these were janitors and cleaners, mortuary employees and workers in pest control.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old
	Metric 5: Sample Size	Medium	limited statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	report does not address variability or uncertainty.
Overall Quality Determination		High	

Study Citation:	Leong, K. J., Dowd, G. F., Macfarland, H. N. (1964). P-dichlorobenzene (1, 4-dichlorobenzene). American Industrial Hygiene Association Journal 25(3):323-325.			
HERO ID:	4912333			
Conditions of Use:	Use-insecticide and disinfectant			
EXTRACTION				
Parameter	Data			
Exposure route:	inhalation and dermal			
Personal protective equipment:	Ordinary safety glasses will provide adequate protection.			
Engineering control:	Good general ventilation is usually adequate in areas where pdichlorobenzene is handled in closed equipment. Where the material is handled in the open as a hot liquid or as a solid, local exhaust ventilation usually will be necessary. Equipment containing (or that has contained) pdichlorobenzene should be thoroughly cleaned before being exposed to a source of ignition.			
Comments:	p-Dichlorobenzene is used mainly as a chemical intermediate, as an insecticide and as a disinfectant.			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evalu- ated
	Metric 3:	Applicability	Low	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	The article is more than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Report clearly documents its data sources.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination		Medium		

Study Citation:	(1982). Investigation of exposure to paradow at the new rolling mill. :Order this.			
HERO ID:	4929935			
Conditions of Use:	Industrial and possibly commercial use			
EXTRACTION				
Parameter	Data			
Worker activity description:	crane operator at Dow Chemical’s New Rolling Mill plant			
Exposure route:	dermal			
Number of workers:	1			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	the data is greater than 20 years old
	Metric 5:	Sample Size	Low	The data pertain to a single person, and not to a representative sample of persons associated with the job function of crane operator.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty information is lacking.
Overall Quality Determination			Medium	

Study Citation:	NIOSH, (2007). NIOSH pocket guide to chemical hazards.			
HERO ID:	192177			
Conditions of Use:	All			
EXTRACTION				
Parameter	Data			
Exposure route:	Exposure route: inhalation, skin absorption, ingestion, skin and/or eye contact (page 127/454)			
Physical form:	Colorless or white crystalline solid with a mothball-like odor. (page 127/454)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	Report uses high quality data and/or techniques or sound methods that are from frequently used sources (NIOSH).
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	From USA
	Metric 3:	Applicability	High	Applicable to all occupational settings where pure p-DCB is handled
	Metric 4:	Temporal Representativeness	Medium	From 2007, the report is generally more than 10 yearsbut no more than 20 years old.
	Metric 5:	Sample Size	N/A	N/A- no sampling related data extracted.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A- no scope for this metric.
Overall Quality Determination		High		

Study Citation:	NIOSH, (2006). Letter to Catherine Roman, USEPA, re: Review of ”Chlorobenzene - In Vitro Dermal Absorption Rate Testing” and ”p-dichlorobenzene - In Vitro Dermal Absorption Rate Testing”.		
HERO ID:	7978675		
Conditions of Use:	All		
EXTRACTION			
Parameter	Data		
Exposure route:	dermal (page 2 of 8)		
Physical form:	p-Dichlorobenzene is a colorless crystal. As a hydrophobic compound, p-dichlorobenzene was first dissolved in isopropyl myristate to achieve a target concentration of 100 mg/mL and the solution was then applied to the epidermal membrane for testing. (Page 2 of 8)		
Dermal exposure data:	”Based on the slope at the steady state (12.8 µg equiv/cm /h), a mean Kp was calculated to be 1 .31 x 10-4 cm/h.” (page 2 of 8)”For the 10- and 60-minute tests, the mean absorption rates were36.9 and 15.3 ug equiv/cm2/h, respectively.” (page 3 of 8)		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	Medium	The assessment or report uses high quality data and/or techniques or sound methods that are not from a frequently used source and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Medium	The report captures operations, equipment, and worker activities that are expected to be reasonably representative of current conditions. The report is more than 10 years but no more than 20 years old.
	Metric 5: Sample Size	Medium	Distribution of samples is characterized with uncertain statistics (mean). It is unclear if analysis is representative.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Variability addressed by using different skin replicates. Uncertainty not addressed.
Overall Quality Determination		High	

Study Citation:	NIOSH, (1978). Occupational health guideline for p-dichlorobenzene.
HERO ID:	8408530
Conditions of Use:	Industrial and commercial use

EXTRACTION	
Parameter	Data
Worker activity description:	One study cites workers engaged in synthesizing or otherwise handling p-dichlorobenzene, and another exposure was through a mothproofing agent. See page 3 of 6 for additional common operations.
Exposure route:	p-Dichlorobenzene can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed (page 1 of 6)
Physical form:	Colorless solid with a mothball-like odor (page 1 of 6)
Area sampling data:	Article cites a study where concentrations range between 10 ppm to 725 ppm. (page 2 of 6) Also see page 2 for monitoring and measurement procedure suggestions.
Exposure duration:	One study cites that 58 workers were exposed for an average of 4.8 years (range – 8 months to 25 years) (page 2 of 6)
Number of workers:	One study cites that 58 workers were exposed for an average of 4.8 years (range – 8 months to 25 years) (page 2 of 6)
Personal protective equipment:	Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with solid particles or vapors from the surface of hot pDCB. Employees should be provided with and required to use dust- and splash-proof safety goggles where pDCB or liquids containing p-dichlorobenzene may contact the eyes. (page 3 of 6) Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. (page 2 of 6)
Engineering control:	General dilution ventilation; local exhaust ventilation (page 3 of 6)
Comments:	though pDCB has a strong odor at concentrations between 30 and 60 ppm, a person may become sufficiently accustomed to the odor to tolerate high concentrations (page 2 of 6)

EVALUATION				
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Methodology	High	The assessment or report uses high quality data
Domain 2: Representativeness		Metric 2: Geographic Scope	High	The data are from the United States
		Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
		Metric 4: Temporal Representativeness	Low	The report is more than 20 years old
		Metric 5: Sample Size	Low	Distribution of samples is characterized by no statistics
Domain 3: Accessibility/ Clarity		Metric 6: Metadata Completeness	High	Report clearly documents its data sources
Domain 4: Variability and Uncertainty		Metric 7: Metadata Completeness	Low	The report does not address variability or uncertainty

Overall Quality Determination

Medium

Study Citation:	Products, Convenience (2016). Safety Data Sheet (SDS): Touch 'n Foam Mouse Shield.			
HERO ID:	6294050			
Conditions of Use:	Use of adhesives and sealants			
EXTRACTION				
Parameter	Data			
Personal protective equipment:	Wear appropriate NIOSH respirator when ventilation is inadequate and occupational exposure limits are exceeded. Protective gloves. Safety glasses.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	SDS information is primary data from the supplier. SDS does not appear to have quality issues.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Product is from a US supplier.
	Metric 3:	Applicability	High	SDS is applicable to an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	Source is from March 2016, which is less than 10 years old.
	Metric 5:	Sample Size	N/A	Only PPE information, no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Source just provides PPE information and does not document how it value was obtained.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Does not address variability or uncertainty.
Overall Quality Determination			High	

Study Citation:	U.S. BLS, (2023). U.S. Census Bureau of Labor Statistics Data from 2021.			
HERO ID:	11138808			
Conditions of Use:	All			
EXTRACTION				
Parameter	Data			
Number of workers: Used to develop a method to estimate number of sites and workers.				
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	BLS is expected to use reliable survey methods.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	U.S. based economic data
	Metric 3:	Applicability	High	These economic data cover all industry and occupation types in scope for all chemicals.
	Metric 4:	Temporal Representativeness	High	The BLS OES data are from 2021
	Metric 5:	Sample Size	High	The BLS OES program provides detailed statistics and estimated relative standard error for each state, industry, and occupation survey conducted (https://www.bls.gov/oes/current/oes_research_estimates.htm).
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	BLS documents results and methods, but underlying survey results not accessible.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Limited discussion of variability and uncertainty in results.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (2020). 2020 CDR: Commercial and consumer use.			
HERO ID:	10366189			
Conditions of Use:	Import			
EXTRACTION				
Parameter	Data			
Number of workers:	Provides range of workers.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	EPA is a trusted source.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	CDR is U.S. based data.
	Metric 3:	Applicability	High	CDR covers chemical importers, which are in scope for p-dcb
	Metric 4:	Temporal Representativeness	High	EPA used data from the 2020 CDR, which includes data reported for 2019.
	Metric 5:	Sample Size	Medium	Due to reporting threshold, statistical representativeness is unclear.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Submissions do not include method of how production volumes were determined. CDR industry sector codes, industrial processing and use codes, industrial function codes, and commercial product codes provide good metadata; but lack of clarifying information and narratives and occasional misreportings limit clarity of data.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	CDR data do not address variability or uncertainty in submitter provided data.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (2020). 2020 CDR: Commercial and consumer use.			
HERO ID:	10366189			
Conditions of Use:	Processing			
EXTRACTION				
Parameter	Data			
Number of workers:	Soap, Cleaning Compound, and Toilet Preparation Manufacturing-Deodorizer:50 – 99Plastics Product Manufacturing-Plasticizer:25 – 49Soap, Cleaning Compound, and Toilet Preparation Manufacturing-Deodorizer:10 – 24Plastics Material and Resin Manufacturing - Monomers:50 – 99			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	EPA is a trusted source.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	CDR is U.S. based data.
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	EPA used data from the 2020 CDR, which includes data reported for 2019.
	Metric 5:	Sample Size	Medium	Due to reporting threshold, statistical representativeness is unclear.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Submissions do not include method of how production volumes were determined. CDR industry sector codes, industrial processing and use codes, industrial function codes, and commercial product codes provide good metadata; but lack of clarifying information and narratives and occasional misreportings limit clarity of data.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	CDR data do not address variability or uncertainty in submitter provided data.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (2026). Chemical Data Reporting (CDR): Reporting year 2024.			
HERO ID:	13246149			
Conditions of Use:	Manufacturing, Repackaging, Incorporation into formulation, mixture, or reaction product, plastics compounding, and use in solid air care products			
EXTRACTION				
Parameter	Data			
Physical form:	Provides physical form for multiple OES.			
Number of workers:	Provides number of workers for multiple OES.			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	EPA is a trusted source.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	CDR is U.S. based data.
	Metric 3:	Applicability	High	CDR covers multiple OES, which are in scope for the chemical.
	Metric 4:	Temporal Representativeness	High	EPA used data from the 2024 CDR.
	Metric 5:	Sample Size	Medium	Number of workers is presented as a range.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	CDR industry sector codes, industrial processing and use codes, industrial function codes, and commercial product codes provide good metadata; but lack of clarifying information and narratives and occasional misreportings limit clarity of data.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	CDR data do not address variability or uncertainty in submitter provided data.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (2020). 2020 CDR data.			
HERO ID:	6275311			
Conditions of Use:	Manufacture and Import			
EXTRACTION				
Parameter	Data			
Physical form:	Provides physical form.			
Number of workers:	Provides number of workers.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	EPA is a trusted source.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	CDR is U.S. based data.	
	Metric 3: Applicability	High	CDR covers chemical manufacturers and importers, which are in scope for all chemicals. Also, downstream industrial use categories are specified, which include multiple relevant OESs.	
	Metric 4: Temporal Representativeness	High	EPA used data from the 2020 CDR, which includes data reported for 2019.	
	Metric 5: Sample Size	Medium	Due to reporting threshold, statistical representativeness is unclear.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Submissions do not include method of how production volumes were determined. CDR industry sector codes, industrial processing and use codes, industrial function codes, and commercial product codes provide good metadata; but lack of clarifying information and narratives and occasional misreportings limit clarity of data.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	CDR data do not address variability or uncertainty in submitter provided data.	
Overall Quality Determination		High		

Study Citation:	Zaman, R. (1992). Solving air emissions problems from metal cleaning operations. The National Environmental Journal 2(4):44.			
HERO ID:	5489562			
Conditions of Use:	commercial use			
EXTRACTION				
Parameter	Data			
Engineering control:	There are a number of design parameters that can be considered in order for a system to operate with minimal sol vent losses. • Work Opening - When a part is introduced into the vapor zone, it displaces and forces vapor out of the machine. As a general rule, the cross-sectional area of the opening should be at least twice the area of the part being cleaned. • Freeboard Height - In most cases, a higher freeboard will result in lower diffusion losses from the vapor blanket. At a minimum, the freeboard height should be at least 75 percent of the smallest horizontal dimension. • Heat Balance - If parts are introduced into the vapor blanket at a lower temperature than the vapor, it is important that the heat capacity of the cleaning system be able to overcome this load to maintain the vapor blanket. If the vapor blanket collapses, solvent condenses on the part and air is pulled into the vapor zone. Once the temperature rises and the vapor blanket is reestablished, solvent laden air is expelled.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data and/or techniques	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data	
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Low	information greater than 20 years	
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	N/A	N/A - information not dependent on metadata	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A - information not dependent on metadata	
Overall Quality Determination		High		

Study Citation:	AS., COWI (2018). Screening programme 2017: Suspected PBT compounds.		
HERO ID:	7303021		
Conditions of Use:	disposal		
EXTRACTION			
Parameter	Data		
Description of release source:	wastewater treatment plant		
Release or emission factors:	Concentrations of p-DCB: wastewater - <0.2 ug/L; landfill run-off - <0.2 ug/L		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	sampling and analytical methodology known
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	The data are from an OECD country other than the U.S.
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	High	no more than 10 years old
	Metric 5: Sample Size	Low	characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination		Medium	

Study Citation:	Atasoy, E., Döğeroğlu, T., Kara, S. (2004). The estimation of NMVOC emissions from an urban-scale wastewater treatment plant. Water Research 38(14-15):3265-3274.		
HERO ID:	3572863		
Conditions of Use:	Disposal		
EXTRACTION			
Parameter	Data		
Description of release source:	waste water treatment plant of the province of Eskisehir in Turkey - emissions from primary clarifier (and its weir), aerated biological treatment, and secondary clarifier (and its weir)		
Release quantity:	Calculated emission rate for pDCB - 1.18kg/yr, and significant portion is from the secondary clarifier. Total flux for pDCB - 50.2 x 10^-10 g/cm2/hr		
Release or emission factors:	”To use the equations given above for the intended purpose of the study, the parameters in the equations had to be specified suitably. Of the main factors that affect the rate of phase transfer, the following are particularly important: (a) surface area for gas–liquid contact, (b) temperature, turbulence and the degree of mixing (c) wastewater retention time and the depth of the wastewater in the system (d) the concentrations of organic compounds in the wastewater; (e) the physical properties of the pollutants (volatilities and diffusivities in water; vapor pressures, Henry’s Law constants, solubilities in or affinities to water, etc.), (f) the presence of a mechanism that inhibits volatilization (such as an oil film), or a competing mechanism (such as biodegradation).”		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	release data methodology is expected to be accurate
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	oecd country- Turkey
	Metric 3: Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Medium	data between 10 and 20 years old
	Metric 5: Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Release data include all associated metadata, including release media; process, unit operation
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	release data study does not address variability or uncertainty
Overall Quality Determination		Medium	

Study Citation: ATSDR, (2006). Toxicological profile for dichlorobenzenes.
HERO ID: 5160103
Conditions of Use: Disposal

EXTRACTION

Parameter	Data
Description of release source:	The primary sources of 1,4-DCB of industrial or commercial origin in the environment are releases from space deodorants and moth repellants into the atmosphere. 1,4-DCB might also be released into water through waste water streams and landfill leachate and to soil through sewage sludge application, disposal of industrial waste, and atmospheric deposition. 1,4-DCB may also be emitted to air from other sources, such as hazardous waste sites (EPA 1981a), during its use as a fumigant (EPA 1981a), or from emissions from waste incinerator facilities (Jay and Stieglitz 1995). These emissions are likely to be a minor contribution to the total atmospheric loading of 1,4-DCB, but may be locally important. There are no known natural sources of 1,4-DCB (IARC 1999). The principal sources of 1,4-DCB release to land are disposal of industrial waste in landfills, application of sewage sludge containing 1,4-DCB to agricultural land, and atmospheric deposition (Wang and Jones 1994b; Wang et al. 1995).
Release quantity:	According to the TRI, in 2003, a total of 96,993 pounds (44 metric tons) of 1,4-DCB was released to the environment from 21 large processing facilities (TRI03 2005). Of this total, an estimated 85,463 pounds (39 metric tons) were released to air, 815 pounds (0.4 metric tons) were released to water, 270 pounds (0.1 metric tons) were released to land, and 10,408 pounds (5 metric tons) were released via underground injection. The total amount of 1,4-DCB released on-site was estimated as 96,696 pounds (44 metric tons). The total amount released off-site was estimated as 297 pounds (0.1 metric tons) (TRI03 2005).
Waste treatment methods and pollution control:	EPA has listed 1,2-, 1,3-, and 1,4-DCB as hazardous wastes and subjects them to hazardous waste regulations. Hazardous wastes are subject to the handling, transport, treatment, storage, and disposal regulations as promulgated under the Resource Conservation and Recovery Act (HSDB 2005; IRPTC 1985). Incineration by appropriate means is the recommended method for the disposal of waste 1,4-DCB (HSDB 2005). 1,4-DCB may be disposed of by making packages of the chemical in paper or other disposable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device or by dissolving the chemical in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device (IRPTC 1985). Halogenated compounds may be disposed of by incineration provided they are blended with other compatible wastes or fuels so that the composite contains <30% halogens. Liquid injection, rotary kiln, and fluidized bed incinerators are typically used to destroy liquid halogenated wastes. Temperatures of at least 2,000–2,200 °F are necessary.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The release data methodology is known.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Medium	data is between 10 and 20 years old
	Metric 5: Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The release data study does not address variability or uncertainty.

Continued on next page ...

p-Dichlorobenzene

Environmental Releases

HERO ID: 5160103 Table: 1 of 1

...continued from previous page

Study Citation: ATSDR, (2006). Toxicological profile for dichlorobenzenes.
HERO ID: 5160103
Conditions of Use: Disposal

		EVALUATION	
Domain	Metric	Rating	Comments
Overall Quality Determination		Medium	

Study Citation:	ATSDR, (1998). Toxicological profile for 1,4-dichlorobenzene (update).		
HERO ID:	5258934		
Conditions of Use:	disposal		
EXTRACTION			
Parameter	Data		
Description of release source:	Industrial releases contribute only a small fraction of the total environmental loading of 1,4-dichlorobenzene (ICF 1987). Use of consumer products containing 1,4-dichlorobenzene is the major source of environmental releases (EPA 1981a).		
Release quantity:	According to the Toxics Release Inventory (TRI), in 1996, a total of 762,085 pounds (381,000 tons) of 1,4-dichlorobenzene was released to the environment from 20 large processing facilities (TRI96 1998). Table 5-1 lists amounts released from these facilities. Of this total, an estimated 236,502 pounds (118,000 tons) were released to air, 1,881 pounds (0.94 tons) were released to water, 480 pounds (0.24 tons) were released to land, 2,000 pounds (1 ton) were released via underground injection, 79 pounds (0.04 tons) were released to publicly owned-treatment works (POTWs), and 521,143 pounds (260 tons) were transferred offsite (TRI96 1998). The TRI data should be used with caution because only certain types of facilities are required to report (EPA 199713). This is not an exhaustive list.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	Medium	Release data is from TRI, the specific methodology reported from TRI for the estimated releases are not specified in this source.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5: Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Release data includes release media but not other meta-data to describe sources of release
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Report addresses uncertainty and variability by noting that list from TRI is not exhaustive but report is limited in this discussion
Overall Quality Determination		Medium	

Study Citation:	Brown, S. L., Chan, F. Y., Jones, J. L., Liu, D. H., Mccaleb, K. E. (1975). Research program on hazard priority ranking of manufactured chemicals (Chemicals 21-40).			
HERO ID:	5251828			
Conditions of Use:	Use			
EXTRACTION				
Parameter	Data			
Release quantity:	Release from use of space odorant - 39 million lbs/yr, use of moth control - 30.6 million lbs/yr			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	data is expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data do not include any needed metadata to understand what the data represent and are not usable in the risk evaluation.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	CalEPA, (1997). Public health goal for 1,4-dichlorobenzene in drinking water.			
HERO ID:	5155646			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	Air release of 1,4-DCB has been estimated at 70 to 90% of the total U.S. production, including contributions from its use as a toilet deodorizer, garbage deodorant and agent for moth control (IARC, 1982; citing Johnston et al., 1979). Since these are the predominant uses of 1,4-DCB and resulted in significant air exposures, they are the most likely sources and route of exposure to humans.			
Release quantity:	Air release of 1,4-DCB has been estimated at 70 to 90% of the total U.S. production, including contributions from its use as a toilet deodorizer (~1.7 x 10^6 kg), garbage deodorant (~3.7 x 10^6 kg) and agent for moth control (~7.8 x 10^6 kg) (IARC, 1982; citing Johnston et al., 1979). Since these are the predominant uses of 1,4-DCB and resulted in significant air exposures, they are the most likely sources and route of exposure to humans.			
Release frequency:	The Toxic Release Inventory (TRI) reported total releases of 1,4-DCB to land of 4,482 pounds forthe years 1987 to 1993. TRI reported total releases of 1,4-DCB to water of 33,675 pounds for the years 1987 to 1993			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	data are from the United States
	Metric 3:	Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	CalEPA, (2008). TSD for noncancer RELs - Appendix D.3 Chronic RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines (OEHHA 1999).			
HERO ID:	628645			
Conditions of Use:	Unknown-Emissions			
EXTRACTION				
Parameter	Data			
Release quantity:	The annual statewide industrial emissions from facilities reporting under the Air Toxics Hot Spots Act in California based on the most recent inventory were estimated to be 30,577 pounds of dichlorobenzene (CARB, 2000).			
Comments:	The sources of release are not stated and therefore their is uncertainty whether these sources are in scope.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The reference for the data is expected to contain accurate data.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data pertain to California.	
	Metric 3: Applicability	Uninformative	The reference for the data must be reviewed to determine applicability. The reference for the data was reviewed (HERO ID 7612740) and it was determined that the release data is not for p-DCB.	
	Metric 4: Temporal Representativeness	Low	The data are more than 20 years old.	
	Metric 5: Sample Size	Low	Statistics are not reported.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Media of release is implied but no other information is provided.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The data do not address variability.	
Overall Quality Determination		Uninformative		

Study Citation:	Chin, J. Y. (2011). Characterization of biofuels blends: Emissions, permeation and apportionment of volatile organic compounds.			
HERO ID:	6026451			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Release quantity:	Average concentrations (ug/m3): during Fall 2009 - 0.62 +/- 0.75; during Winter 2009 - 0.2 +/- 0.29; during Spring 2010 - 0.57 +/- 0.86; for Summer 2010 - 0.33 +/- 0.33 +/-0.49			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	data between 10 and 20 years old
	Metric 5:	Sample Size	Medium	uncertain statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	does not address variability or uncertainty
Overall Quality Determination		Medium		

Study Citation:	Clement Associates., Inc. (1989). Human health risk assessment for the Ciba-Geigy St Gabriel, LA incineration project with cover letter dated 042789.
HERO ID:	890000189:#86-890000189.
Conditions of Use:	1335586
	disposal

EXTRACTION

Parameter	Data
Description of release source:	Liquid Incinerator and rotary kiln incinerator.
Release quantity:	Relative amount in feed streams for the liquid incinerator for pDCB is "very low" and the approximate percent of chemical waste feed is 0.19 where the estimated chemical feed rate is 26.464 lbs/yr. Estimate emissions are 7.94×10^{-2} lbs/yr (average) and 5.29×10^{-1} lbs/yr. For the rotary kiln incinerator, p-DCB emission rates are given in Table C-11 (PDF pg 99/475)
Release or emission factors:	For the liquid incinerator, average and maximum DRE are 0.999997 and 0.999998, respectively. These DREs were calculated from trial burn data involving p-DCB and two other chemicals (PDF pg. 80/475)
Release frequency:	A conservative assumption applied for all emissions estimate was that both incinerators would operate 24 hours/day, 365 days/year.
Waste treatment methods and pollution control:	Scrubber system - to remove particulated and HCl from the flue gas stream.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	methodology is approved and well described
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old
	Metric 5: Sample Size	Medium	Average and high destruction and removal efficiencies (DREs) are reported.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Meta data include source of waste feed to incinerators, type of incinerators, and media of release.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Variability in DRE is reported.

Overall Quality Determination**High**

Study Citation:	Cordova-Orellana, C. (2017). Air toxic emissions and associated health risks in Cook County, IL.			
HERO ID:	6026136			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Release quantity:	See page 86 of 143 for NEI values for p-DCB in Illinois, included in a table that lists the top 20 air toxics that contribute to area/non-point air emission. This includes 473 tons per year (tpy) in 1999, 1,227tpy in 2002 and 2005. See page 99 of 143 for this information except in Cook County IL for total air emissions (p-DCB on list in 2002 and 2005) and page 101 for Cook County area/non-point air emissions (p-DCB on list in 1999, 2002, 2005).			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	From NEI
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	In USA
	Metric 3:	Applicability	Low	Relevant release data but there was no occupational scenario references.
	Metric 4:	Temporal Representativeness	Medium	data as recent as 2005 included
	Metric 5:	Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Variability among years and area vs point sources briefly described.
Overall Quality Determination			Medium	

Study Citation:	Cudahy, J. J. (1998). Low waste feed concentrations and destruction removal efficiency. Waste Management 18(6-8):453-459.
HERO ID:	1487499
Conditions of Use:	disposal

EXTRACTION

Parameter	Data
Waste treatment methods and pollution control:	use of hazardous waste incinerators. feed concentration with pDCB 65,000 ppm by weight - DRE - 99.998%

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	Low	The methodology is not specified although a reference to the original source is given.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Data is associated with the U.S.
	Metric 3: Applicability	High	Disposal is a COU.
	Metric 4: Temporal Representativeness	Low	The data is more than 20 years old.
	Metric 5: Sample Size	Low	Data not characterized by statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Source of release and medium of release are given. Frequency of release is not applicable in the case of destruction and removal efficiency (DRE).
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability or uncertainty is not addressed although an original reference is given.

Overall Quality Determination**Medium**

Study Citation:	Earthjustice, (2020). Exhibit 1 to comments of rubbertown emergency action et al., re: TSCA risk evaluations for high-priority substances and substances undergoing manufacturer-requested risk evaluations.		
HERO ID:	10385015		
Conditions of Use:	Disposal		
EXTRACTION			
Parameter	Data		
Description of release source:	Disposal from chemical plants, refineries, paper mills, and waste treatment facilities in concentrated regions in Texas.		
Release quantity:	Releases & Transfers of High Priority Chemicals (Port Arthur, TX Area) 2012-2018 (lbs): Air = 22.3; Total = 22.3; Offsite Transfer = 141.0; Incoming Waste Transfers = 44,818.0; % of Nationwide Total (releases) = 0.030; % Nationwide Total (Offsite Transfers) = 2.094; % Nationwide Total (Incoming Waste Transfers) = 1.531Releases & Transfers of High Priority Chemicals (Houston, TX Area) 2012-2018 (lbs): Air = 89.00; Total = 89.00; Offsite Transfer = 53,787.00; Incoming Waste Transfers = 1,133,497.00; % of Nationwide Total (releases) = 0.030; % Nationwide Total (Offsite Transfers) = 2.094; % Nationwide Total (Incoming Waste Transfers) = 38.723Releases & Transfers of High Priority Chemicals (Mossville, LA Area) 2012-2018 (lbs): Air = 1.00; Land = 1.00; Total = 1.00; % of Nationwide Total (releases) = 0.030; % Nationwide Total (Offsite Transfers) = 0.00004Releases & Transfers of High Priority Chemicals in Cancer Alley, 2012-2018 (lbs): Air = 359.00; Land = 1.00; Total = 359.0; Offsite Transfer = 73,906.00; % of Nationwide Total (releases) = 0.030; % Nationwide Total (Offsite Transfers) = 2.094		
Release or emission factors:	See release quantity information.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Releases are reported from Toxics Release Inventory (TRI) and expected to cover all release sources reported to TRI.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States and are representative of the industry being evalu-ated.
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	High	Data were collected in the past 10 years.
	Metric 5: Sample Size	High	Discrete release data provided.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Provides annual release data for various media, but additional metadata is not provided.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Variability throughout various facilities and regions are considered. However, measure-ment uncertainty is not addressed.
Overall Quality Determination		High	

Study Citation:	Ecology and Environment, (1992). Site investigation and evaluation of remedial measures report Howard Hughes properties plant site, Los Angeles, California.
HERO ID:	6311590
Conditions of Use:	Disposal

EXTRACTION

Parameter	Data
Description of release source:	Storm drainage discharge sites
Release quantity:	In soil, concentrations of p-DCB ranged from 20 to 90 ppb in the salvage yard, and between 20 and 6900 ppb in the former drum storage area. In groundwater, concentrations of p-DCB ranged from ND to 400,000 ppb
Waste treatment methods and pollution control:	Soil remediation and groundwater restoration was performed at the site. Soil remediation included removal of soils containing chemicals in excess of hazardous waste criteria, and technologies involved were dewatering, excavation, and backfilling. Groundwater remediation included use of groundwater extraction wells and treatment plants.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	uses high quality data
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	Low	The release data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	data is greater than 20 years
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Release data include release media but no other metadata
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The release data study does not address variability or uncertainty

Overall Quality Determination**Medium**

Study Citation:	ENSR, (1991). Ab 2588 Health Risk Assessment for Kern River and Racetrack Oil Fields, Bakersfield, California with attachments and cover letter dated 090591.
HERO ID:	1481756
Conditions of Use:	Commercial use of p-DCB in lubricants and greases.

EXTRACTION

Parameter	Data
Description of release source:	Emissions from four oil and gas production operations in California
Release quantity:	Emissions from Racetrack Hill site was 0.00144434 lbs/yr (chlorobenzene considered instead of pDCB only). Emissions from Kern River site 0.002 lbs/yr (chlorobenzene considered instead of pDCB only).
Release or emission factors:	Unit risk (DHS and EPA cancer potency values) for pDCB - 1.1E-5 (ug/m3)^-1

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The release data methodology is known
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	Data greater than 20 years old
	Metric 5: Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The release data study does not address variability or uncertainty.

Overall Quality Determination**Medium**

Study Citation:	ERG, (1998). Air emissions inventories, volume 2: Point sources: Chapter 11: Preferred and alternative methods for estimating air emissions from plastic products manufacturing.
HERO ID:	7349020
Conditions of Use:	Processing: Intermediate in plastic material and resin manufacturing

EXTRACTION

Parameter	Data
Description of release source:	The primary sources of emissions at plastic products manufacturing facilities are the pieces of equipment (e.g., extruder hopper, die head, sander) used to handle raw materials and produce the final product. These are typically the locations where chemical reactions occur, liquid solvents and solvent blends are exposed to the atmosphere, solid resin is heated and melted, and additives are introduced. In addition to emissions generated directly from primary production processes associated with plastic products manufacturing, there may be additional emissions produced by secondary processes at these facilities. Emission sources from these secondary processes include storage tanks, equipment leaks, wastewater treatment, combustion sources, and cleaning and surface coating operations. (p. 17)
Release or emission factors:	19.6 lb PM/million lb HDPE (at 380 deg F) (Example 11.5-2; this emission factor is based on real data while other examples presented in this source appear to have made-up parameters)
Waste treatment methods and pollution control:	"It is expected that VOC and organic HAP emissions could be controlled by incineration, adsorption, absorption, or condensation. Incineration and carbon adsorption have been identified as technologies currently in use at polystyrene foam manufacturing facilities (EPA, 1990). PM emissions generated from finishing operations, including cutting and grinding, are typically controlled by cyclones or fabric filters" (p. 21)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium
			The release data methodology is known or expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High
	Metric 3:	Applicability	Medium
	Metric 4:	Temporal Representativeness	Low
	Metric 5:	Sample Size	N/A
			No sample data.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium
			Release data include most critical metadata, including release media and emission factor, but lacks additional metadata, such as the activity that is the source of the release.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium
			Emission factor provided for only one process, therefore variability is not addressed. Uncertainty is documented.

Overall Quality Determination**Medium**

Study Citation:	Gullett, B. K., Oudejans, L., Tabor, D., Touati, A., Ryan, S. (2012). Near-real-time combustion monitoring for PCDD/PCDF indicators by GC-REMPI-TOFMS. Environmental Science & Technology 46(2):923-928.			
HERO ID:	2048411			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	boiler exit concentrations			
Release quantity:	average concentration 10.31 +/- 1.52 ug/m3			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	approved method
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	High	data less than 10 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Release data include all associated metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion on uncertainty
Overall Quality Determination			High	

Study Citation:	Harkov, R., Gianti, S. J., Bozzelli, J. W., Laregina, J. E. (1985). Monitoring volatile organic compounds at hazardous and sanitary landfills in New Jersey. Journal of Environmental Science and Health, Part A: Environmental Science and Engineering 20(5):491-502.
HERO ID:	5245498
Conditions of Use:	Disposal

EXTRACTION

Parameter	Data
Description of release source:	6 abandoned hazardous waste sites and one sanitary landfill in New Jersey
Release quantity:	Average concentrations of p-DCB at different sites (ppbv): GEMS - 0.31, BC - 0.09, KRA - 0.54, LP - 0.09, WOOD - 0.03, EDGE - 0.07, PP - 0.05. Maximum concentration detected at these 6 sites - 4.19.
Release or emission factors:	wind speed, precipitation and temperature,
Waste treatment methods and pollution control:	Some internal factors that could be important in controlling VOC emission rates are the presence of gas vents, leachate ponds and leaking drums, soil temperatures, moisture levels and texture types, depth-to-soil surface of VOC dumping and concentrations of VOC in soil solutions.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	High US data
	Metric 3:	Applicability	High The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low data greater than 20 years old
	Metric 5:	Sample Size	Medium Distribution of samples is characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low The release data study does not address variability or uncertainty.

Overall Quality Determination**Medium**

Study Citation:	Hart, J. R. (1994). Comparison of emissions from burning hazardous waste in a dry-process cement kiln with emission from burning conventional fossil fuels. Hazardous Waste and Hazardous Materials 11(1):193-199.
HERO ID:	658817
Conditions of Use:	Commercial use - manufacture of Portland Cement

EXTRACTION

Parameter	Data
Description of release source:	cement kiln
Release quantity:	pDCB was not detected in the emission
Waste treatment methods and pollution control:	water spray, multicyclone, use of baghouse
Comments:	There is no mention of disposal of pDCB in the cement kiln that is the subject of the data source.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The methodology is well described.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	The release data pertain to disposal
	Metric 4: Temporal Representativeness	Low	The data is more than 20 years old.
	Metric 5: Sample Size	Low	Statistics not reported.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	The data include release media and process.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability is not addressed.

Overall Quality Determination**Medium**

Study Citation:	IARC, (1999). Hexachlorobutadiene. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 73 73:277-294.			
HERO ID:	18474			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	The major sources of para-dichlorobenzene in the atmosphere are due to volatilization during its consumer or commercial use and from waste sites and emissions from waste incinerator facilities.			
Release quantity:	In 1994, estimated emissions of pDCB from 23 facilities were 117,000 kg; emissions from municipal wasteincinerator plants in Germany at concentrations of 0.51 µg/m3 para-dichlorobenzene; para-Dichlorobenzene was found in industrial effluentsfrom 1.7% of 1306 sites and in 3% of ambient water samples from 8575 sites, at a medianconcentration < 0.1 µg/L; para-dichlorobenzene were 500 kg to land.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	release data methodology is known or expected to be accurate	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data	
	Metric 3: Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old	
	Metric 5: Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Release data include most critical metadata, including release media, but lacks additional metadata	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	release data study does not address variability or uncertainty.	
Overall Quality Determination		Medium		

Study Citation:	IARC, (1982). IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans: Some industrial chemicals and dyestuffs. IARC monographs on the evaluation of carcinogenic risks to humans 29:1-398.			
HERO ID:	27010			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Description of release source:	manufacture, use as a toilet bowl deodorant, garbage deodorant, moth control.			
Release quantity:	As estimated 70-90% of the annual US production of para-dichlorobenzene has been reported to be released into the air. In 1972, loss of pDCB to the US environment during manufacture was estimated to have been 540 thousand kg (USEPA 1980). About 1700 thousand kg of pDCB were estimated to be released into US air from its use as a toilet bowl deodorant; 3700 thousand kg from its use as a garbage deodorant; and 7800 thousand kg from its use for moth control (Johnston et al., 1979). Air concentration data reported in on page 223. During 1977, 4.1 million kg of DCB were released to water resulting from its use as a deodorant in toilet bowls and garbage.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Low	methodology not specified although reported data is referenced.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data pertains to US
	Metric 3:	Applicability	High	The data pertain to COU
	Metric 4:	Temporal Representativeness	Low	Data is more than 20 years old
	Metric 5:	Sample Size	Low	Statistics are not reported.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Some meta data such medium and frequency are reported.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability not addressed.
Overall Quality Determination		Medium		

Study Citation:	IARC, (1982). Ortho- and para-dichlorobenzenes. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, vol. 29:213-238.			
HERO ID:	4912310			
Conditions of Use:	Air Care Products			
EXTRACTION				
Parameter	Data			
Release quantity:	About 1700 thousand kg of para-dichlorobenzene were estimated to be released into US air from its use as a toilet bowl deodorant; 3700 thousand kg from its use as a garbage deodorant; and 7800 thousand kg from its use for moth control (Johnston et al., 1979).			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	release data methodology is known or expected to be accurate but methodologies of these estimates are not provided in the article.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	U.S. data
	Metric 3:	Applicability	Medium	Release data is for manufacturing which is not in scope but may provide information for import.
	Metric 4:	Temporal Representativeness	Low	more than 20 years old.
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Release data include most critical metadata, including release media and release frequency, but lacks additional metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	release data study does not address variability or uncertainty.
Overall Quality Determination			Medium	

Study Citation:	IARC, (1982). Ortho- and para-dichlorobenzenes. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, vol. 29:213-238.			
HERO ID:	4912310			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Release quantity:	As estimated 70-90% of the annual US production of para-dichlorobenzene has been reported to be released into the air. In 1972, loss of para-dichlorobenzene to the US environment during manufacture was estimated to have been 540 thousand kg (US Environmental Protection Agency, 1980c).			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	Medium	release data methodology is known or expected to be accurate but methodologies of these estimates are not provided in the article.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	U.S. data	
	Metric 3: Applicability	Medium	Release data is for manufacturing which is not in scope but may provide information for import.	
	Metric 4: Temporal Representativeness	Low	more than 20 years old.	
	Metric 5: Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Release data include most critical metadata, including release media and release frequency, but lacks additional metadata.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	release data study does not address variability or uncertainty.	
Overall Quality Determination		Medium		

Study Citation:	IARC, (1999). Some chemicals that cause tumours of the kidney or urinary bladder in rodents and some other substances.			
HERO ID:	666726			
Conditions of Use:	consumer/commercial use			
EXTRACTION				
Parameter	Data			
Description of release source:	The production and use of para-dichlorobenzene, primarily in a variety of consumer products (space deodorants, room fresheners, toilet deodorizer, general insecticide) and as an agricultural fumigant, is the main sources of their release to the environment from various waste streams. Major sources of para-dichlorobenzene in the atmosphere are due to volatilization during its consumer or commercial use and from waste sites and emissions from waste incinerator facilities (Agency for Toxic Substances Disease Registry, 1997). The principal sources of para-dichlorobenzene on land are disposal of industrial waste in landfills, application of sewage sludge containing para-dichlorobenzene to agricultural land and atmospheric deposition (Webber & Lesage, 1989; Wang et al., 1992, 1995; Webber et al. 1996).			
Release quantity:	Estimated emissions of para-dichlorobenzene from 23 facilities were 117 000 kg. 723 kg of para-dichlorobenzene were released from 23 facilities to surface water. In 1994, industrial releases of para-dichlorobenzene to the land from 33 facilities in the United States amounted to 500 kg (National Library of Medicine, 1998).			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	References pertaining to the release data are sources such as TRI that are expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data pertains to U.S.
	Metric 3:	Applicability	High	The data pertains to COUs
	Metric 4:	Temporal Representativeness	Low	The data is more than 20 years old.
	Metric 5:	Sample Size	Low	Statistics are not reported.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Release data include release media and frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The data do not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	IPCS, (1991). Chlorobenzenes other than hexachlorobenzene.			
HERO ID:	81628			
Conditions of Use:	General			
EXTRACTION				
Parameter	Data			
Release quantity:	Estimated quantity of 1,4-DCB lost to the environment during manufacture in relation to total 1983 production: 1983 PV: 24 x 10^6 kg; losses during manufacture: 1.8-2.8 x 10^5 kg; Losses to environment: 1.7-2.7 x 10^5 (pg. 14/97 of PDF)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	Low	The release data methodology is not specified.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Release data pertains to U.S.	
	Metric 3: Applicability	High	Data pertaining to manufacture is reported.	
	Metric 4: Temporal Representativeness	Low	Data is more than 20 years old.	
	Metric 5: Sample Size	Low	Statistics are not reported.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Release media is not reported which implies that the releases are total releases to all media.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.	
Overall Quality Determination		Low		

Study Citation:	Luin, Van, A. B., Starkenburg, Van, W. (1985). Hazardous Substances in Waste Water. Water Science and Technology 17(6-7):843–853.			
HERO ID:	5443237			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	dye industry			
Release quantity:	median concentrations of p-DCB in influent and effluent of six municipal waste water treatment plants (in ug/l): <5/<5			
Waste treatment methods and pollution control:	percent removal of pDCB in six municipal waste water treatment plants: number of samples 1, mean >72			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5:	Sample Size	High	statistical distribution of samples is fully characterized.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination			Medium	

Study Citation:	Macleod, M., Mackay, D. (1999). An assessment of the environmental fate and exposure of benzene and the chlorobenzenes in Canada. Chemosphere 38(8):1777-1796.			
HERO ID:	660263			
Conditions of Use:	Use			
EXTRACTION				
Parameter	Data			
Release quantity:	Emission data is discussed in page 1778. Estimated emission in southern Ontario: air - 1750 tons/yr; water - 0; soil - 1.525 tons/yr			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	Data is from Canada
	Metric 3:	Applicability	Low	Data is not specific to any industry or CoU of p-DCB that would be in the scope of the RE (general release estimates)
	Metric 4:	Temporal Representativeness	Low	Data is more than 20 years old
	Metric 5:	Sample Size	Low	characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data include release media but no other metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	release data study does not address variability or uncertainty.
Overall Quality Determination			Low	

Study Citation:	Middleton, P., Sockwell, R., Carter, L., W.P. (1990). Aggregation and analysis of volatile organic compound emissions for regional modeling. Atmospheric Environment, Part A: General Topics 24(5):1107-1133.			
HERO ID:	87136			
Conditions of Use:	Commercial use			
EXTRACTION				
Parameter	Data			
Description of release source:	manufacturing and waste treatment			
Release quantity:	Annual 1980 total emissions for US was 12,000 metric tons per year. Mass of halobenzenes was 602 gigagrams per year.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Methodology is expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data pertains to U.S.
	Metric 3:	Applicability	High	Data pertain to COU in scope.
	Metric 4:	Temporal Representativeness	Low	Data are more than 20 years old.
	Metric 5:	Sample Size	Low	Statistics not reported.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	A limited discussion of variability is included.
Overall Quality Determination			Medium	

Study Citation:	Midwest Research Institute, (1984). Performance evaluation of full-scale hazardous waste incinerators - Volume I (excutive summary) contract no. 68-02-3177 (43).
HERO ID:	1269556
Conditions of Use:	disposal

EXTRACTION

Parameter	Data
Description of release source:	incineration
Release quantity:	emission - conc - 8.5 - 100 ng/L and output rate - 0.0012 - 0.0058 g/min. pDCB in scrubber makeup water - ND;
Release or emission factors:	Incinerator input rates of p-DCB given in Table E-6. Emission factors may be calculated from this data and the release quantities. DRE are given in Table E-14.
Waste treatment methods and pollution control:	Combustion gases leave the oxidizer and travel downward through a spray chamber and quench pot before entering a vertical scrubber/demister and exiting via the exhaust stack. For liquid waste, the flow is manually controlled by adjusting the tank pressure. Gaseous waste is diverted to scrubbers in the event of incinerator shutdown.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old
	Metric 5: Sample Size	High	Repeated analysis data and recovery data are reported.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Release data include all metadata.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	Release data for 3 runs is reported.

Overall Quality Determination**High**

Study Citation:	Milbrandt, A., Coney, K., Badgett, A., Beckham, G. T. (2022). Quantification and evaluation of plastic waste in the United States. Resources, Conservation and Recycling 183:106363.			
HERO ID:	11360398			
Conditions of Use:	Waste Handling			
EXTRACTION				
Parameter	Data			
Release quantity:	plastic waste landfilled in kt (pg.4)			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	Medium	The report is for an occupational scenario, but is not chemical specific.
	Metric 4:	Temporal Representativeness	High	The report was published in 2022 which is less than 10 years old.
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	The report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination			High	

p-Dichlorobenzene

Environmental Releases

HERO ID: 11360398 Table: 2 of 2

Study Citation:		Milbrandt, A., Coney, K., Badgett, A., Beckham, G. T. (2022). Quantification and evaluation of plastic waste in the United States. Resources, Conservation and Recycling 183:106363.		
HERO ID:		11360398		
Conditions of Use:		Recycling		
		EXTRACTION		
Parameter		Data		
Release quantity:		kt recycled plastic (pg. 4)		
		EVALUATION		
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Methodology	High	The assessment or report uses high quality data.
Domain 2: Representativeness		Metric 2: Geographic Scope	High	Data are from the United States and are representative of the industry being evaluated.
		Metric 3: Applicability	Medium	The report is for an occupational scenario, but is not chemical specific.
		Metric 4: Temporal Representativeness	High	The report was published in 2022 which is less than 10 years old.
		Metric 5: Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity		Metric 6: Metadata Completeness	High	The report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty		Metric 7: Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination		High		

Study Citation:	Miller, C., Srivastava, R. K., Ryan, J. V. (1994). Emissions of organic hazardous air pollutants from the combustion of pulverized coal in a small-scale combustor. Environmental Science & Technology 28(6):1150.			
HERO ID:	5705544			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	flue gases from the combustion of pulverized coal in a small-scale down-fired combustor			
Release quantity:	Emission under three combustion conditions categorized as baseline, high stoichiometric ratio (SR), and air staging (low NOx) (lb/10^6 BTU): 1) max - 4.179 x 10^-7, min - 0; 2) max - 2.806 x 10^-7, min - 4.203 x 10^-8; 3) max - 4.17 x 10^-7, min - 0			
Release or emission factors:	particulate control equipment, leaks, r combustion zone temperatures in tubes			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Medium	uncertain statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Release data include most critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion on uncertainty
Overall Quality Determination			High	

Study Citation:	Nakamura, J., Azuma, N., Kameya, T., Kobayashi, T., Urano, K. (2008). Analysis of the toxicity-weighted release amount ranking of PRTR chemicals in Japan. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 43(5):452-459.			
HERO ID:	1025153			
Conditions of Use:	commercial use			
EXTRACTION				
Parameter	Data			
Release quantity:	release amount 1.9e+7 kg/year to the atmosphere for FY 2003 in Japan			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	data is for Japan (OECD country)
	Metric 3:	Applicability	Low	The release sources are not reported but the data is obtained from Japan’s pollutant release and transfer registry and therefore this data may be relevant to the COUs.
	Metric 4:	Temporal Representativeness	Medium	data is more than 10 years old but less than 20 years old
	Metric 5:	Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics. It is unclear if analysis is representative.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Release data include most critical metadata, including release media and release frequency, but lacks additional metadata, such as process, unit operation, and/or activity that is the source of the release.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion on uncertainty
Overall Quality Determination			Medium	

Study Citation:	Namiesnik, J., Zygmunt, B., Kozdron-Zabiegala, B. (1994). Some aspects of indoor air pollution and analysis. Polish Journal of Environmental Studies 3(4):5-19.			
HERO ID:	6021395			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Release quantity:	Emission rate from building materials: 1) spray foam - ND - 0.03 mg/m2/h for dichlorobenzenes; 2) foam board - ND - 0.04 mg/m2/h for dichlorobenzenes; 3) glued carpet - <0.1 ug/m2/h for p-DCB; 4) linoleum tiles - 3.6 ug/m2/h for p-DCB; 5) polystyrene foam - 0.7 ug/m2/h for p-DCB. Emissions from consumer products and miscellaneous: 1) cleaning agents and pesticides - 0.4 ug/m2/hr for pDCB.			
Release or emission factors:	dust, air movement, temperature, air pressure			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	methodology well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Medium	uncertain statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	include some critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).			
HERO ID:	1998192			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Description of release source:	The level of chlorobenzene emissions from any given facility is a function of variables such as capacity, throughput and control measures, and should be determined through direct contact with plant personnel. (page 48 of 175) See page 51 of 175 for a more complete description of emissions.			
Release quantity:	Approximately 70 to 90 percent of p-dichlorobenzene’s annual production may eventually be released to the atmosphere. (page 28 of 175)			
Release or emission factors:	Emission factors for p-DCB are shown on table 4-7 on page 52 of 175. There are factors for process, storage, and fugitive category as well as total. The total is 7.24 kg p-DBC emitted per Mg produced.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The release data methodology is known or expected to be accurate and is known to cover all release sources at the site.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	From USA	
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Low	1994	
	Metric 5: Sample Size	N/A	Overall emission factors rather than data points.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Release data include all associated metadata, including release media; process, unit operation, or activity that is the source of the release; and release frequency.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	The release data study provides only limited discussion of the variability in the determinants of release. The release data study provides only limited discussion of the uncertainty in the release results.	
Overall Quality Determination		High		

Study Citation:	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).			
HERO ID:	1998192			
Conditions of Use:	Processing as a reactant			
EXTRACTION				
Parameter	Data			
Description of release source:		See page 69 of 175 for a description of possible P-DCB emissions from the manufacturing of polyphenylene sulfide, including emissions from process equipment vents, open process equipment, equipment leaks, storage tank vents, transfer and handling operations, and polymer washing and drying operations. Level of emissions depends on capacity, throughput, and control measures.		
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The release data methodology is known or expected to be accurate and is known to cover all release sources at the site.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	From USA
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	1994
	Metric 5:	Sample Size	N/A	Overall emission factors rather than data points.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Release data include all associated metadata, including release media; process, unit operation, or activity that is the source of the release; and release frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The release data study provides only limited discussion of the variability in the determinants of release. The release data study provides only limited discussion of the uncertainty in the release results.
Overall Quality Determination			High	

Study Citation:	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).			
HERO ID:	1998192			
Conditions of Use:	Processing, incorporation into formulation, odor agents in cleaning compounds			
EXTRACTION				
Parameter	Data			
Description of release source:	Para-dichlorobenzene is most likely to enter the atmosphere from the volatilization of household deodorant products and moth flakes. (page 28 of 175) It is estimated that all p-DCB incorporated into solid space and garbage deodorants will enter the atmosphere by sublimation during production or use. It is estimated that approximately 90 percent of the p-DCB used for this purpose is released to the air; the remaining 10 percent is released to either land or water, depending upon whether it is used as a garbage deodorant or toilet deodorant, respectively. (page 99 of 175)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The release data methodology is known or expected to be accurate and is known to cover all release sources at the site.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	From USA	
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Low	1994	
	Metric 5: Sample Size	N/A	Overall emission factors rather than data points.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Release data include all associated metadata, including release media; process, unit operation, or activity that is the source of the release; and release frequency.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	The release data study provides only limited discussion of the variability in the determinants of release. The release data study provides only limited discussion of the uncertainty in the release results.	
Overall Quality Determination		High		

Study Citation:	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).			
HERO ID:	1998192			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Release or emission factors: Emission Factors for wastewater treatment operations for p-DCB are on page 107 of 175.				
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The release data methodology is known or expected to be accurate and is known to cover all release sources at the site.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	From USA
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	1994
	Metric 5:	Sample Size	N/A	Overall emission factors rather than data points.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Release data include all associated metadata, including release media; process, unit operation, or activity that is the source of the release; and release frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The release data study provides only limited discussion of the variability in the determinants of release. The release data study provides only limited discussion of the uncertainty in the release results.
Overall Quality Determination			High	

Study Citation:	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.			
HERO ID:	6629633			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	incinerators, landfill leachate, fugitive emissions, injections into underground wells (see page 50-51 of 89 for descriptions)			
Release quantity:	See pages 50-51 for concentrations of pDCB in various release streams, and emission amounts according to TRI.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	This document is a compilation of studies, each one referenced in the text.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	From USA	
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Medium	Operations, equipment, and worker activities are expected to be reasonably representative of current conditions. The monitoring data were collected after the most recent PEL establishment or update but are generally more than 10 years old. This document includes a compilation of studies from various times.	
	Metric 5: Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Document sites various reputable studies.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	Document sites various reputable studies.	
Overall Quality Determination		High		

Study Citation:	NICNAS, (2000). Priority existing chemical assessment report No. 13: Para-dichlorobenzene.			
HERO ID:	5155557			
Conditions of Use:	Commercial use-air freshener, toilet bricks			
EXTRACTION				
Parameter	Data			
Description of release source:	1) Reformulation, 2) End use - air freshener, toilet bricks			
Release quantity:	Worst case scenarios for annual release (kg)- 1) Reformulation - 10,000 kg, 2) End use - air freshener - 130,000 kg, toilet blocks - 570,000 to air and 280000 to water			
Release or emission factors:	Assuming reformulation processes are conducted on 200 days of the year, this results in estimated release to the atmosphere of up to 50 kg per day.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	release data methodology is expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	includes critical metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	NIEHS, (2004). 1,4-Dichlorobenzene. U.S. National Toxicology Program. Report on Carcinogens 11(2004):III85-III87.			
HERO ID:	4912209			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Release quantity:	“In 1988, EPA’s Toxics Release Inventory reported environmental releases of 1.9 million pounds of 1,4-dichlorobenzene, mostly (> 99%) to air. Releases have since declined steadily; in 2007, 11 facilities released a total of 79,317 lb, mostly to air (TRI 2009)...1,4-Dichlorobenzene was also identified in municipal solid waste in Huntsville, Alabama, at a concentration of 5.8 μg/kg (Leahy et al. 2004).”			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Low	Release data is taken from EPA TRI, but the methodologies are not specified in the article
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Medium	data is between 10 and 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Report only includes release media but no additional meta-data
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	release data does not address variability or uncertainty
Overall Quality Determination		Medium		

Study Citation:	OECD, (2009). Emission scenario document on plastic additives.		
HERO ID:	5079084		
Conditions of Use:	Plastic Material Manufacturing		
EXTRACTION			
Parameter	Data		
Description of release source:	Release from manufacture of plastics materials which includes from raw material handling, compounding, conversion.		
Release or emission factors:	Emission factors are provided during various processes during the lifecycle of the plastic compound, but the EF is dependent on the type of additive.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The release data methodology is based on industry input and expert judgement, in which these estimations have been peer-reviewed by other OECD countries. Methodology is expected to be accurate and cover all release sources at the site.
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	The data are from an OECD country other than the U.S., and locality-specific factors (e.g., potential differences in regulatory emission limits, industry/ process technologies) may impact releases relative to the U.S.
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Medium	Information are more than 10 years but no more than 20 years old.
	Metric 5: Sample Size	N/A	Emission factors are conservative estimations, sample size is N/A
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Release data include all associated metadata, including release media; process, unit operation, or activity that is the source of the release; and release frequency.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Release information does discuss potential variability between types of plastics and other differences. Uncertainty in information is only limited discussion.
Overall Quality Determination		High	

Study Citation:	OECD, (2011). Emission scenario document on the chemical industry.			
HERO ID:	6306753			
Conditions of Use:	Processing as a reactant			
EXTRACTION				
Parameter	Data			
Description of release source:	Releases include any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of any chemical or chemical mixture. Some emission sources that can be identified within the CPI and these include: • fugitive releases (including leaks) • point sources (venting of equipment and through incomplete separation) • residuals from (transport) containers (drums, tank trucks, rail cars) • equipment cleaning. Fugitive emissions occur from sources in many places within the process. They include leaks from valves, compressors seals, pump seals, pressure relieve valves, flanges and other connections, open-ended lines and sampling connections, but also building ventilation systems and any other non-point sources. Important point sources are those generally originating from unit operations like distillation columns, strippers, absorption columns, reactors, condensers and dryers. Point source releases also include air pollution control equipment and storage tanks. Emission occurs through vents, stacks, ducts and pipes. Material may also be lost through cleaning from various types of vessels containing remnants of chemicals including process equipment.			
Release or emission factors:	Emission factors reported per equipment used			
Comments:	Includes some models as well.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The release data is provided from industry and expert judgement, estimations are peer-reviewed by OECD countries
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	The data are from an OECD country other than the U.S.
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	No more than 10 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Release data include all associated metadata, including release media; process, unit operation, or activity that is the source of the release; and release frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The release data study addresses variability by providing parameters to modified based on the specifics of the chemical. There is discussion of uncertainty in their assumptions.
Overall Quality Determination		High		

Study Citation:	Olin Chemicals, (1987). Industrial hygiene sampling for toluene diisocyanate at Olin Chemical Moundsville plant.			
HERO ID:	4930031			
Conditions of Use:	industrial use			
EXTRACTION				
Parameter	Data			
Description of release source:	Possible source is a large crane operating near sampling area.			
Release quantity:	Not detected			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Low	The release data methodology is not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	more than 20 years old
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Uninformative	Release data do not include any needed metadata to understand what the data represent and are not usable in the risk evaluation.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination		Uninformative		

Study Citation:	Radian Corp, (1991). Letter from Chevron Corporation to USEPA submitting enclosed submission of four Chevron USA oil production facility risk assessment facilities in California with attachments.			
HERO ID:	1481749			
Conditions of Use:	Use			
EXTRACTION				
Parameter	Data			
Description of release source:	4 oil and gas production operations in California for Chevron Corp			
Release frequency:	365 days/year			
Comments:	This data source is a risk assessment report pertaining to an oil and gas production field. An oil and gas production field may be a site at which lubricants and greases containing p-DCB are used. Furthermore, there is mention of p-DCB in this report, and therefore this data source may be relevant to the COU of commercial use in lubricants and greases. However, p-DCB emission data do not appear to be included in this report.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Low	release data methodology is not specified and the report does not appear to include any p-DCB release data.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	The report does not appear to include any p-DCB release data.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	The report does not appear to include any p-DCB release data.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not appear to include any p-DCB release data.
Overall Quality Determination		Low		

Study Citation:	RIVM, (1991). Integrated criteria document chlorobenzenes. :281.			
HERO ID:	5159927			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	1,4-DCB is the only chlorobenzene used in disinfectant products, namely, air fresheners, toilet blocks, urinal tablets and mothballs. Its use in air fresheners has fallen to zero in Netherlands in the 1980s. There has also been a sharp decline in the use of 1,4-DCB in mothballs. 1,4-DCB in wastes and emissions from toilet bloacks and urinal tablets (tonnes per year): for industries - surface water emission - 3, atmospheric emission - 194, industrial waste - 10, STP sludge - 6, degradation in STP; for households - surface water emission - , atmospheric emission - 67, STP sludge - 2.			
Release quantity:	Emissions to water (assumed) - 5.2 tonnes/yr; emission to air (assumed) - 261 tonnes/yr			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The release data methodology is known or expected to be accurate	
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	OECD country	
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old	
	Metric 5: Sample Size	Low	no statistics	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	Release data include release media but no other metadata.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The release data study does not address variability or uncertainty.	
Overall Quality Determination		Medium		

Study Citation:	Tansel, B., Eyma, R. R. (1999). Volatile organic contaminant emissions from wastewater treatment plants during secondary treatment. Water, Air, and Soil Pollution 112(3-4):3-4.
HERO ID:	2310704
Conditions of Use:	disposal

EXTRACTION

Parameter	Data
Description of release source:	wastewater treatment plants during secondary treatment
Release quantity:	Liquid phase concentrations of DCB that were found in at least 90% of the 24-hour composite samples analyzed since 1985: influent - ~7 ug/L, effluent - ~1 ug/L. Conc measured in the effluent of the North Regional Wastewater treatment Plant in Broward County, Florida - 12 ug/L. Predicted p-DCB emission rates are also reported.
Waste treatment methods and pollution control:	aerator, clarifier, weir

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	Medium	The methodology associated with the measurements of p-DCB concentration in influent and effluent streams is not specified. The model for prediction of effluent concentrations is adequately described.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	Waste water treatment is means of disposal which is a COU.
	Metric 4: Temporal Representativeness	Low	data more than 20 years old
	Metric 5: Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	no metadata
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	does not address variability or uncertainty

Overall Quality Determination**Medium**

Study Citation:	U.S. EPA, (2020). National Emissions Inventory (NEI): p-Dichlorobenzene (pDCB), reporting years 2017 and 2020.			
HERO ID:	13243354			
Conditions of Use:	All			
EXTRACTION				
Parameter	Data			
Description of release source:	Provides unit/process of release.			
Release quantity:	Provides release data.			
Release or emission factors:	Provides release data.			
Release frequency:	Provides annual operating time.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	Medium	Submitters provide general method used to calculate emissions, but details not provided.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	NEI is U.S. based data.	
	Metric 3: Applicability	High	NEI includes industries included in the scopes of multiple chemicals.	
	Metric 4: Temporal Representativeness	High	NEI data are from 2020.	
	Metric 5: Sample Size	Medium	Universe is limited to units subject to NESHAP with threshold potential to emit, although states may have different requirements; statistical representativeness is unclear.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	NEI includes release media and generally also includes daily and annual operating time, specific unit/process that is the source of release, and presence of engineering controls.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	NEI does not address variability or uncertainty in submitter provided data.	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (2023). Discharge Monitoring Report (DMR) data: p-Dichlorobenzene (pDCB), reporting years 2019-2023.			
HERO ID:	13243355			
Conditions of Use:	All			
EXTRACTION				
Parameter	Data			
Release quantity:	Provides release data.			
Release or emission factors:	Provides media of release and release data.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Low	Methodology used by submitters to estimate release data is not known.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	DMR is U.S. based data.
	Metric 3:	Applicability	High	DMR includes industries included in the scopes of multiple chemicals.
	Metric 4:	Temporal Representativeness	High	DMR data are from 2019-2023.
	Metric 5:	Sample Size	Medium	Universe is limited to NPDES permit holders; statistical representativeness is unclear.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	DMR only includes release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	DMR does not address variability or uncertainty in submitter provided data.
Overall Quality Determination		Medium		

p-Dichlorobenzene

Environmental Releases

HERO ID: 13243358 Table: 1 of 1

Study Citation:	U.S. EPA, (2023). Toxics Release Inventory (TRI) data: p-Dichlorobenzene (pDCB), reporting years 2019-2023.			
HERO ID:	13243358			
Conditions of Use:	All			
EXTRACTION				
Parameter	Data			
Description of release source:	Provides media of release			
Release or emission factors:	Provides release data			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Low	Methodology used by submitters to estimate release data is not known.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	TRI is U.S. based data
	Metric 3:	Applicability	High	TRI includes industries included in the scopes of multiple chemicals
	Metric 4:	Temporal Representativeness	High	TRI data are from 2019-2023.
	Metric 5:	Sample Size	Medium	Due to reporting requirements, statistical representativeness is unclear.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	TRI only includes release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	TRI does not address variability or uncertainty in submitter provided data.
Overall Quality Determination		Medium		

Study Citation:	U.S. EPA, (1995). AP-42: Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition.			
HERO ID:	46492			
Conditions of Use:	emissions			
EXTRACTION				
Parameter	Data			
Description of release source:	Emission sources listed in this article include waste oil combustors, multiple hearth sewage sludge incinerators, fluidized bed sewage sludge incinerators, and rail tank car cleaning.			
Release quantity:	Emissions of 1,4-DCB from multiple hearth sewage sludge incinerators: uncontrolled – 4.1 E-1 g/Mg dry sludge burned (8.2 E-4 lb/ton dry sludge burned) with emission rating E; controlled source – cyclone/venturi – 7.0 E-3 g/Mg dry sludge burned (1.4 E-5 lb/ton dry sludge burned) with emission rating E; venturi/impingement – 2.4 E-1 g/Mg dry sludge burned (4.8 E-4 lb/ton dry sludge burned) with emission rating E.			
Release or emission factors:	Emission factors for dichlorobenzene from waste oil combustors (Emission rating – D): Space Heaters - Vaporizing Burner - 8.0 E-7 kg/m3 (6.7 E-6 lbs/1000 gal); Space Heaters - Atomizing Burner – ND.Emission factors for 1,4-DCB for fluidized bed sewage sludge incinerators (Emission rating – D) - Venturi/Impingement – 2.4 E2 g/Mg dry sludge burned (0.48 lb/ton dry sludge burned).			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	release data methodology is known
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	data are from the United States
	Metric 3:	Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	more than 20 years old
	Metric 5:	Sample Size	Low	characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data include release media but no other metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The release data study provides only limited discussion of the variability in the determinants of release, but no discussion of theuncertainty in the release results.
Overall Quality Determination		Medium		

Study Citation:	U.S. EPA, (2019). National Emissions Inventory (NEI) [database]: CASRNs 79-00-5, 75-34-3, 107-06-2, 78-87-5, 84-61-7, 106-99-0, 106-93-4, 50-00-0, 85-44-9, 106-46-7, 85-68-7, 84-74-2, and 115-86-6.			
HERO ID:	6535959			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Release quantity:	Data collected from the files "PDB_EPA_NEI_1_11013_1 through **_4" - Total emissions (lbs):AK8.06840068AL675.7872478AR50.60675852AZ161177.2299CA1077899.647CO4			
Release or emission factors:	Additional files are available. July 2019 data from the National Emissions Inventory			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	Medium	release data is expected to be accurate	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data	
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	High	data is less than 10 years old	
	Metric 5: Sample Size	Low	no statistics	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Release data include all associated metadata	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	limited discussion on uncertainty	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (1995). Ap-42: Chapter 4.12 - Manufacture of rubber products.			
HERO ID:	7315841			
Conditions of Use:	Processing - Rubber Manufacturing			
EXTRACTION				
Parameter	Data			
Description of release source:	rubber manufacturing			
Release or emission factors:	Emission factors for p-DCB for different rubber manufacturing units are provided in the Excel file "Emission Factor Tables.xls". Relevant emission information can be found on the Autoclave, Mixing, Platen Press, Grinding, and Tire Cure tabs.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	The release data is more than 10 years but no more than 20 years old
	Metric 5:	Sample Size	Low	Distribution of samples is characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The release data study does not address variability or uncertainty.
Overall Quality Determination			Medium	

Study Citation:	U.S. EPA, (2021). National analysis TRI dataset (TRI): Data used for TSCA risk evaluations, reporting year 2019.			
HERO ID:	8347325			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	Manufacture, Process or Otherwise Use Activities reported			
Release quantity:	TRI data on pDCB:Fugitive Air Release (lb), Stack Air Release (lb), On-site Water Release (lb)On-site Land Release (lb)Off-site Release (gross) (lb)Total on- and off-site releases (gross) (lb)Off-site Release (net) (lb)Total on- and off-site releases (net) (lb)On-site "contained" release (section 8.1a) (lb)Other on-site release (section 8.1b) (lb)Off-site "contained" releases (section 8.1c) (lb)Other off-site releases (section 8.1d) (lb)On-site energy recoveryOff-site Energy Recovery (lb)On-site Recycling (lb)Off-site Recycling (lb)On-site Treatment (lb)Total off-site Treatment (lb), including wastewaterOff-site treatment (lb), excluding wastewater			
Comments:	Notes:Manufacture, Process or Otherwise Use Activities reported are in Columns AJ - BA• Value of 1 for an activity indicates facility reported that activity• Facilities first select at least one of manufacturing, processing, and otherwise use, then select at least one activity in each category chosen. • Facilities report as many activities as are applicable. • The "Processing - Recycling" activity was first included as an option in RY2018. Earlier years leave this column blank."Industry" is a TRI data field translating NAICS codes into TRI sectors. It may not map exactly to other industry/sector classifications.Reporting transfers to POTWs has changed over this time period. Starting with reporting year 2018, facilities enter the quantity of the chemical that is treated at the POTW and separately report the quantity that is released at the POTW. Prior to 2018, default values were typically applied to assign what portion of the chemical quantity transferred to the POTW was released versus treated.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The release data methodology is known or expected to be accurate and is known to cover all release sources at the site.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	No more than 10 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Release data include all associated metadata, including release media; process, unit operation, or activity that is the source of the release; and release frequency.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The release data study provides only limited discussion of the variability in the determinants of release. The release data study provides only limited discussion of the uncertainty in the release results.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (2019). TRI on-site and off-site reported disposed of or otherwise released (in pounds), for all industries.			
HERO ID:	8784984			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	TRI data reflect releases and other waste management activities of chemicals, not whether (or to what degree) the public has been exposed to those chemicals			
Release quantity:	TRI On-site and Off-site Reported Disposed of or Otherwise Released (in pounds), for All industriesTotal On-site Disposal or Other Releases : 55,030Total Off-site Disposal or Other Releases : 35Total On- and Off-siteOther Releases Disposal : 55,065			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The release data methodology is known or expected to be accurate and is known to cover all release sources at the site. TRI Data	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.	
	Metric 3: Applicability	High	The release data are for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	High	no more than 10 years old	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative. (assumed based on TRI data)	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Release data include most critical metadata, including release media and release frequency, but lacks additional metadata, such as process, unit operation, and/or activity that is the source of the release.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The release data study does not address variability or uncertainty.	
Overall Quality Determination		High		

Study Citation:	Wallace, L. A., Pellizzari, E., Leaderer, B., Zelon, H., Sheldon, L. (1987). Emissions of volatile organic compounds from building materials and consumer products. Atmospheric Environment 21(2):385-393.			
HERO ID:	23126			
Conditions of Use:	Commercial use - Building materials (cleansers and polishes, glues, floor and wall coverings)			
EXTRACTION				
Parameter	Data			
Description of release source:	15 building materials - paint on sheetrock, carpet and carpet glue, wallpaper and adhesives, cleansers and a spray pesticide			
Release quantity:	Emission flux for pDCB: 440+/-5 ng/min/m2 for cleaning agents and psticides; 41+/-14 ng/min/m2 for glued carpet.			
Comments:	emission flux calculated from measurements of concentration in an emission chamber.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	Data more than 20 years old
	Metric 5:	Sample Size	High	mean and standard deviation for 3 observations reported.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	N/A	not applicable to data pertaining to emission flux.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	not applicable to data pertaining to emission flux.
Overall Quality Determination			High	

Study Citation:	Zuraimi, Tham, K. W., Sekhar, S. C. (2004). A study on the identification and quantification of sources of VOCs in 5 air-conditioned Singapore office buildings. Building and Environment 39(2):165.			
HERO ID:	5252426			
Conditions of Use:	commercial use			
EXTRACTION				
Parameter	Data			
Description of release source:	air-conditioned Singapore office buildings			
Release quantity:	Area-specific emission rates (ug/m2/h) from building materials, ventilation systems and occupants and their activities are as follows: Building materials - mean - 1250.55 range - 8.9 - 7014.1, ventilation system - mean - 1448 range - 18.6 - 7349			
Release or emission factors:	variations caused by different occupant densities, (b) daily variations in their nature of works, (c) daily variations in the amount of cleaning and printing (d) daily variations in the types and number of equipment			
Comments:	variations caused by different occupant densities, (b) daily variations in their nature of works, (c) daily variations in the amount of cleaning and printing (d) daily variations in the types and number of equipment			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	release data methodology is known or expected to be accurate
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	non-OECD country
	Metric 3:	Applicability	Low	the release data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer
	Metric 4:	Temporal Representativeness	Medium	data is between 10 and 20 years old
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	contains relevant metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion on uncertainty
Overall Quality Determination		Medium		

Study Citation:	ECHA, (2004). European Union risk assessment report: 1,4-dichlorobenzene.		
HERO ID:	5017839		
Conditions of Use:	Disposal		
EXTRACTION			
Parameter	Data		
Description of release source:	production, use as an intermediate, formulation to air fresheners or moth repellents, use as air fresheners or moth repellents, use in the production of grinding wheels		
Release quantity:	Release from formulation to air fresheners or moth repellents: local - 29 tonnes/yr, regional - 29 tonnes/yr, continental - 72.4 tonnes/yr. Release from use as air fresheners or moth repellents: regional - 682 tonnes/year directly + 21 tonnes/year via the sewage treatment plants (STP), continental - 6,821 tonnes/year directly + 210 tonnes/year via the STP. Release from use in the production of grinding wheels: local - 10 tonnes/yr, regional - 10 tonnes/yr, continental - 100 tonnes/yr.		
Release or emission factors:	Release from production: 0.7% of the amount produced (1994 data). Release from use as an intermediate: 0.014%-0.009% of the amount processed (1992 & 1994 data).		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	release data methodology is expected to be accurate
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	OECD country
	Metric 3: Applicability	High	release data are for an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old
	Metric 5: Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	includes just the critical metadata
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	limited discussion of the uncertainty in the release results
Overall Quality Determination	Medium		

Study Citation:	OECD, (2013). Emission scenario document on the industrial use of adhesives for substrate bonding.
HERO ID:	3827300
Conditions of Use:	Use of adhesive/sealant

EXTRACTION

Parameter	Data
Description of release source:	container cleaning, unloading, equipment cleaning, application losses, curing/drying, trimming
Release or emission factors:	Release/emission factor - Container cleaning: 0.2% (bulk liquids); 0.6% (small containers for liquids); 3% (drums for liquids) Equipment Cleaning: 1-2%
Waste treatment methods and pollution control:	incineration; thermal oxidizers (catalytic and thermal) and, to a lesser extent, carbon adsorbers and solvent recovery condensers as the most common control device Efficiencies: 0-100%

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source
Domain 2: Representativeness	Metric 2: Geographic Scope	High	U.S. data
	Metric 3: Applicability	Medium	Report covers industrial use of adhesive which may be similar to use of sealant.
	Metric 4: Temporal Representativeness	Medium	Assessment is generally based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering various chemical functions, types of adhesives, and end use markets.

Overall Quality Determination**High**

Study Citation:	OECD, (2004). Emission scenario document on lubricants and lubricant additives.		
HERO ID:	3827416		
Conditions of Use:	Use of Lubricants and Functional Fluids		
EXTRACTION			
Parameter	Data		
Description of release source:	Processing: unloading, container cleaning, blending, sampling, equipment cleaning, loadingUse: unloading, container cleaning, disposal of spent lube oil (5,40,56,88,99,100/119)		
Release quantity:	Provides models for estimating various fugitive air releases		
Release or emission factors:	Release factors (78/119)Spillage 0.125% wastewater, 1% landfill, 0.375% waste oil;Consumed 24% exhaust emissions to air, 1% leakage to soil/water;Used oil 25% re-used as fuel oil in house, 13.75-26.5% re-used as fuel oil after treatment, 21.5-34.25% home use: disposed to wastewater/soil/landfill;Emission factor (69/119)		
Release frequency:	Processing: 100-300 days (64,65/119)Use: Changeout rates for lubricant/functional fluids range from three to 60 months. This corresponds to one to four changeouts per year		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	Data are from OECD.
	Metric 3: Applicability	High	Data are for Use of Lubricants and Functional Fluids, an in-scope occupational scenario.
	Metric 4: Temporal Representativeness	Low	Assessment is based on data greater than 20 years old and industry conditions that are expected to be outdated.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Variability addressed with ranges. Uncertainty not addressed.
Overall Quality Determination		High	

Study Citation:	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.			
HERO ID:	6385735			
Conditions of Use:	Processing and Use - Formulation and Use of Automotive Lubricants			
EXTRACTION				
Parameter	Data			
Description of release source:	PROC: unloading, container cleaning, blending, sampling, equipment cleaning, loading USE: unloading, container cleaning, disposal of spent lube oil			
Release quantity:	Provides models for estimating various fugitive air releases			
Release or emission factors:	Release or Emission Factor: "PROC: Container cleaning: 0.2% (bulk liquids), 0.6% (small containers for liquids), 3% (drums for liquids) Equipment Cleaning: 1% USE: Container cleaning: 0.2% (bulk liquids), 0.6% (small containers for liquids), 3% (drums for liquids) Disposal: 97-99.8%"			
Waste treatment methods and pollution control:	PROC: incineration USE: incineration. P2 Control & %Efficiency: PROC: incineration, LEV, scrubbers, physical/chemical treatments, ultrafiltration, oxidation, evaporation/distillation, oil/water separation, dissolved air flotation, and biological treatment USE: incineration, scrubbers			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	This ESD was developed by EPA based on U.S. data
	Metric 3:	Applicability	Medium	Data is for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
	Metric 4:	Temporal Representativeness	High	Assessment is based on current industry conditions and data no more than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple additive types.
Overall Quality Determination		High		

Study Citation: OECD, (2009). Emission scenario document on transport and storage of chemicals.
HERO ID: 6393282
Conditions of Use: ProcessingTransportation and Storage

EXTRACTION

Parameter	Data
Description of release source:	filling and emptying of containers, storage, pipelines, washing and cleaning, recycling and disposal of packaging
Release or emission factors:	Filling/emptying: 0.05-70 kg/tonne 0.21-0.61% (solids) Storage (breathing losses): 0.01-13.1 kg/m3 storage capacity-yr Fugitive emissions from leaking seals, connectors and flanges: 0.01-1.67 g/h Storage of solids in open systems: 0.12-20 kg/tonne Container residuals: <1% (road tankers); 0.19-0.63% (rail tankers); 1% (drums); 0.3% (IBCs) Fugitive emissions during container cleaning: 1.07-311 g/container (road tanker); 0.3-2,350 g/ container (rail and ship tanker) Disposal: 0.01% (drums); 0.3% (IBCs); 0.0025-0.25 kg/bag (solids)
Waste treatment methods and pollution control:	Vapor balancing

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	This ESD was not developed by EPA, but another OECD-member country.
	Metric 3: Applicability	Medium	Data is for an in-scope occupational scenario; however, data is general and not specific to a chemical.
	Metric 4: Temporal Representativeness	Low	Assessment is based on data greater than 20 years old.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple chemical forms, containers and storage system types.

Overall Quality Determination**Medium**

p-Dichlorobenzene

Environmental Releases

HERO ID: 10480466 Table: 1 of 1

Study Citation:	U.S. EPA, (2023). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).			
HERO ID:	10480466			
Conditions of Use:	Use - Laboratory Chemicals			
EXTRACTION				
Parameter	Data			
Description of release source:	container unloading, container cleaning, labware equipment cleaning, during laboratory analyses, waste disposalMedia: Water, air, landfill			
Release or emission factors:	Transfer operation losses of solids: 0.5%Container Cleaning (liquids in small containers): 0.6%Container Cleaning (solids): 1%Labware equipment cleaning (liquids): 2%Labware equipment cleaning (solids): 1%laboratory waste disposal: 100%			
Release frequency:	260 day/yr			
Waste treatment methods and pollution control:	Labware rinsed with water. Non-hazardous chemicals to landfill. laboratory chemicals or solvents used to clean labware may be considered hazardous. hazardous waste must be disposed of by incineration or to designated hazardous waste landfills			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	Assessment uses high quality information/data from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	This GS is based on U.S. data
	Metric 3:	Applicability	Medium	Data is for an in-scope occupational scenario; however, data is general and not specific to a chemical.
	Metric 4:	Temporal Representativeness	High	Assessment is based on current industry conditions and data no more than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (2022). Chemical repackaging - Generic scenario for estimating occupational exposures and environmental releases (revised draft).			
HERO ID:	11182966			
Conditions of Use:	Repackaging			
EXTRACTION				
Parameter	Data			
Description of release source:	Table 4-1 presents a summary of assessed releases (pg 22 of 116)			
Waste treatment methods and pollution control:	Wastewater produced at repackaging sites may be managed in a variety of ways depending on the facility-specific permitting requirements and the applicable effluent guidelines, which may vary widely due to the range of industrial sectors that perform repackaging operations. However, because there are regulatory standards for wastewater discharges in the United States, EPA expects wastewater containing the chemical of interest will be treated prior to discharge. Therefore, this GS assesses water releases as wastewater that may be treated on-site and discharged to a surface water or to a publicly-owned treatment works (POTW) or transferred off-site for treatment and discharge (pg 21 of 116)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The assessment does not address variability or uncertainty.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (2021). Use of chemicals in fuels and related products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).
HERO ID:	11203977
Conditions of Use:	Use in Fuels and related Products

EXTRACTION

Parameter	Data
Description of release source:	Figure 2-1 (13 of 76) shows the release sources and sections 2.1 through 2.3 (pg 14 of 76) discussed the associated release sources.Receiving and Storage of Fuel at Fueling StationsChemicals in fuels and related products are expected to be received at use sites (i.e., fueling stations) via tank trucks, rail cars, tankers, barges, and pipelines. The fuels are then transferred from these transport containers to on-site storage tanks, typically through pipes and hoses. Workers may be potentially exposed during the unloading of fuel from the original transport containers into on-site storage tanks. Releases of chemicals may also occur during this stage, from storage tank working losses during the unloading of the fuel from transport containers into storage tanks, and from cleaning of transport containers. Additionally, equipment leaks may result from valves, flanges, and connectors (EPA, 1999).Dispensing of Fuel from Storage Tank to EngineAt the use site, fuels are dispensed from storage tanks to vehicles or other equipment. Storage tanks for fuel are typically underground, and fuel is pumped upwards through tubes and nozzles. Workers may be potentially exposed during the transfer of fuel from the storage tank to a vehicle or other equipment, where not conducted by the consumer. Releases of chemicals may also occur during this stage. Releases of small amounts of gasoline vapors have been shown to occur at service stations during refueling of vehicles (ATSDR, 1995). Most releases come from displacement of hydrocarbon vapors during filling of the vehicle. Some release may also occur from spills, line leaks, and storage tank leaks. Volatile hydrocarbons in fuel spilled on soil or surface water will rapidly evaporate into the air (ATSDR, 1995).Combustion of FuelDuring combustion, fuel is burned to provide energy to an engine. In a typical internal combustion engine, fuel is mixed with air in a chamber. This mixture is ignited with a spark and energy from the burning fuel is used to power the vehicle or machine. Exhaust gases leave through a tailpipe or vent (EPA, 1999). Byproducts of fuel combustion are released with exhaust gases into the atmosphere during engine use. Compounds formed during the combustion of fuel include hydrocarbons, carbon monoxide, nitrogen oxides, particles, carbon dioxide, sulfur compounds, and aldehydes (Hancsok, 2016). Workers may or may not be exposed to these combustion byproducts, depending on their proximity to the engine.
Release quantity:	To estimate annual releases across all sites from a given release source, the daily release rates must be multiplied by the number of release days (i.e., TIMEoperating_days).and the total number of sites using the chemical of interest (i.e., Nsites). Some process releases are expected to occur to the same receiving medium on the same days (pg 26 of 76)
Release or emission factors:	AP-42 Emission Factors may be used to estimate the rate at which the chemical of interest is emitted during this activity (pg 58 of 76)
Release frequency:	the number of operating days associated with fueling stations (TIMEoperating_days) should be assumed to be 365 days/yr (pg 16 of 76)
Waste treatment methods and pollution control:	pg 27 of 76:Various use sites may employ different types of control technologies to reduce the wastes and emissions generated during the use of fuels and related products. According to EPA's AP-42, current controls for Liquified Petroleum Gas combustion at industrial sites include retrofit systems that implement low-NOx burners and flue gas recirculation (EPA, 2008). In terms of loading losses and equipment leaks, typical control techniques include submerged loading, storage tanks with internal floating roofs, carbon adsorption, and leak detection and repair systems. These techniques have an efficiency anywhere between 58-99% (EPA, 1999).Last, to minimize combustion emissions, many vehicle and machine engines now include combustion improvement technologies. Some of these technologies include advanced variable geometry turbocharger with inter cooling, ultrahigh injection pressures, electronic fuel injection and control, exhaust gas recycle with temperature management, onboard diagnostics, catalytic exhaust converters (aftertreatment systems), lean de-NOx catalyst, and regenerative diesel particulate filters (Hancsok, 2016).

EVALUATION

Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States

Continued on next page ...

Environmental Releases

...continued from previous page

Study Citation:	U.S. EPA, (2021). Use of chemicals in fuels and related products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).
HERO ID:	11203977
Conditions of Use:	Use in Fuels and related Products

EVALUATION

Domain	Metric	Rating	Comments
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5: Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity			
	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty			
	Metric 7: Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized

Overall Quality Determination

High

Study Citation:	U.S. EPA, (2004). Additives in plastics processing (compounding) – generic scenario for estimating occupational exposures and environmental release – Draft.
HERO ID:	6311218
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product -

EXTRACTION

Parameter	Data
Description of release source:	Container residue from additive transport container released to water, incineration, or landfill; Dust generation from transferring/compounding released to water or landfill; Fugitive air emissions from compounding/shaping released to water or air; Equipment cleaning and cooling water from compounding released to water (page 10 of 18)
Release quantity:	Provides models for estimating releases for each of the four release types listed in "description of release source" (page 12-14 of 18)
Release or emission factors:	See pages 12-14 for these values, embedded in the model descriptions: Container cleaning: 1% (solids), 0.2% (bulk liquids) 0.6% (small containers for liquids) 3% (drums for liquids) Compounding dusts: 0.21-0.65% Compounding Volatiles: 0.002-0.05% Equipment Cleaning: 2%
Release frequency:	250 days/yr (page 11 of 18)
Waste treatment methods and pollution control:	See page 14 of 18 for control technologies (examples for water include recycling, evaporation pool, septic tank with leach field, evaporation from equipment, land application, contract haul, settling, pH adjustment, activated sludge, activated carbon adsorption, filtration, and vacuum filtration. For air, bag filters are suggested and said to be 99% efficient.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	This GS is based on U.S. data
	Metric 3: Applicability	Medium	Data are for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
	Metric 4: Temporal Representativeness	Medium	Assessment is generally based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple plastic and additive types.

Overall Quality Determination**High**

Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.			
HERO ID:	8726954			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Description of release source:	Spillage to water during transfer and sampling. Land release from residual product. Air release negligible due to low vapor pressure (page 2 of 20).			
Release quantity:	58 kg/site/day into water, 7,800 kg/year into land (page 2 of 20)			
Release frequency:	350 days/year water releases (page 2 of 20)			
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	USA	
	Metric 3: Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs	
	Metric 4: Temporal Representativeness	Low	1992	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.			
HERO ID:	8726954			
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product			
EXTRACTION				
Parameter	Data			
Description of release source:	residual product in water release during equipment cleaning and spillage. Assume all spillage is recovered in process sewer. No land release. Air release negligible due to low vapor pressure (page 3 of 20).			
Release quantity:	0.7 kg/site/day into water (page 3 of 20)			
Release frequency:	350 days/year water releases (page 3 of 20)			
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	USA	
	Metric 3: Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs	
	Metric 4: Temporal Representativeness	Low	1992	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.			
HERO ID:	8726954			
Conditions of Use:	Commercial Use - Lubricants and greases			
EXTRACTION				
Parameter	Data			
Description of release source:	See page 13 of 20 for the amounts and percent of oil disposed of in various ways (such as burned, dumped, etc.)			
Release quantity:	99516 kg/year from used oil to incineration. 9257 kg/year from used oil to land through dumping, landfilling, and road oiling.			
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.			
EVALUATION				
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	USA
	Metric 3:	Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs
	Metric 4:	Temporal Representativeness	Low	1992
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.
Overall Quality Determination			High	

Study Citation:	Anonymous, (1987). Chemical review: 1,4-dichlorobenzene. Dangerous Properties of Industrial Materials Report 7(4):7-25.			
HERO ID:	5251382			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Waste treatment methods and pollution control:	RCRA 3001-3004 subjects waste product, off-specification batches, and spill residues in excess of 1000 kg to handling report/recordkeeping requirements. RCRA 3001-3004 designates p-dichlorobenzene and dichlorobenzene, N.O.S. as Appendix VIII Chemicals.			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	the article is greater than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metadata
Overall Quality Determination		High		

Study Citation:	Clapp, L. W., Talarczyk, M. R., Park, J. K., Boyle, W. C. (1994). Performance comparison between activated-sludge and fixed-film processes for priority pollutant removals. Water Environment Research 66(2):153-160.
HERO ID:	3585789
Conditions of Use:	disposal

EXTRACTION

Parameter	Data
Waste treatment methods and pollution control:	Total percent removals achieved by both activated sludge reactor and the low-loaded biological aerated filter reactor for pDCB - >81% for both for influent concentration of 1.04 ug/L

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	assessment uses high quality data
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	report is for an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5: Sample Size	Medium	Distribution of samples is characterized by a range with uncertain statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	report does not address variability or uncertainty

Overall Quality Determination**Medium**

Study Citation:	Dempsey, C. R. (1993). A comparison of organic emissions from hazardous waste incinerators versus the 1990 toxics release inventory air releases. Journal of the Air and Waste Management Association 43(10):1374-1379.			
HERO ID:	659922			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Description of release source:	hazardous waste incinerators			
Release quantity:	Reasonable worst case HWI stack emissions - 86 ng/L or 0.75 tons/yr; 1990 TRI air release - 409 tons/yr; Ratio of HWI to TRI Emissions - 0.184%			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	High-quality data from frequently used sources and are generally accepted by the scientific community
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Low	No statistics presented
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.
Overall Quality Determination		Medium		

Study Citation:	Deng, Y., Bonilla, M., Ren, H., Zhang, Y. (2018). Health risk assessment of reclaimed wastewater: A case study of a conventional water reclamation plant in Nanjing, China. Environment International 112:235-242.
HERO ID:	4728647
Conditions of Use:	Disposal

EXTRACTION

Parameter	Data
Description of release source:	water reclamation plant in Nanjing, China
Waste treatment methods and pollution control:	oxidation ditch, coagulation tank, biological aerated filter, ultraviolet disinfection pool

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2: Geographic Scope	Low	The data are from a non-OECD country
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	The report provides only limited discussion of the variability but none on uncertainty in the results.

Overall Quality Determination**High**

Study Citation:	EC, (1987). Guidelines for Canadian drinking water quality: Guideline technical document – Dichlorobenzenes.
HERO ID:	7681885
Conditions of Use:	Use of deodorant

EXTRACTION

Parameter	Data
Description of release source:	1,4-isomer may be released into water from urinal deodorants. (page 1 of 4)
Waste treatment methods and pollution control:	It is unlikely that DCB levels are reduced significantly during conventional drinking water treatment processes. However, removal of volatile organic compounds by packed tower aeration and granular activated carbon adsorption has been estimated to be 90 to 99% effective, and it is likely that concentrations of DCBs below 1 mg/L can be achieved in Canadian drinking water supplies using these methods. (page 1 of 4)

EVALUATION

Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources (e.g., European Union or OECD reports, NIOSH HHES, journal
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	The data are from an OECD country other than the U.S. (Canada).
	Metric 3:	Applicability	Medium	The report is not for a specific occupational scenario, but contains information that may be relevant to an occupational scenario within the scope of the risk evaluation, in terms of the type of industry, operations, and work activities.
	Metric 4:	Temporal Representativeness	Low	The report is more than 20 years old. The report captures operations, equipment, and worker activities that are expected to be outdated.
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.

Overall Quality Determination**Medium**

Study Citation:	Ifeadi, C. N. (1975). Screening study to develop background information and determine the significance of air contaminant emissions from pesticide plants.			
HERO ID:	63834			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Waste treatment methods and pollution control:	Some companies, for example, Allied, Solvent, and Specialty, with annual capacities around 10 million pounds, do not utilize control devices. They argue that it will be too restrictive if they are compelled to have all pDCB operating areas confined and exhaust air sent through a scrubbing system. The size of the control hood will be too large due to the extensive area involved.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The model can be appropriately applied to an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Monitoring data include most critical metadata, such as sample type and exposure type, but lacks additional metadata, such as sample durations, exposure durations, exposure frequency, and/or worker activity
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	only limited discussion of the uncertainty in the exposure estimates
Overall Quality Determination		Medium		

Study Citation:	Love, O. T., Jr, Miltner, R. J., Eilers, R. G., Fronk-Leist, C. A. (1983). Treatment of volatile organic compounds in drinking water.
HERO ID:	5255836
Conditions of Use:	Disposal

EXTRACTION

Parameter	Data
Waste treatment methods and pollution control:	See page 77 of 120 for a description of aeration (see page 87 for a graph of this) and adsorption as methods of wastewater treatment for p-DCB (see page 89 for a graph of this). Also see page 93 of 120 (Table 15) for a table showing how boiling removes p-DCB from water.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	EPA
Domain 2: Representativeness	Metric 2: Geographic Scope	High	United States
	Metric 3: Applicability	Medium	effectiveness of water treatment may be relevant to release information
	Metric 4: Temporal Representativeness	Low	From 1983
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The report addresses variability and uncertainty in the results. Uncertainty is well characterized

Overall Quality Determination**High**

Study Citation:	Marshall, K. A., Pottenger, L. H. (2016). Chlorocarbons and chlorohydrocarbons. :1-29.			
HERO ID:	3828879			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Waste treatment methods and pollution control:	Regulations are in place to control the use and disposal of these substances. Within the manufacturing environment, waste minimization is typically the first priority, and is achieved through adoption of efficient technologies. Secondly, wastes and by-products that are generated are reused as feedstock for other processes whenever possible. Any by-products of manufacture that cannot be utilized must be destroyed in a manner to prevent harm to the environment. These wastes are considered hazardous and are regulated under the federal Resource Conservation and Recovery Act (RCRA). Conventional disposal of chlorinated hydrocarbon wastes has been achieved by high temperature incineration. This process produces aqueous HCl, water, and carbon dioxide, and steam is cogenerated.			
Comments:	General background information			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	data are from the United States
	Metric 3:	Applicability	Medium	report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.
Overall Quality Determination			Medium	

Study Citation:	NIOSH, (1978). Occupational health guideline for p-dichlorobenzene.			
HERO ID:	8408530			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Waste treatment methods and pollution control:	p-Dichlorobenzene may be disposed of: (1) By making packages of p-dichlorobenzene in paper or other flammable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. (2) By dissolving p-dichlorobenzene in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. (page 3 of 6)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	The report is more than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty
Overall Quality Determination		High		

Study Citation:	Ware, G. W. (1988). Ortho-, meta-, and para-dichlorobenzene. Reviews of Environmental Contamination and Toxicology 106:51-68.			
HERO ID:	4912307			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Description of release source:	Most of the para-isomer produced is released to the environment during its use in deodorants and moth repellents.			
Waste treatment methods and pollution control:	Granular-activated carbon (GAC) adsorption and aeration for the removal of ortho-, meta-, and para-dichlorobenzene from water have been reported to be effective. A study (McCarty, et al., 1979)showed that 83 to 97% of trace quantities (Ilg/L range) of ortho-DCB, meta-DCB, and para-DCB were removed. A laboratory showed diffused air reactor was able to reduce p-DCB by 77%. Activated carbon also removed pDCB (Dobbs and Cohen, 1980).			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty
Overall Quality Determination		High		

Study Citation:	ECHA, (2004). European Union risk assessment report: 1,4-dichlorobenzene.			
HERO ID:	5017839			
Conditions of Use:	manufacture			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	The consumption quantities world-wide for the three most important manufacturing regions, Western Europe, the USA and Japan, were reported to be 113,000 tonnes/year in 1989 (BUA, 1994). In general a decreasing consumption of 1,4-dichlorobenzene has been observed during the last few years.			
Process description:	1,4-Dichlorobenzene is produced by direct chlorination according to a continuous method where liquid benzene is converted with gaseous chlorine in the presence of a catalyst. Through the choice of molar ratio between benzene and chlorine the isomeric ratio of 1,2- to 1,4-dichlorobenzene can be influenced. The chlorination products are separated by distillation (BUA, 1994). This production process is considered in the main category Ib, closed system, isolated intermediates. After crystallisation, the final product can be packaged and transported in solid or liquid form; the corresponding operations are performed in closed systems.			
Chemical concentration:	Degree of purity of the produced/imported products within the EU: 99.7-99.9%			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Report uses high quality data.
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country.
	Metric 3:	Applicability	Medium	The assessment is for an occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, in terms of the type of industry, operations, and workactivities.
	Metric 4:	Temporal Representativeness	Low	Data is greater than 20 years old.
	Metric 5:	Sample Size	Low	No statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Report clearly documents its data sources
Overall Quality Determination		Medium		

Study Citation:	OECD, (2013). Emission scenario document on the industrial use of adhesives for substrate bonding.			
HERO ID:	3827300			
Conditions of Use:	Use of adhesive/sealant			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	1,500 - 9,100,000 kg adhesive/site-yr			
Process description:	unloading, dilute and mix (optional), application (roll, spray, curtain, bead/syringe), drying/curing, product finishing			
Throughput:	Provides methodology for estimating throughput based on the amount of adhesives used, and the concentration of the chemical in the formulation			
Number of sites:	541-22,294			
Chemical concentration:	Provides conc. estimates based on chemical function and adhesive type, not chemical specific.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	U.S. data	
	Metric 3: Applicability	Medium	Report covers industrial use of adhesive which may be similar to use of sealant.	
	Metric 4: Temporal Representativeness	Medium	Assessment is generally based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions.	
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering various chemical functions, types of adhesives, and end use markets.	
Overall Quality Determination		High		

Study Citation:	OECD, (2004). Emission scenario document on lubricants and lubricant additives.			
HERO ID:	3827416			
Conditions of Use:	Use of Lubricants and Functional Fluids			
EXTRACTION				
Parameter	Data			
Life cycle description:	Processing and Use of Lubricants and Functional Fluids			
Process description:	Replacement/reconditioning rate from once every 3 months to 5 years (85/119)			
Throughput:	one container per lubricant/functional fluid changeout			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.	
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	Data are from OECD.	
	Metric 3: Applicability	High	Data are for Use of Lubricants and Functional Fluids, an in-scope occupational scenario.	
	Metric 4: Temporal Representativeness	Low	Assessment is based on data greater than 20 years old and industry conditions that are expected to be outdated.	
	Metric 5: Sample Size	Low	Sample distribution is described qualitatively.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.	
Overall Quality Determination		Medium		

Study Citation:	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.		
HERO ID:	6385735		
Conditions of Use:	Processing and Use - Formulation and Use of Automotive Lubricants		
EXTRACTION			
Parameter	Data		
Production, import, or use volume:	6.3 billion kg lubricants/yr		
Process description:	Processing: Unloading raw materials, blending, intermediate storage Use: Unloading lube oil, removing spend oil and replacing with new oil, disposing/recycling of used oil		
Throughput:	Provides methodology for estimating throughput based on the amount of lubricant produced, and the concentration of the chemical in the lube oil		
Number of sites:	Provides methodology for estimating number of sites based on chemical PV, the use rate, and the concentration of the chemical in the lubricant		
Chemical concentration:	Provides conc. estimates based on chemical function, not chemical specific.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	This ESD was developed by EPA based on U.S. data
	Metric 3: Applicability	Medium	Data is for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
	Metric 4: Temporal Representativeness	High	Assessment is based on current industry conditions and data no more than 10 years old.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple additive types.
Overall Quality Determination		High	

Study Citation:	OECD, (2009). Emission scenario document on transport and storage of chemicals.		
HERO ID:	6393282		
Conditions of Use:	ProcessingTransportation and Storage		
EXTRACTION			
Parameter	Data		
Production, import, or use volume:	11 million tonnes shipped via rail tankers 30 million tonnes shipped via pipelines		
Process description:	On-site storage of chemicals, filling of containers, transport to distributors/downstream users/consumers, containers with residual chemical transported to recycling/cleaning or disposal site, empty/cleaned containers returned to distributor or production site		
Number of sites:	Container cleaning sites in UK: 40 for road tankers; 8 for steel drums; 8 for plastics drums; 6 for fibre drums; 13 for IBCs; 7 for hazardous waste containers		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	This ESD was not developed by EPA, but another OECD-member country.
	Metric 3: Applicability	Medium	Data is for an in-scope occupational scenario; however, data is general and not specific to a chemical.
	Metric 4: Temporal Representativeness	Low	Assessment is based on data greater than 20 years old.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple chemical forms, containers and storage system types.
Overall Quality Determination		Medium	

Study Citation:	U.S. EPA, (2023). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).		
HERO ID:	10480466		
Conditions of Use:	Use - Laboratory Chemicals		
EXTRACTION			
Parameter	Data		
Production, import, or use volume:	Provides methodology to estimate annual use rate. Provides some use rate quantities for the first 10 chemicals in table 1-2		
Life cycle description:	Use - Laboratory Chemicals		
Process description:	Receive chemicals, weigh or measure chemical, add chemical to labware, dilute/add other laboratory chemicals, add sample, run analytical testing, dispose of sample and laboratory chemical waste		
Throughput:	260 days/yr255 grams reagent/site-day (average); 2,000 mL reagent/site-day (average); Table 3-2 gives daily throughput for laboratory stock solutions		
Number of sites:	Provides methodology to estimate number of sites based on chemical production volume, annual throughput - 40,639 total establishments		
Chemical concentration:	Provides conc. estimates based on the chemical function, not chemical specific.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality information/data from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	This GS is based on U.S. data
	Metric 3: Applicability	Medium	Data is for an in-scope occupational scenario; however, data is general and not specific to a chemical.
	Metric 4: Temporal Representativeness	High	Assessment is based on current industry conditions and data no more than 10 years old.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering different chemical functions
Overall Quality Determination		High	

Study Citation:	U.S. EPA, (2022). Chemical repackaging - Generic scenario for estimating occupational exposures and environmental releases (revised draft).			
HERO ID:	11182966			
Conditions of Use:	Repackaging			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Section 3.4 presents the formula for determining annual repackaging rate, and section 3.5 for annual use rate for the chemical of interest.			
Life cycle description:	pg 4 of 116: Chemicals may be repackaged at any stage in their lifecycle. However, the scope of the generic scenario mainly applies to chemicals that go through a repackaging process after they are domestically manufactured or imported into the U.S. The general principals in this GS may be adapted for repackaging during other stages (e.g., after processing/formulation).			
Process description:	Details of the repackaging process is provided in section 2.0. Repackaging operations for liquid chemicals typically involve pouring or pumping the product from the original containers or mixing /storage tanks into the new containers.			
Throughput:	Section 3.5 provides formula for calculating the annual throughput			
Number of sites:	Section 3.7 provides formula for determining the number of sites			
Chemical concentration:	Section 3.3 provides formula for concentration of chemical of interest			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States	
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	High	The report is generally no more than 10 years old.	
	Metric 5: Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The assessment does not address variability or uncertainty.	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (2021). Use of chemicals in fuels and related products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).
HERO ID:	11203977
Conditions of Use:	Use in Fuels and related Products

EXTRACTION	
Parameter	Data
Production, import, or use volume:	Formula for determining Annual production volume is in Section 3.7 (pg 19 of 76)
Process description:	Section 2 provides the general process for the use of fuels and related products, including associated environmental release sources and occupational exposure activities. Liquified petroleum gas, gasoline, and diesel are stored and transported as liquids under moderate pressures until use/combustion (EPA, 2008). Fuels and related products may be transported with rail cars, tank trucks, marine vessels, or via pipeline (EPA, 2008). After transport to fuel service stations, fuels are typically stored in large storage tanks until transferred to vehicles or other equipment to be combusted to provide energy (EPA, 2008).
Throughput:	Annual Throughput of Fuel per Site formula is provided in sections 3.4 and 3.9.
Number of sites:	Number of Use Sites formula is provided in section 3.7.
Chemical concentration:	Concentration of the chemical formula is provided in Section 3.3.

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized

Overall Quality Determination	High
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Study Citation:	U.S. EPA, (2004). Additives in plastics processing (compounding) – generic scenario for estimating occupational exposures and environmental release – Draft.
HERO ID:	6311218
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product -

EXTRACTION	
Parameter	Data
Production, import, or use volume:	provides the North American Production (lb/yr) of the types of Thermoplastics from 2003 (page 3 of 18)
Process description:	See page 4 of 18 for description, described briefly: Polymer pellets/resins received, blending/compounding into masterbatch (see page 8-9 of 18 for detailed description of methods for this step), extrusion/shaping.
Throughput:	Provides methodology for estimating throughput based on the amount of plastic produced, and the concentration of the chemical additive in the plastic (page 11 of 18)
Number of sites:	'Provides methodology for estimating number of sites based on chemical PV, the amount of plastic produced, and the concentration of the chemical additive in the plastic (page 11-12 of 18). In 2001 there were 715 plastic compounding sites (page 11 of 18).
Chemical concentration:	'Provides conc. estimates based on additive function in various plastics, not chemical specific (page 5-6 of 18)

		EVALUATION	
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Assessment uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	This GS is based on U.S. data
	Metric 3: Applicability	Medium	Data are for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
	Metric 4: Temporal Representativeness	Medium	Assessment is generally based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions.
	Metric 5: Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple plastic and additive types.

Overall Quality Determination	High
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Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.			
HERO ID:	8726954			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	fuel additive production volume is 1,000,000 PMN/yr (page 2 of 20)			
Process description:	The PMN is the product of a specialty chemical manufacturing process. The nature of the production process varies among additives. Most of the PMN is diluted to between 90 - 50 % in mineral oil to facilitate handling. Process varies; most are batch specially chemical operations. (page 2 of 20). See page 7-8 for a very general process description of manufacturing additives.			
Number of sites:	2 sites (page 2 of 20). Today more than 30 companies produce LOAs or "packages" of LOAs and sell them to lube oil blending facilities. A few large companies both manufacture LOAs and blend LOAs into lube oils. The production volume of an LOA is classified as "nonreported" or "confidential" by most of the major LOA manufacturers. (page 6 of 20)			
Chemical concentration:	additive concentration in lube product is 1.0% kg PMN/kg lube (page 2 of 20). See Exhibit 1 on page 6 of 20 for a description of major lube oil additives and their functions/concentrations (don't see DCBs here)			
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	USA
	Metric 3:	Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs
	Metric 4:	Temporal Representativeness	Low	1992
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.			
HERO ID:	8726954			
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	fuel additive production volume is 1,000,000 PMN/yr (page 3 of 20)			
Process description:	PMN is blended with basestock and other additives to make lubricant product. 10% PMN in additive package is blended with base stock to about 1.0% concentration and then packaged in cans or drums. Blending is usually done in-line. (page 3 of 20) See page 8 of 20 for a general description of blending/formulation via batch blending, partial in-line blending, and continuous in-line blending.			
Number of sites:	2 sites (page 3 of 20). Today more than 30 companies produce LOAs or "packages" of LOAs and sell them to lube oil blending facilities. A few large companies both manufacture LOAs and blend LOAs into lube oils. The production volume of an LOA is classified as "nonreported" or "confidential" by most of the major LOA manufacturers. (page 6 of 20)			
Chemical concentration:	additive concentration in lube product is 1.0% kg PMN/kg lube (page 3 of 20). See Exhibit 1 on page 6 of 20 for a description of major lube oil additives and their functions/concentrations (don't see DCBs here)			
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	USA
	Metric 3:	Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs
	Metric 4:	Temporal Representativeness	Low	1992
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (1992). Generic scenario document for lube oil additives.			
HERO ID:	8726954			
Conditions of Use:	Commercial Use - Lubricants and greases			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Fuel additive production volume is 1,000,000 PMN/yr, 29.3 MM gallons of/year of lube with PMN (page 4 of 20). See page 12 of 20 for use volumes for various oil uses.			
Number of sites:	4,000 pure lube sites, 57629 general automotive sites (page 4 of 20)			
Chemical concentration:	additive concentration in lube product is 1.0% kg PMN/kg lube (page 4 of 20)			
Comments:	p-DCB is not mentioned by name, or even broadly, however use in lubricant oil is a COU and therefore this generic scenario may be relevant. Page 15-19 has sample calculations of how some of the numbers were obtained.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	USA	
	Metric 3: Applicability	Medium	Does not mention DCB but covers some information relevant to two COUs	
	Metric 4: Temporal Representativeness	Low	1992	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The assessment addresses variability and uncertainty in the results. Uncertainty is well characterized.	
Overall Quality Determination		High		

Study Citation:	ACC, (2023). p-Dichlorobenzene (p-DCB) occupational inhalation exposure study conducted during polyphenylene sulfide manufacture and compounding.			
HERO ID:	13006361			
Conditions of Use:	Processing as a Reactant			
EXTRACTION				
Parameter	Data			
Process description:	PDF Pg. 4 and 5”The process uses all liquid raw materials and solvent. The process is completely closed: there are no open drums, totes, tanks or vessels. There are no vessel openings for solids loading.” Image of polymerization process at bottom of page 4.			
Number of sites:	1 Celanese sites (Wilmington, NC) and 1 Solvay site (Borger, TX). Pg. 2			
Chemical concentration:	PDF Pg. 5”The concentration of p-DCB at the facilities ranges from 100% in the p-DCB storage tanks to <100 ppm in the final solid polymer.”			
Comments:	Life cycle description not given but a process description is given.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for processing as a reactant, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old. [2023]
	Metric 5:	Sample Size	High	Two sites, but they represent all of polymer manufacturing using p-DCB in the US (supplement PDF)
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Report documents sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	NA, process description
Overall Quality Determination			High	

Study Citation:	ACC, (2023). p-Dichlorobenzene (p-DCB) occupational inhalation exposure study conducted during polyphenylene sulfide manufacture and compounding.			
HERO ID:	13006361			
Conditions of Use:	Plastic compounding			
EXTRACTION				
Parameter	Data			
Process description:	PDF Pg. 5”In the compounding facilities, PPS polymer is blended with other additives and extruded into pellets. Extruders have individual exhaust ventilation over the die heads.”			
Number of sites:	1 Celanese site (Florence, KY)			
Chemical concentration:	PDF Pg. 5”The concentration of p-DCB at the facilities is <100 ppm in the final solid polymer.”			
Comments:	Life cycle description not given but a process description is given.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for plastic compounding, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old. [2023]
	Metric 5:	Sample Size	Low	Only 1 site included in the study.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Sources documented (the sites themselves are the sources)
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed, with only one site.
Overall Quality Determination			High	

Study Citation:	Anonymous (1996). No additional spent solvent listings proposed. Hazardous Waste Consultant 14(7):B7-B11.			
HERO ID:	2529471			
Conditions of Use:	disposal of p-DCB used as a lab solvent			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	For pDCB, quantity used as a solvent including lab solvent and paint stripping solvent (which is not a COU and was being phased out according to the data source)- 6,288 kg/yr			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	used data from reputable source accepted by the scientific community	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data	
	Metric 3: Applicability	High	The information pertains to a COU	
	Metric 4: Temporal Representativeness	Low	data is more than 20 years old	
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	N/A	N/A - information not dependent on metada	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A - information not dependent on metada	
Overall Quality Determination		High		

Study Citation:	Anonymous, (1987). Chemical review: 1,4-dichlorobenzene. Dangerous Properties of Industrial Materials Report 7(4):7-25.			
HERO ID:	5251382			
Conditions of Use:	manufacturing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Dow Chemical Company USA, Michigan Division produced 1-10 million lbs in 1977, PPG Industries, Inc., WV produced 10-50 million lbs in 1977, Monsanto Company IL produced 1-10 million lbs in 1977, Montrose Chemical Corp. of Cal, NV produced 1-10 million lbs in 1977, Solvent Chemical Corp NY produced 100,000-1 million lbs in 1977, ABC Compounding Corp GA produced 1-10 thousand lbs in 1977, Allied Chemical Corp NY produced 1-10 million lbs in 1977, Dover Chemical Corp OH produced 1-10 million lbs in 1977, Norton Co MA produced 10-100 thousand lbs in 1977, ICC Industries NY imported, ICI Americas Inc DE produced 100,000-1 million lbs in 1977			
Process description:	Preparation by Sandmeyer procedure from the appropriate chloroaniline, and along with o- and m-dichlorobenzenes, by chlorination of chlorobenzene. Separation of mixture containing m-, o-, and p-dichlorobenzenes by distillation and crystallization. (R-10) Chlorobenzene is produced commercially by passing dry chlorine into benzene in the presence of a catalyst, e.g., molybdenum chloride, at atmospheric pressure and 30-50 C. This continuous process, in which an excess of benzene is used, yields 14 parts monochloro- to 1 part of dichlorobenzene. (R-14) Chlorination of benzene or chlorobenzene at 150-190 C with a ferric chloride catalyst PDCB can be crystallized out, washed with methanol, and dried under vacuum at 100 C. (R-24)			
Number of sites:	11			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data	
	Metric 3: Applicability	High	report is for an occupational scenario within the scope of the risk evaluation	
	Metric 4: Temporal Representativeness	Low	data is greater than 20 years old	
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A - information not dependent on metadata	
Overall Quality Determination		High		

Study Citation:	APR, (2020). U.S. post-consumer plastic recycling data.			
HERO ID:	11360400			
Conditions of Use:	Recycling			
EXTRACTION				
Parameter		Data		
Production, import, or use volume:		Provides millions of lb/yr of different plastic classifications		
Life cycle description:		Recycling		
EVALUATION				
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Methodology	Medium	Report uses high quality data that are not from frequently-used sources and there are no known quality issues.
Domain 2: Representativeness		Metric 2: Geographic Scope	High	Data are from the U.S.
		Metric 3: Applicability	Medium	Data are for Recycling, an in-scope occupational scenario but not specific to p-dcb
		Metric 4: Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old.
		Metric 5: Sample Size	Low	Sample distribution is described qualitatively.
Domain 3: Accessibility/ Clarity		Metric 6: Metadata Completeness	Medium	Methods, results, and assumptions are clearly documented, but underlying data sources are not fully transparent.
Domain 4: Variability and Uncertainty		Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.
Overall Quality Determination			Medium	

Study Citation:	Aragón-González, G., Barragán-Santiago, I., Cano-Blanco, M., León-Galicia, A., Morales-Gómez, J. R. (2019). Automatic tablet machine. Journal of Physics: Conference Series 1221(1):012030.
HERO ID:	10139648
Conditions of Use:	Incorporation into Formulation (Air care product)

EXTRACTION	
Parameter	Data
Process description:	PDF Pg. 3-7The tablet manufacturing machine consists of a rotating table with 15 double cavity moulds designed to simultaneously compact 2 tablets using hydraulic power. Each mould has 2 cavities with 1 actuator for each cavity. The tablet material is loaded in a hopper and fed to the mould cavities using a work conveyor driven by a pneumatic motor. The mass flow is regulated adjusting the angular velocity and a variable orifice valve. The table is rotated through a pneumatic rotatory actuator which rotates to cover all 15 moulds in increments of 1.0s."Its average particle diameter is about 4 mm, very volatile at room temperature and sublimates easily...The approximated density of the granulated material is 610 kg/m3. "Descriptions of the pneumatic power system, hydraulic power system, and electronic control system are given in PDF Pg. 4-6.
Throughput:	3,600 deodorant tablets per hour (396kg/hr of material).Quote: "A Mexican manufacturing plant, whose main product is deodorant tablets for domestic and commercial use, requested the design, construction, and start up of an automatic machine to make 3 600 deodorant tablets per hour of Paradichlorobenzene (PDB). The tablets should have a density no less than 1 400 [kg/m3] with a weight variation of 5% maximum. (page 1 of PDF)
Comments:	PV, live cycle description, and chemical concentration are not given in the document. This is not an active process, but a proposal for a new machine to make p-DCB deodorizers.

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	Data are from Mexico, an OECD country.
	Metric 3:	Applicability	High	Data are for incorporation into formulation of air care products, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old. [2019]
	Metric 5:	Sample Size	N/A	No data involved
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	No data involved

Overall Quality Determination

High

Study Citation:	Aronson, D. B., Bosch, S., Gray, D. A., Howard, P. H., Guiney, P. D. (2007). A comparative human health risk assessment of p-dichlorobenzene-based toilet rimblock products versus fragrance/surfactant-based alternatives. Journal of Toxicology and Environmental Health, Part B: Critical Reviews 10(7):467-526.			
HERO ID:	449472			
Conditions of Use:	Commercial and Consumer Use - odor masking product			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Table 1 contains data pertaining to annual US demand of pDCB and the share of this demand for various uses. For example, Annual U.S. Demand for pDCB over the last 20–30 Years ranges between 63 million lbs (1981) and 93 million lbs (1999)			
Physical form:	Toilet rimblock products are generally manufactured as solid cakes.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses data from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	contains data from US
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	Data more than 20 years old
	Metric 5:	Sample Size	Low	not characterized by statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The model does not characterize variability or uncertainty
Overall Quality Determination		Medium		

Study Citation:	ATSDR, (2006). Toxicological profile for dichlorobenzenes.
HERO ID:	5160103
Conditions of Use:	manufacture/import

EXTRACTION	
Parameter	Data
Production, import, or use volume:	Production of 1,4-DCB in the United States has risen from approximately 15 million pounds (6,800 metric tons) in 1981 to approximately 72 million pounds (32,600 metric tons) in 1993 (IARC 1999). The production volume of 1,4-DCB reported by manufacturers in 1998 and 2002 was within the range of greater than 50 million pounds to 100 million pounds (>23,000–45,000 metric tons) (EPA 2002e). The historical rate of growth of this chemical from 1989–1998 was 1.1 percent per year (CMR 1999). Import volumes of 1,4-DCB were 867,441 kg (1.9 million pounds), 1,113,676 kg (2.5 million pounds), 996,649 kg (2.2 million pounds), 3,283,759 kg (7.2 million pounds), and 3,019,233 kg (6.7 million pounds) for 1990, 1991, 1992, 1993, and 1994, respectively.
Life cycle description:	For the past 20 years, 1,4-DCB has been used principally (25–55% of all uses) as a space deodorant for toilets and refuse containers, and as a fumigant for control of moths, molds, and mildews. In recent years, the use of 1,4-DCB in the production of polyphenylene sulfide (PPS) resin has increased steadily (25–50% of its total use). 1,4-DCB is also used as an intermediate in the production of other chemicals such as 1,2,4-trichlorobenzene (approximately 10%). Minor uses of 1,4-DCB include its use in the control of certain tree-boring insects and ants, and in the control of blue mold in tobacco seed beds (CMR 1999; HSDB 2005).
Process description:	Chlorinated benzenes are produced typically by reacting liquid benzene with gaseous chlorine in the presence of a catalyst at moderate temperature (unspecified) and atmospheric pressure (IARC 1999; Rossberg et al. 2002). This reaction yields a mixture of chlorobenzene isomers with varying degrees of chlorination. A maximum dichlorobenzene yield of 98% is obtainable in a batch process in which 2 moles of chlorine is used per mole of benzene (mass ratio approximately 1.8:1) in the presence of ferric chloride and sulfur monochloride (IARC 1999). 1,2- and 1,4- DCB are the major DCB isomers formed in this process, with 1,2:1,4 ratios dependant on the type of catalyst used (Table 5-1). 1,3-DCB is also formed, but in much smaller quantities (Krishnamurti 2001). The DCB isomers are typically separated by crystallization and distillation.
Throughput:	Current annual 1,4-DCB production capacity for Solutia Inc. and PPG Industries, Inc. are 39 and 40 million pounds (17,700 and 18,100 metric tons), respectively (SRI 2005).
Number of sites:	1,4-DCB and 1,2-DCB are currently produced by 2 U.S. companies at 2 different locations: Solutia Inc., in Sauget, Illinois and PPG Industries, Inc., in Natrium, West Virginia (SRI 2005).

		EVALUATION	
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	The report is for an occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Medium	contain data that is between 10 and 20 years old
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The report does not address variability or uncertainty.

Continued on next page ...

p-Dichlorobenzene

General Engineering Assessment

HERO ID: 5160103 Table: 1 of 1

...continued from previous page

Study Citation:	ATSDR, (2006). Toxicological profile for dichlorobenzenes.		
HERO ID:	5160103		
Conditions of Use:	manufacture/import		
Domain	Metric	EVALUATION Rating	Comments
Overall Quality Determination		High	

Study Citation:	ATSDR, (1998). Toxicological profile for 1,4-dichlorobenzene (update).
HERO ID:	5258934
Conditions of Use:	manufacture

EXTRACTION	
Parameter	Data
Production, import, or use volume:	The volume of 1,4-dichlorobenzene produced in the United States in 1972, 1975, 1977, and 1981 was estimated to be 35 million kg (77.2 million pounds), 20.8 million kg (45.9 million pounds), 16-116 million pounds (7.25-52.6 million kg), and 15 million pounds (6.8 million kg), respectively (HSDB 1998). The production of 1,4-dichlorobenzene steadily increased from 1980 to 1989 at a rate of about 2% per year (Chemical Marketing Reporter 1990). The production volume of 1,4-dichlorobenzene increased from 1984 to 1994 at a rate of 4% annually. The production volume was 4.264 (1984), 4.779 (1985), 5.035 (1986), 5.155 (1987), 5.601 (1988), 5.344 (1989), 5.200 (1990), 5.350 (1991), 5.656 (1992), 5.791 (1993), and 6.227 billion pounds (1994) (C&EN 1995). Import volumes of 1,4-dichlorobenzene were 867,441 kg (1.9 million pounds), 1,113,676 kg (2.5 million pounds), 996,649 kg (2.2 million pounds), 3,283,759 kg (7.2 million pounds), and 3,019,233 kg (6.7 million pounds) for 1990, 1991, 1992, 1993, and 1994, respectively.
Life cycle description:	For the past 20 years, 1,4-dichlorobenzene has been used principally (35-55% of all uses) as a space deodorant for toilets and refuse containers, and as a fumigant for control of moths, molds, and mildews. A significant amount of 1,4-dichlorobenzene is exported (34%), with lesser amounts used in the production of polyphenylene sulfide (PPS) resin (approximately 27% of its total use), and as an intermediate in the production of other chemicals such as 1,2,4-trichlorobenzene (approximately 10%). Minor uses of 1,4-dichlorobenzene also include its use in the control of certain tree-boring insects and ants, and in the control of blue mold in tobacco seed beds (Chemical Marketing Reporter 1990; HSDB 1998).
Process description:	1,4-Dichlorobenzene is produced by the chlorination of benzene or chlorobenzene in the presence of a catalyst (typically ferric oxide) followed by either fractional distillation or crystallization of the resulting mixture of chlorinated benzenes to yield 1,4-dichlorobenzene (HSDB 1998; IRPTC 1985).
Throughput:	urrent annual production capacity for theMonsanto Company, PPG Industries, Inc., and Standard Chlorine Chemical Company is 33, 36, and75 million pounds, respectively (SRI 1996). he annual production capacity was 132, 127,371, 138, and 144 million pounds in 1988,1994, 1995, 1996, and 1997 respectively
Number of sites:	1,4-Dichlorobenzene is currently produced by 3 U.S. companies at 3 different locations: Monsanto Company, in Sauget, Illinois; PPG Industries, Inc., in Natrium, West Virginia; and Standard Chlorine of Delaware, Inc., in Delaware City, Delaware (SRI 1997). Current annual production capacity for the Monsanto Company, PPG Industries, Inc., and Standard Chlorine Chemical Company is 33, 36, and 75 million pounds, respectively (SRI 1996).

		EVALUATION	
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data sources
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The report does not address variability or uncertainty.

Continued on next page ...

p-Dichlorobenzene

General Engineering Assessment

HERO ID: 5258934 Table: 1 of 2

...continued from previous page			
Study Citation:	ATSDR, (1998). Toxicological profile for 1,4-dichlorobenzene (update).		
HERO ID:	5258934		
Conditions of Use:	manufacture		
Domain	Metric	EVALUATION Rating	Comments
Overall Quality Determination		High	

Study Citation:	ATSDR, (1998). Toxicological profile for 1,4-dichlorobenzene (update).		
HERO ID:	5258934		
Conditions of Use:	Disposal		
EXTRACTION			
Parameter	Data		
Process description:	1,4-Dichlorobenzene may be disposed of by making packages of the chemical in paper or other disposable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device or by dissolving the chemical in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device (IRPTC 1985). Halogenated compounds may be disposed of by incineration provided they are blended with other compatible wastes or fuels so that the composite contains less than 30% halogens. Liquid injection, rotary kiln, and fluidized bed incinerators are typically used to destroy liquid halogenated wastes. Temperatures of at least 2,000-2,200 °F and residence times of seconds for liquids and gases, and hours for solids (HSDB 1998).		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The assessment is a generally accepted source and does not indicate flaws or quality issues.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	U.S. data
	Metric 3: Applicability	High	Disposal is an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	More than 20 years old.
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The report addresses variability in different treatment methods and uncertainty is further addressed in the report by discussion of TRI releases.
Overall Quality Determination		High	

Study Citation:	Bakoğlu, M., Karademir, A., Ayberk, S. (2004). An evaluation of the occupational health risks to workers in a hazardous waste incinerator. Journal of Occupational Health 46(2):156-164.				
HERO ID:	1441172				
Conditions of Use:	Disposal				
EXTRACTION					
Parameter		Data			
Process description:		The incinerator had a 2-stage combustion system consisting of a rotary kiln and a vertical shaft. The capacity of the plant is 35,000 tons/yr and is equipped with an electrostatic precipitator, a venturi scrubber, a lime-scrubber, and an activate dcarbon unit. Industrial and clinical wastes (in liquid and solid forms) are combusted in the incinerator.			
EVALUATION					
Domain		Metric		Rating	Comments
Domain 1: Reliability		Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness		Metric 2:	Geographic Scope	Medium	The data is from an OECD country other than the U.S- Turkey report is for an occupational scenario within the scope of the risk evaluation. data is between 10 and 20 years old N/A - information not dependent on samples
	Metric 3:	Applicability	High		
	Metric 4:	Temporal Representativeness	Medium		
	Metric 5:	Sample Size	N/A		
Domain 3: Accessibility/ Clarity		Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty		Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination				High	

Study Citation:	Betts, W. D. (2000). Tar and pitch. :1-31.			
HERO ID:	8486216			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Process description:	In the late 1980s, Brodie crystallizers were installed in the United Kingdom and in France for upgrading phthalic-grade naphthalene to 99% purity or better. This apparatus, developed by Union Carbide Corporation, Australia, for separating o- and p-dichlorobenzene, was adapted for naphthalene refining. (page 12 of 31)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Kirk-Othmer Encyclopedia of Chemical Technology	
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	Australia	
	Metric 3: Applicability	Low	The separation process that p-DCB goes through is very briefly and peripherally described	
	Metric 4: Temporal Representativeness	Low	before 1980s	
	Metric 5: Sample Size	N/A	N/A-data not applicable to sample	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Low	No source for this mentioned	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The report does not address variability or uncertainty.	
Overall Quality Determination		Low		

Study Citation:	Brown, S. L., Chan, F. Y., Jones, J. L., Liu, D. H., Mccaleb, K. E. (1975). Research program on hazard priority ranking of manufactured chemicals (Chemicals 21-40).			
HERO ID:	5251828			
Conditions of Use:	manufacture			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Total US production = 77.3 million lbs/yr			
Life cycle description:	Total US consumption = 77.3 million lbs/yr; Dispersive use = 69.6 million lbs/yr with 39.0 million lbs/yr for space odorant and 30.6 million lbs/yr for moth control			
Number of sites:	8 producing companies and 9 producing locations			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination		High		

Study Citation:	CalEPA, (1997). Public health goal for 1,4-dichlorobenzene in drinking water.		
HERO ID:	5155646		
Conditions of Use:	manufacture		
EXTRACTION			
Parameter	Data		
Production, import, or use volume:	U.S. production of 1,4-DCB has been estimated at 15 x 10^6 pounds (1981; HSDB, 1997), while U.S. imports have been estimated at 1.09 x 10^7 grams (HSDB, 1997).		
Process description:	1,4-DCB may be synthesized using a Friedel-Crafts catalyst such as ferric oxide in the chlorination of liquid benzene (Health Canada, 1993). This reaction produces primarily 1,4-DCB with less than ~1% contaminating mono-, di- and trichlorobenzenes, although these by-products may be separated out by subsequent fractionation. 1,4-DCB may also be synthesized using the Sandmeyer process using the appropriate chloroaniline compound as a substrate, or by the chlorination of chlorobenzene (HSDB, 1997).		
Throughput:	Consumption pattern estimates have ranged from 35 to 40% for moth control, 35 to 55% as a space deodorant and the balance for miscellaneous and other uses (HSDB, 1997).		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	High	report is for an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old
	Metric 5: Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A - information not dependent on metadata
Overall Quality Determination		High	

Study Citation:	CDC, (2009). Fourth national report on human exposure to environmental chemicals.			
HERO ID:	664488			
Conditions of Use:	Use			
EXTRACTION				
Parameter	Data			
Life cycle description:	The dichlorobenzenes are chemical intermediates in synthesis of dyes, pesticides, and other industrial products. 1,4-Dichlorobenzene (1,4-DCB; para-dichlorobenzene) is used also as a moth repellent and as a deodorizer.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States	
	Metric 3: Applicability	Low	The report is for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer	
	Metric 4: Temporal Representativeness	Medium	The report is generally more than 10 years but no more than 20 years old.	
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A - information not dependent on metada	
Overall Quality Determination		High		

Study Citation:	Chin, J. Y. (2011). Characterization of biofuels blends: Emissions, permeation and apportionment of volatile organic compounds.				
HERO ID:	6026451				
Conditions of Use:	use				
EXTRACTION					
Parameter	Data				
Chemical concentration:	Concentration of pDCB at the site studied were 0.45 ug/m3 (mean) and 6.04 ug/m3 (max)				
EVALUATION					
Domain	Metric		Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	high quality data	
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data	
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.	
	Metric 4:	Temporal Representativeness	High	data is less than 10 years old	
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized	
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, andassumptions.	
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The report addresses variability and uncertainty in the results.	
Overall Quality Determination			High		

Study Citation:	Clement Associates,, Inc. (1989). Human health risk assessment for the Ciba-Geigy St Gabriel, LA incineration project with cover letter dated 042789. 890000189:#86-890000189.			
HERO ID:	1335586			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Process description:	Th. CBA-GEIGY St. Gabriel, LA, plane is a continuous, completely automated process plant operated by the Corporation’s Agricultural Division. The CIBA-GEIGY St. Gabriel liquid incinerator is a multi-component facility designed to burn both aqueous and liquid organic wastes from St. Gabriel plant operations as well as certain wastes from other CIBA-GEIGY facilities. It comprises waste feed storage tanks, a thermal oxidizer (incinerator), quench pot and secondary quench, a hydro-sonic off-gas scrubber system, and a vent stack. Table B-4 in Appendix B (PDF pg. 55/475) includes information on amount of pDCB in the feed of this incinerator.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	he assessment or report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	N/A	N/A - information not dependent on metada
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination			High	

Study Citation:	Csiszar, S. A., Meyer, D. E., Dionisio, K. L., Egeghy, P., Isaacs, K. K., Price, P. S., Scanlon, K. A., Tan, Y. M., Thomas, K., Vallero, D., Bare, J. C. (2016). Conceptual framework to extend life cycle assessment using near-field human exposure modeling and high-throughput tools for chemicals. Environmental Science & Technology 50(21):11922-11934.			
HERO ID:	3464314			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Life cycle description:	pDCB releases due to chemical and product manufacturing. pDCB releases to outdoor media (urban air, water). Among the products where pDCB is used are closet air freshner, moth products, toilet bowl deodorizer. pDCB can be released to indoor/near field media. Under disposal, pDCB is sent to landfill and pDCB can be released from there. Impact scores for pDCB are 5 x 10^-12 for manufacturing, 3 to 6 x 10^-5 for use, and 0 to 2 x 10^-8 for disposal. Exposure to the FU product type (air freshener) contributed approximately 20% to the overall mean near-field exposure, meaning the aggregate exposure was dominated by the other consumer products containing p-DCB. the use-stage had the highest human exposure potential and, therefore, the highest health impact or risk potential for p- DCB.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	sound methodology
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The uses mentioned are COU.
	Metric 4:	Temporal Representativeness	High	less than 10 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	The source of information is stated.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination		High		

Study Citation:	Deng, Y., Bonilla, M., Ren, H., Zhang, Y. (2018). Health risk assessment of reclaimed wastewater: A case study of a conventional water reclamation plant in Nanjing, China. Environment International 112:235-242.			
HERO ID:	4728647			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Chemical concentration:	Concentrations of pDCB from reclaimed wastewater treatment units are: oxidation ditch - 87 +/- 5.5, coagulation tank – 65 +/- 9.1, biological aerated filter – 63 +/- 27, UV disinfection pool – 74 +/- 9.8			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data	
Domain 2: Representativeness	Metric 2: Geographic Scope	Low	The data are from a non-OECD country	
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	High	The report is generally no more than 10 years old.	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	The report provides only limited discussion of the variability but none on uncertainty in the results.	
Overall Quality Determination		High		

Study Citation:	Earthjustice, (2020). Exhibit 1 to comments of rubbertown emergency action et al., re: TSCA risk evaluations for high-priority substances and substances undergoing manufacturer-requested risk evaluations.			
HERO ID:	10385015			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	No production or use volume reported for p-DCB.			
Number of sites:	Port Arthur: 1 siteHouston: 1 siteMossville: 1 siteCancer Alley: 2 sites			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Number of sites gathered from Toxics Release Inventory reporting.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5:	Sample Size	High	Discrete release data provided.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Variability is addressed by evaluating the number of sites throughout different regions. However, uncertainty in not characterized.
Overall Quality Determination			High	

Study Citation:	Eklund, B., Anderson, E. P., Walker, B. L., Burrows, D. B. (1998). Characterization of landfill gas composition at the Fresh Kills municipal solid-waste landfill. Environmental Science & Technology 32(15):2233-2237.			
HERO ID:	1487387			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Process description:	The Fresh Kills Landfill is the largest MSW landfill in the United States. The landfill is divided into four sections, two of which no longer accept waste and two which are open and accept waste from all five boroughs of New York. The landfill currently accepts primarily residential (household) garbage; hazardous waste and medical waste are not currently placed in the landfill. Some organic matter in the garbage, such as leaves and Christmas trees, is segregated and sent to a composting facility. The type of wastes and the composition of the wastes within each of the four sections are believed to be similar. Section 1/9 has an active gas collection system which covers the southern 2/3 of this section. The gas collection system is operated by a contractor and produces about 400 000 m3/day of landfill gas. The landfill gas is routed to a gas processing plant adjacent to section 1/9 where condensate, CO2, and VOCs are removed and pipeline quality natural gas is produced. The VOCs and condensate are incinerated, and the cleaned gas is sold to a local utility.			
Chemical concentration:	Average Landfill Gas Composition - 13.97 ppmv; ratio of pDCB to total VOC concentration - 3.1 % at gas collection system, 2.8% at passive vents, 6.1% at flux chamber samples			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	uses high quality data	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data	
	Metric 3: Applicability	High	report is for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old	
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	N/A	N/A - information not dependent on metadata	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A - information not dependent on metadata	
Overall Quality Determination		High		

Study Citation:	ENF, (2024). Plastic recycling plants in the United States.			
HERO ID:	11360395			
Conditions of Use:	Recycling			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	provides some values for materials processed in tons/yr (2,3,5/6)			
Number of sites:	59 sites			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Medium	Report uses high quality data that are not from frequently-used sources and there are no known quality issues.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	Medium	Data are for Recycling, an in-scope occupational scenario but not specific to p-DCB
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old.
	Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment results are provided but underlying methods, assumptions, and data sources are not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.
Overall Quality Determination			Medium	

Study Citation:	ERG, (1998). Air emissions inventories, volume 2: Point sources: Chapter 11: Preferred and alternative methods for estimating air emissions from plastic products manufacturing.			
HERO ID:	7349020			
Conditions of Use:	Processing: Intermediate in plastic material and resin manufacturing			
EXTRACTION				
Parameter	Data			
Process description:	”Solid and foamed plastic products are manufactured by a variety of methods. The choice of manufacturing techniques used to process a plastic product depends largely on whether the resin is a thermoplastic or thermoset, and the dimensions, shape, or physical qualities of the desired product. This section describes the major manufacturing techniques used to fabricate intermediate and final plastic products. Extrusion is the most widely used processing technique, followed by injection molding, blow molding, and foam processing (Midwest Research Institute, 1993).These four manufacturing techniques, in addition to lamination, coating, and finishing operations, are described below” p. 11			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data that are from frequently used sources and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	Medium	The report is for an occupational scenario within the scope of the risk evaluation, however there is no specific mention of p-DCB.
	Metric 4:	Temporal Representativeness	Low	The report is more than 20 years old. The report captures operations, equipment, and worker activities that are expected to be outdated.
	Metric 5:	Sample Size	N/A	This data is not dependent on sampling.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - Process Description
Overall Quality Determination			High	

Study Citation:	Exponent,, Inc., (2024). Occupational inhalation exposure assessment for p-dichlorobenzene (with supplemental data and clarification letter).			
HERO ID:	13170985			
Conditions of Use:	Processing as a reactant			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	The amount of p-DCB generated per year is very low (~1,000 lbs/year) and is a very small portion of the IFS generated. (pg. 24)			
Process description:	The Lake Charles complex contains a Derivatives unit, in which chlorine is combined with ethylene and ethylene derivates to produce chlorinated hydrocarbons. This is a continuous, semi-automatic process. Full descriptions for all SEG processes are provided in Appendix B.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	The test order uses NIOSH Method 1003.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Report is for Processing as a reactant, an in-scope OES.
	Metric 4:	Temporal Representativeness	High	Data are from 2024.
	Metric 5:	Sample Size	High	Discrete sampling data is presented in Appendix C.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All assumptions, methods, and results are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The availability of all associated metadata within the monitoring study allows for the determination of uncertainty from the sampling and analytical methods and of the variability in the determinants of exposure.
Overall Quality Determination			High	

Study Citation:	Fishbein, L. (1979). Potential halogenated industrial carcinogenic and mutagenic chemicals. IV. Halogenated aryl derivatives. Science of the Total Environment 11(3):259-278.
HERO ID:	659539
Conditions of Use:	Commercial use (moth repellent; mildew control agent; space deodorant; intermediate in production of dyes, insecticides, pharmaceuticals and organic chemicals; as a catalyst for manufacture of mercapto acids; and as an intermediate in the production of polyphenylene sulfide resins and the dye intermediate 2,5-dichloroaniline

EXTRACTION	
Parameter	Data
Production, import, or use volume:	U.S. Production of pDCB was 45.8 million lbs and the 1976 production is estimated to have been 70 million lbs. The estimated U.S. consumption pattern for pDCB in 1975 was: 50% as a space odorant; 40% for moth control; and 10% for miscellaneous growth
Process description:	Chlorinated benzenes are formed progressively and simultaneously when chlorine reacts with benzene at elevated temperatures in the presence of chlorination catalysts. For higher yields of the pDCB isomer an "orienting" catalyst such as an arylsulphonic acid can be employed or alternatively chlorination can be carried out further to convert the ortho-isomer to 1,2,4-trichlorobenzene from which the pDCB can be separated by distillation.

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	report uses data from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	Data more than 20 years old
	Metric 5:	Sample Size	Low	not characterized by statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The model does not characterize variability or uncertainty

Overall Quality Determination

Medium

Study Citation:	Gamble, M. H. (1979). Para-dichlorobenzene. Chemistry in Britain 15(1):12.			
HERO ID:	4915094			
Conditions of Use:	commercial use			
EXTRACTION				
Parameter	Data			
Life cycle description:	pDCB is used by ICI in air-freshening compound called "Maskador"			
Chemical concentration:	the Maskador contains 99% pure pDCB			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Low	The data used in the report are not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	Low	The report is for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer
	Metric 4:	Temporal Representativeness	Low	information presented is more than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Uninformative	Assessment or report does not document its data sources, assessment methods, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.
Overall Quality Determination		Uninformative		

Study Citation:	Garbassi, F., Po, R. (2001). Engineering thermoplastics. :168-228.			
HERO ID:	8486226			
Conditions of Use:	Processing, use as reactant			
EXTRACTION				
Parameter	Data			
Process description:	Poly(phenylene sulfide) (PPS) is obtained by condensation polymerization of p-dichlorobenzene with Na2S, operating in a dipolar aprotic solvent like N-methylpyrrolidinone or N-methylcaprolactam. See page for small diagram. (Page 34 of 61)			
Comments:	p-DCB mentioned very briefly			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Kirk-Othmer Encyclopedia
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	USA
	Metric 3:	Applicability	High	p-DCB use as reactant
	Metric 4:	Temporal Representativeness	Low	2001
	Metric 5:	Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.
Overall Quality Determination			High	

Study Citation:	Geibel, J., Leland, J. (2000). Polymers containing sulfur, poly(phenylene sulfide).			
HERO ID:	8486224			
Conditions of Use:	Processing, use as a reactant			
EXTRACTION				
Parameter	Data			
Process description:	The synthesis of Poly(p-phenylene sulfide)(PSS) involves the polymerization of p-dichlorobenzene and a sodium sulfide source in a polar organic compound at elevated temperature and pressure. (page 2 of 25). See page 3 of 25 for an in depth description of the manufacturing processes of this PSS chemical, an important step of which includes (for the Philips process, page 4 of 25) the polymerization of the dehydrated sulfur source with p-dichlorobenzene to yield a slurry of PPS and by-product sodium chloride in the solvent or (for the Kureha process, page 7 of 25)) polymerization of the dehydrated sodium sulfide with p-dichlorobenzene at a low temperature to form a prepolymer. In another process for the synthesis of PPS, as well as other poly(arylene sulfide)s and poly(arylene oxide)s, a pentamethylcyclopentadienylruthenium(I) π -complex is used to activate p-dichlorobenzene toward displacement by a variety of nucleophilic comonomers (page 9 of 25)			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Kirk-Othmer Encyclopedia of Chemical Technology
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	USA
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	2000 I believe?
	Metric 5:	Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High	The report addresses variability in processes used to manufacture the relevant chemical
Overall Quality Determination			High	

Study Citation:	Hansen, J., Schneider, T., Olsen, J. H., Laursen, B. (1993). Availability of data on humans potentially exposed to suspected carcinogens in the Danish working environment. Pharmacology & Toxicology 72(Supplement 1):77-85.			
HERO ID:	1010267			
Conditions of Use:	Commercial use			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	10,000 tons/yr			
Life cycle description:	space deodorant for toilets			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Low	The data, data sources, and/or techniques or methods used in the assessment or report are not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	Data is for Denmark - an OECD country
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion of the variability and completeness
Overall Quality Determination			Low	

Study Citation:	Hill, R. H., Ashley, D. L., Head, S. L., Needham, L. L., Pirkle, J. L. (1995). p-Dichlorobenzene exposure among 1,000 adults in the United States. Archives of Environmental Health 50(4):277-280.			
HERO ID:	3485315			
Conditions of Use:	use			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	expected production of p-DCB for 1990 was approximately 140 million lb. Median concentration of DCP in urine was 9ug/L, and maximum concentration detected was 1,200 ug/L.			
Life cycle description:	2,5-dichlorophenol (DCP) is a metabolite of p-DCB, and were found in 96% of urine samples obtained from selected children who lived in two Arkansas communities. The Pearson correlation coefficient between urinary DCP and p-DCB blood concentrations was .82 (p < 0.0001).			
Chemical concentration:	concentrations of p-DCB in personal air samples ranged from 0.02 to 2 600 pg/m3. p-DCB was found in the air in 80% of the homes tested.			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability
Overall Quality Determination		Medium		

Study Citation:	Hsiao, P. K., Lin, Y. C., Shih, T. S., Chiung, Y. M. (2009). Effects of occupational exposure to 1,4-dichlorobenzene on hematologic, kidney, and liver functions. International Archives of Occupational and Environmental Health 82(9):1077-1085.			
HERO ID:	4931409			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	From 1998 to 2002, annual production of 1,4-DCB in the United States (US) increased from 23,000 to 45,000 metric tons (ATSDR 2006).			
Life cycle description:	1,4-DCB is use as a chemical intermediate for dyes, polyphenylene sulfide resin, and 1,2,4-trichlorobenzene. In households and public lavatories, it is used as a room deodorant, toilet deodorizer, moth repellent, and mildew control agent.			
Process description:	mothball manufacture included four steps: pulverization of the raw 1,4-DCB (purity > 99.5%), addition with mixing of perfume and color additives, pressing into blocks, and Welling and packaging in plastic bags or containers.			
Chemical concentration:	raw 1,4-DCB (purity > 99.5%)			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	data are from the United States
	Metric 3:	Applicability	High	report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Medium	data is between 10 and 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination		High		

Study Citation:	IARC, (1999). Hexachlorobutadiene. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 73 73:277-294.			
HERO ID:	18474			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Production of para-dichlorobenzene in the United States has increased since the 1980s, from approximately 6800 tonnes in 1981 to approximately 32 600 tonnes in 1993 (International Trade Commission, 1993; Environmental Protection Agency, 1998b). In the United States and Canada, para-dichlorobenzene is used mainly as an air freshener and a moth repellent (e.g. as ‘moth balls’ or ‘moth crystals’) and in a range of pesticidal applications. It is also used in the manufacture of 2,5-dichloroaniline and pharmaceuticals; in the manufacture of polyphenylene sulfide resins used for surface coatings and moulding resins; and to control mildew.			
Process description:	Chlorobenzenes are prepared industrially by reaction of liquid benzene with gaseous chlorine in the presence of a catalyst at moderate temperature and atmospheric pressure. Dichlorobenzenes are formed in this process as isomeric mixtures with a low content of the 1,3-isomer. A maximum dichlorobenzene yield of 98% is obtainable in a batch process in which 2 mol of chlorine per mol of benzene are reacted in the presence of ferric chloride and sulfur monochloride at mild temperatures. The remainder of the product consists of mono- and trichlorobenzene. About 75% para-dichlorobenzene, 25% ortho-dichlorobenzene and only 0.2% meta-dichlorobenzene are obtained (Beck, 1986).			
Chemical concentration:	Pure-grade para-dichlorobenzene consists of > 99.8% para-dichlorobenzene, < 0.05% chlorobenzene and trichlorobenzene and < 0.1% ortho- and meta-dichlorobenzene (Beck, 1986).			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data more than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination			High	

Study Citation:	IARC, (1982). IARC monographs on the evaluation of the carcinogenic risk of chemicals to humans: Some industrial chemicals and dyestuffs. IARC monographs on the evaluation of carcinogenic risks to humans 29:1-398.
HERO ID:	27010
Conditions of Use:	Manufacture

EXTRACTION	
Parameter	Data
Production, import, or use volume:	Total US production of pDCB by five producers in 1979 amounted to 37.9 million kg. In 1980, total US exports of all DCBs amounted to 17.3 million kg.
Process description:	p-DCB was synthesized by chlorination of benzene in the liquid phase in the presence of a Friedel-Crafts catalyst (usually ferric oxide) and fractionation of the resulting mixture of chlorinated benzenes.
Number of sites:	5 producers in US in 1979
Chemical concentration:	pDCB is available in the US as technical grades of unusually high purity: 100% in crystalline form and 99.92% in liquid form (on an anhydrous basis). In western Europe, pDCB is available with a minimum purity of 99%. pDCB is available in Japan as a white, flaked product, with a minimal freezing-point of 52.9°C.

EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data from frequently used sources
Domain 2: Representativeness	Metric 2: Geographic Scope	High	contains data from US
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	Data more than 20 years old
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The report addresses variability and uncertainty in the results. Uncertainty is well characterized.

Overall Quality Determination

High

Study Citation:	IARC, (1982). Ortho- and para-dichlorobenzenes. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans, vol. 29:213-238.
HERO ID:	4912310
Conditions of Use:	Manufacturing

EXTRACTION	
Parameter	Data
Production, import, or use volume:	Total US production of para-dichlorobenzene by five producers in 1979 amounted to 37.9 million kg. Another company reported production of an undisclosed amount of a mixture of ortho- and para-dichlorobenzenes (US International Trade Commission, 1980a). Separate production data for this mixture were last reported in 1964, when three companies reported a total production of 5.9 million kg (U~ Tariff Commission, 1965). Imports of para-dichlorobenzene through the principal US customs districts were last reported in 1978, when they totaled 10.9 thousand kg (US International Trade Commission, 1979). Separate data on US exports of para-dichlorobenzene are not reported; however, in 1980, total US exports of all dichlorobenzenes amounted to 17.3 million kg (US Department of Commerce, 1981).
Process description:	Chlorobenzenes, including para-dichlorobenzene were first synthesized in the mid- 1800s; direct chlorination of benzene was reported in 1905, and commercial production was started in England in 1909 and in the US in 1915. para-Dichlorobenzene is now produced commercially by the direct chlorination of benzene in the liquid phase . in the presence of a Friedel-Crafts catalyst (usually ferric oxide) and fractionation of the resulting mixture of chlorinated benzenes (Kao and Poffenberger, 1979).
Number of sites:	six producers in 1979
Chemical concentration:	para-Dichlorobenzene is available in the US as technical grades of unusually high purity: 100% in crystalline form and 99.92% in liquid form (on an anhydrous basis).

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	U.S. data
	Metric 3:	Applicability	Low	Manufacturing is not in scope, but information may be applicable to scenario within scope.
	Metric 4:	Temporal Representativeness	Low	more than 20 years old.
	Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	provides only limited discussion of the variability and uncertainty in the results.

Overall Quality Determination

Medium

Study Citation:	IARC, (1999). Some chemicals that cause tumours of the kidney or urinary bladder in rodents and some other substances.			
HERO ID:	666726			
Conditions of Use:	Manufacture			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Production of para-dichlorobenzene in the United States has increased since the 1980s, from approximately 6800 tonnes in 1981 to approximately 32 600 tonnes in 1993 (International Trade Commission, 1993; Environmental Protection Agency, 1998b).			
Life cycle description:	In the United States and Canada, para-dichlorobenzene is used mainly as an air freshener and a moth repellent (e.g. as ‘moth balls’ or ‘moth crystals’) and in a range of pesticidal applications. It is also used in the manufacture of 2,5-dichloroaniline and pharmaceuticals; in the manufacture of polyphenylene sulfide resins used for surface coatings and moulding resins; and to control mildew. In Japan, the pattern of use of para-dichlorobenzene is about 81% for moth control, 11% for polyphenylene sulfide resins and 8% for dyestuffs (Beck, 1986; National Toxicology Program, 1991c; Bryant, 1993; Budavari, 1996; Government of Canada, 1993a; Environmental Protection Agency, 1998b). 1,4- DCB is present as an impurity in the ortho and meta isomers of chlorobenzene and the fractions of these impurities is stated in page 225.			
Process description:	Chlorobenzenes are prepared industrially by reaction of liquid benzene with gaseous chlorine in the presence of a catalyst at moderate temperature and atmospheric pressure. Dichlorobenzenes are formed in this process as isomeric mixtures with a low content of the 1,3-isomer. About 75% para-dichlorobenzene, 25% ortho-dichlorobenzene and only 0.2% meta-dichlorobenzene are obtained (Beck, 1986).			
Chemical concentration:	Pure-grade para-dichlorobenzene consists of > 99.8% para-dichlorobenzene, < 0.05% chlorobenzene and trichlorobenzene and < 0.1% ortho- and meta-dichlorobenzene (Beck, 1986).			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data more than 20 year old
	Metric 5:	Sample Size	Low	characterized by no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	limited discussion of the variability and uncertainty in the results
Overall Quality Determination			High	

Study Citation:	Ifeadi, C. N. (1975). Screening study to develop background information and determine the significance of air contaminant emissions from pesticide plants.			
HERO ID:	63834			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	The 1974 annual US capacity was 141 million pound. The production in 1972 and 1973 was 77.3 and 85 million pounds, respectively, and the 1974 production is estimated to show a moderate increase of about 93.5 million pounds, Generally, production haa varied from 50 to 60 percent of plant capacity.			
Process description:	P-DCB is produced almost entirely as a by-product from the manufacture of monochlorobenzene, which is produced by the chlorination of benzene. Generally, prolonged chlorination is used to produce various by-products besides pDCB.			
Number of sites:	9 plants			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	Data more than 20 years old
	Metric 5:	Sample Size	Low	not characterized by statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The model does not characterize variability or uncertainty
Overall Quality Determination		Medium		

Study Citation:	IPCS, (1991). Chlorobenzenes other than hexachlorobenzene.			
HERO ID:	81628			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	During 1980-83, 1,4-DCB produced was 24 million kg globally. Approximately 50% of chlorobenzene (including chlorobenzenes other than 1,4-DCB) was manufactured in US and remainder primarily in Western Europe and Japan.			
Life cycle description:	Used As a moth repellent, general insecticide, germicide, space deodorant;in the manufacture of 2,5-dichloroaniline and dyes; as a chemical intermediate; in pharmaceutical products; in agricultural fumigants (pg. 14)			
Process description:	DCBs are produced by the direct chlorination of benzene in the liquid phase, using a Lewis acid catalyst, such as ferric chloride. In the liquid-phase chlorination of monochlorobenzene, 1,2-, and 1,4-dichlorobenzenes are the predominant products.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	contains data from US
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	Data more than 20 years old
	Metric 5:	Sample Size	Low	not characterized by statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The model does not characterize variability or uncertainty
Overall Quality Determination		Medium		

Study Citation:	Juvancz, Z., Bodane-Kendrovics, R., Beleznay, P., Erdelyi, I., Klujber-Mohr, M. (2010). Determination of 1,4-dichlorobenzene in environmental matrices. Chromatographia 71(1):S125-S128.			
HERO ID:	2627817			
Conditions of Use:	Manufacture-Worldwide			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Production of DCB was 14,495 tonnes annually worldwide in 1994, including 3,170 tonnes in Europe			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	high quality data source
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	High	report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data presented is more than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	report does not address variability or uncertainty.
Overall Quality Determination			Medium	

Study Citation:	Krishnamurti, R. (2001). Chlorinated benzenes.
HERO ID:	5177139
Conditions of Use:	Manufacturing

EXTRACTION

Parameter	Data
Production, import, or use volume:	"42 million kilograms of p-dichlorobenzene consumed in the United States in 1988" (p. 11. See pages 9-12 for more economic information)
Life cycle description:	"Of 42 million kilograms of p-dichlorobenzene consumed in the United States in 1988, 21% was for PPS. The second largest consumption in the United States of p-dichlorobenzene (16%) is the room deodorant market which is static and likely to remain unchanged. Moth control (11%) is also expected to remain static. However, when the room deodorant and moth control markets in the United States are added together they become the largest consumption, similar to the world market. Exports accounted for about 30% and about 21% remained in inventory" (p. 11 of 15)"p-Dichlorobenzene's largest and growing outlet is in the manufacture of poly(phenylene sulfide) resin (PPS). Other applications include room deodorant blocks and moth control, a market which is static and likely to remain unchanged but combined is currently a larger outlet than PPS. Small amounts of p-dichlorobenzene are used in the production of 1,2,4- trichlorobenzene, dyes, and insecticide intermediates. Exports have been a principal factor in U.S. production with about 25% exported in 1988" (page 13 of 15)
Process description:	"The production of any chlorinated benzene is a multiple-product operation. Plants for chlorobenzene must produce HCl and some other chlorinated benzenes. Only limited control can be exercised over the product ratios. Chlorinated benzenes can be produced by the vapor-phase chlorination of benzene using air and HCl as chlorinating agents. This was the first stage of the Raschig phenol process. The energy costs are so high, this process could never have been considered in the past to commercially produce chlorobenzenes as main products. Chlorine and benzene react in the vapor phase at 400 to 500 degrees C to give a different distribution of products, but such a process is much more costly than conventional liquid-phase operations. All of the chlorobenzenes are now produced by chlorination of benzene in the liquid phase. Ferric chloride is the most common catalyst. Although precautions are taken to keep water out of the system, it is possible that the FeCl ₃ •H ₂ O complex catalyst is present in most operations owing to traces of moisture in benzene entering the reactor. This FeCl ₃ •H ₂ O complex is probably the most effective catalyst." (page 3 of 15) More details about the manufacture of chlorobenzenes, including conditions and upkeep of the reactors, continues on page 5 and 6. The dichlorobenzene isomers have very similar vapor pressures making separation by distillation difficult. Crystallization is generally used in combination with distillation to obtain the pure 1,2 and 1,4-dichlorobenzene isomers. The small quantity of 1,3-dichlorobenzene isomer produced is not generally isolated as a pure product. Environmental concerns have led to the use of improved crystallization systems that contain the products with minimal losses to the environment. (page 6 of 15)"The split between para and ortho is currently around three parts para to one part ortho. " (page 10 of 15). The split also varies depending on the catalyst (Table 3, page 5 of 15)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source (Kirk-Othmer) and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	The report is more than 20 years old. The report captures operations, equipment, and worker activities that are expected to be outdated.
	Metric 5: Sample Size	N/A	No sampling occurred in this report
Domain 3: Accessibility/ Clarity			

Continued on next page ...

p-Dichlorobenzene

General Engineering Assessment

HERO ID: 5177139 Table: 1 of 2

...continued from previous page

Study Citation:		Krishnamurti, R. (2001). Chlorinated benzenes.		
HERO ID:		5177139		
Conditions of Use:		Manufacturing		
Domain		Metric	EVALUATION	
			Rating	Comments
Metric 6:		Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty				
Metric 7:		Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination			High	

Study Citation:	Krishnamurti, R. (2001). Chlorinated benzenes.		
HERO ID:	5177139		
Conditions of Use:	Distribution in Commerce		
EXTRACTION			
Parameter	Data		
Process description:	1,4-Dichlorobenzene is shipped either in molten form in insulated steel tank cars with heater coils, or as flake or granular solid in suitably sealed containers, such as paper bags, fiber packs, or drums. Phenolic linings in all vessels offer protection over a wide range of conditions for all chlorobenzenes as well as the vessels themselves. For drums, the phenolic coating should be modified with epoxy for maximum impact resistance. 1,4-Dichlorobenzene has different labeling classifications depending on its intended use. Regulatory requirements change so the latest regulations should be checked and observed. (page 7 of 15)		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source (Kirk-Othmer) and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	The report is more than 20 years old. The report captures operations, equipment, and worker activities that are expected to be outdated.
	Metric 5: Sample Size	N/A	No sampling occurred in this report
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination		High	

Study Citation:	Lim, H. H., Shin, H. S. (2017). Sensitive Determination of Volatile Organic Compounds and Aldehydes in Tattoo Inks. Journal of Chromatographic Science 55(2):109-116.			
HERO ID:	3491065			
Conditions of Use:	commercial use- tattoo ink			
EXTRACTION				
Parameter	Data			
Chemical concentration:	In 5 of the 16 analyzed tattoo ink samples with concentrations of up to 48.07 mg/kg was detected. Detection range - 0.12 - 48.06 mg/kg, mean - 9.81 +/- 21.4 mg/kg			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues	
Domain 2: Representativeness	Metric 2: Geographic Scope	Low	non-OECD country	
	Metric 3: Applicability	Uninformative	CoU is out of scope and tattoo inks are not covered under TSCA.	
	Metric 4: Temporal Representativeness	High	Data less than 10 years old	
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.	
Overall Quality Determination		Uninformative		

Study Citation:	Liu, W., Zheng, M., Wang, D., Xing, Y., Zhao, X., Ma, X., Qian, Y. (2004). Formation of PCDD/Fs and PCBs in the process of production of 1,4-dichlorobenzene. Chemosphere 57(10):1317-1323.			
HERO ID:	2161460			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Life cycle description:	production of p-DCB			
Process description:	direct chlorination of benzene or chlorobenzene in the presence of a Friedel–Crafts catalyst. The usual catalyst is ferric chloride (FeCl3), which can be added to the reaction mixture or generated in situ by exposing a large iron surface to the liquid being chlorinated. The pure products of p-DCB and other polychlorobenzenes are obtained through distillation and crystallization from the mixture of polychlorinated benzenes.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	Process well described
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	data is from non-OECD country
	Metric 3:	Applicability	High	report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	data is between 10 and 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	N/A	N/A - information not dependent on metada
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination		Medium		

Study Citation:	Marshall, K. A., Pottenger, L. H. (2016). Chlorocarbons and chlorohydrocarbons. :1-29.			
HERO ID:	3828879			
Conditions of Use:	manufacturing			
EXTRACTION				
Parameter	Data			
Life cycle description:	para-Dichlorobenzene is used as a moth repellent, and for the control of mildew and fungi. It is also used for odor control. It is a chemical intermediate in the manufacture of pharmaceuticals, polyphenylene sulfide, and other organicchemicals.			
Process description:	Continuous chlorination of benzene at 30–50 degC in the presence of a Lewis acid typically yields 85% monochlorobenzene. Temperatures in the range of 150–190 degC favor production of the dichlorobenzene products. The p-DCB is produced in a ratio of 2–3:1 of the o-DCB. Other methods of aromatic ring chlorination include use of a mixture of hydrogen chloride and air in the presence of a copper–salt catalyst or sulfuryl chloride in the presence of aluminum chloride at ambient temperature.			
Throughput:	Chlorobenzene accounts for over 70% of chlorinated aromatic use in the world. The remaining demand is primarily for o- and p-dichlorobenzene.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	data are from the United States
	Metric 3:	Applicability	Medium	report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report is generally no more than 10 years old.
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Assessment or report provides results, but the underlying methods, data sources, and assumptions are not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.
Overall Quality Determination			Medium	

Study Citation:	Midwest Research Institute, (1984). Performance evaluation of full-scale hazardous waste incinerators - Volume I (excutive summary) contract no. 68-02-3177 (43).			
HERO ID:	1269556			
Conditions of Use:	disposal			
EXTRACTION				
Parameter	Data			
Chemical concentration:	pDCB in liquid waste feed to incinerators: 56,000-80,000 ug/g;			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The report uses high quality methods.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	Disposal is a COU
	Metric 4:	Temporal Representativeness	Low	more than 20 years old
	Metric 5:	Sample Size	Medium	A range of values is reported.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Mehtods are documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Limited discussion of variability and uncertainty.
Overall Quality Determination		High		

Study Citation:	Milbrandt, A., Coney, K., Badgett, A., Beckham, G. T. (2022). Quantification and evaluation of plastic waste in the United States. Resources, Conservation and Recycling 183:106363.			
HERO ID:	11360398			
Conditions of Use:	Recycling			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Plastic waste managed in kt in 2019 (pg. 4)			
Life cycle description:	Recycling (pg. 4)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Report uses high quality data from frequently-used sources.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Data are from the U.S.	
	Metric 3: Applicability	Medium	Data are for Recycling, an in-scope occupational scenario but not specific to a chemical	
	Metric 4: Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old.	
	Metric 5: Sample Size	Low	Sample distribution is described qualitatively.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.	
Overall Quality Determination		High		

Study Citation:	Milbrandt, A., Coney, K., Badgett, A., Beckham, G. T. (2022). Quantification and evaluation of plastic waste in the United States. Resources, Conservation and Recycling 183:106363.			
HERO ID:	11360398			
Conditions of Use:	Waste Handling			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Plastic waste landfilled in kt in 2019 (pg. 4)			
Life cycle description:	Waste Handling (pg. 4)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Report uses high quality data from frequently-used sources.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Data are from the U.S.	
	Metric 3: Applicability	Medium	Data are for Waste Handling, an in-scope occupational scenario, but not specific to a chemical	
	Metric 4: Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old.	
	Metric 5: Sample Size	Low	Sample distribution is described qualitatively.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.	
Overall Quality Determination		High		

Study Citation:	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).		
HERO ID:	1998192		
Conditions of Use:	Manufacturing		
EXTRACTION			
Parameter	Data		
Production, import, or use volume:	The annual capacity of p-dichlorobenzene is 60 million kilograms (132 million pounds). (page 29 and 48 of 175) See page 50 of 175 for capacity by facility.		
Life cycle description:	Summary of end uses for p-DCB can be found on page 36 of 175		
Process description:	See page 48 for description of p-DCB manufacturing, including the distillation of crude chlorobenzene and methods for purifying the p-DCB in that product.		
Number of sites:	Currently, three facilities have the capacity to produce both o- and p-dichlorobenzene (page 29 and 48 of 175) The three major producers of o- and p-dichlorobenzene are listed in Table 4-5 on page 50 of 175.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources (EPA)
Domain 2: Representativeness	Metric 2: Geographic Scope	High	United States
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	From 1994
	Metric 5: Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The report addresses variability and uncertainty in the results. Uncertainty is well characterized.
Overall Quality Determination		High	

Study Citation:	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).			
HERO ID:	1998192			
Conditions of Use:	Processing as a reactant			
EXTRACTION				
Parameter	Data			
Life cycle description:	Para-dichlorobenzene is used in the manufacture of 1,2,4-trichlorobenzene, polyphenylene sulfide resins, and as an intermediate in the dye industry. (page 10 and 30 of 175). Para-dichlorobenzene is used in the production of polyphenylene sulfide: it is the single largest product manufactured from p-DCB. See page 66 of 175 for a description of this.			
Process description:	See page 67 of 175 for a process description of how p-DCB is used in the production of polyphenylene sulfide.			
Throughput:	In 1988, polyphenylene sulfide resin manufacturing consumed 22 percent of all the p-dichlorobenzene manufactured for that year. (page 30 of 175)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources (EPA)	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	United States	
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.	
	Metric 4: Temporal Representativeness	Low	From 1994	
	Metric 5: Sample Size	N/A	N/A-data not applicable to sample	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	The report addresses variability and uncertainty in the results. Uncertainty is well characterized.	
Overall Quality Determination		High		

Study Citation:	(1994). Locating and Estimating Air Emissions from Sources of Chlorobenzenes (Revised March 1994).
HERO ID:	1998192
Conditions of Use:	Processing, incorporation into formulation, odor agents in cleaning compounds

EXTRACTION	
Parameter	Data
Production, import, or use volume:	In 1988, 16 percent of p-DCB production in the United States, equaling 6.8 million kilograms (15 million pounds), was consumed in the manufacture of space deodorants. (page 99 of 175)
Life cycle description:	Sixteen percent of p-DCB produced in the United States has a non-intermediate dispersive use in space, toilet bowl, and garbage deodorants. Due to its volatility, density, pleasant odor, and solid nature at room temperature, it is used alone or in combination with disinfectant substances to produce deodorants in a variety of continuous evaporation forms, most commonly solid air deodorizers and toilet blocks. (page 98 of 175)
Process description:	See page 98 of 175 for a process description of p-DCB for use as deodorant products.
Chemical concentration:	p-DCB-derived deodorant products contain up to 100% p-DCB with perfume added in some cases. Limited information was available detailing the processes by which the deodorant types are manufactured. However, most solid block deodorants are formed by combining the active ingredients such as p-DCB with a carrier substance. (page 98 of 175)

		EVALUATION	
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High
			The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources (EPA)
Domain 2: Representativeness	Metric 2:	Geographic Scope	High
	Metric 3:	Applicability	High
	Metric 4:	Temporal Representativeness	Low
	Metric 5:	Sample Size	N/A
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High
			Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	High
			The report addresses variability and uncertainty in the results. Uncertainty is well characterized.

Overall Quality Determination

High

Study Citation:	(1982). Investigation of exposure to paradow at the new rolling mill. :Order this.			
HERO ID:	4929935			
Conditions of Use:	Industrial and possibly commercial use			
EXTRACTION				
Parameter	Data			
Process description:	The process used spraying sheet with a solution of pDCB in kerosene by two persons one of which is a crane operator at Dow’s New Rolling Mill. This solution was made by dissolving several tablespoons of crushed pDCB in a quart of kerosene. Sprayingof the sheet was done by two men. The men lifted each sheet on edge, one spraying the two sides of the sheet with the pDCB solution by means of a paint spray-gun. The sheet was then laid over on a truck and the next sheet lifted on edge. Spraying was done for 10 to 15 mins at a time, 6 to 8 times a day.			
Chemical concentration:	Sample analyzed 10.9% pDCB by weight			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	report is for an occupational scenario
	Metric 4:	Temporal Representativeness	Low	data is greater than 20 years
	Metric 5:	Sample Size	Low	The data pertain to two workers only and not to a sample of workers whose job function is operation of a crane or more generally use of p-DCB to spray objects.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources, assessment methods, results
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty information is lacking.
Overall Quality Determination		Medium		

Study Citation:	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.		
HERO ID:	6629633		
Conditions of Use:	Manufacturing		
EXTRACTION			
Parameter	Data		
Production, import, or use volume:	Manufacturing - see pages 75-76 of 89 for various capacity information. 2015: 50,000,000 - 100,000,000 lbs		
Process description:	manufacturing: "Chlorobenzenes are prepared industrially by reaction of liquid benzene with gaseous chlorine in the presence of a catalyst at moderate temperature and atmospheric pressure. ... Generally, mixtures of isomers and compounds with varying degrees of chlorination are obtained. ... Dichlorobenzenes are formed in this process as isomeric mixtures with a low content of the 1,3-isomer. A maximum dichlorobenzene yield of 98% is obtainable in a batch process in which 2 mol of chlorine per mol of benzene are reacted in the presence of ferric chloride and sulfur monochloride at mild temperatures. The remainder of the product consists of mono- and trichlorobenzene. About 75% para-dichlorobenzene, 25% ortho-dichlorobenzene and only 0.2% meta-dichlorobenzene are obtained." It is also a by-product in the manufacture of monochlorobenzene by direct chlorination of benzene, and can be separated from o- and m0 via distillation and crystallization. (page 72 of 89)		
Number of sites:	See page 71-72 of 89 for a list of relevant companies		
Chemical concentration:	Pure-grade para-dichlorobenzene consists of > 99.8% para-dichlorobenzene, < 0.05% chlorobenzene and trichlorobenzene and < 0.1% ortho- and meta-dichlorobenzene (page 75 of 89)		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2: Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	High	The report captures operations, equipment, and worker activities expected to be representative of current conditions. The report is generally no more than 10 years old.
	Metric 5: Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination		High	

Study Citation:	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.			
HERO ID:	6629633			
Conditions of Use:	Import			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Import - 2003: 20 million lbs (page 76 of 89)			
Number of sites:	See page 71-72 of 89 for a list of relevant companies			
Chemical concentration:	Product concentrations listed on page 73-74 of 89Pure-grade para-dichlorobenzene consists of > 99.8% para-dichlorobenzene, < 0.05% chlorobenzene and trichlorobenzene and < 0.1% ortho- and meta-dichlorobenzene (page 75 of 89)			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report captures operations, equipment, and worker activities expected to be representative of current conditions. The report is generally no more than 10 years old.
	Metric 5:	Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination			High	

Study Citation:	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.			
HERO ID:	6629633			
Conditions of Use:	Processing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	See page 75 of 89 for consumption patterns, % distribution of uses, and demand.			
Process description:	See page 73-74 of 89 for a list of pDCB uses and concentrations within the product.			
Number of sites:	See page 71-72 of 89 for a list of relevant companies			
Chemical concentration:	Product concentrations listed on page 73-74 of 89			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report captures operations, equipment, and worker activities expected to be representative of current conditions. The report is generally no more than 10 years old.
	Metric 5:	Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination			High	

Study Citation:	NCBI, (2020). PubChem database: compound summary: 1,4-dichlorobenzene.			
HERO ID:	6629633			
Conditions of Use:	Disposal			
EXTRACTION				
Parameter	Data			
Process description:	See page 68-69 of 89 for disposal methods for pDCB. Recommendable method is incineration.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	The report captures operations, equipment, and worker activities expected to be representative of current conditions. The report is generally no more than 10 years old.
	Metric 5:	Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination			High	

Study Citation:	NICNAS, (2000). Priority existing chemical assessment report No. 13: Para-dichlorobenzene.		
HERO ID:	5155557		
Conditions of Use:	manufacturing		
EXTRACTION			
Parameter	Data		
Production, import, or use volume:	In 1989, it was estimated that the world-wide production capacity (excluding the former USSR) for p-DCB was 165,000 tonnes. Based on Customs import data and industry information, for the past 5 years the amount of p-DCB imported into Australia typically ranges between 500 to 1000 tonnes per annum.		
Process description:	The manufacture of p-DCB is accomplished by the fluid phase chlorination of benzene in the presence of a catalyst, usually ferric chloride, aluminium chloride or stannous tetrachloride, at atmospheric pressure between 20 to 80oC (Beck, 1986). By adjusting the temperature of the process and the molar ratio of benzene to chlorine, the percentage of final chlorinated products can be determined. The process typically yields a mixture of chlorobenzene, isomers of dichlorobenzene and small quantities of higher chlorinated benzenes. Subsequent purification is achieved by distillation and fractional crystallisation. The resulting p-DCB contains less than 0.5% each of 1,2- and 1,3-dichlorobenzene and less than 0.1% monochlorobenzene and trichlorobenzene.		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	OECD country
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	data greater than 20 years old
	Metric 5: Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A-data not applicable to metadata completeness
Overall Quality Determination	Medium		

Study Citation:	NIEHS, (2004). 1,4-Dichlorobenzene. U.S. National Toxicology Program. Report on Carcinogens 11(2004):III85-III87.			
HERO ID:	4912209			
Conditions of Use:	Manufacturing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	In 2005, U.S. production capacity for 1,4-dichlorobenzene was reported to be 79 million pounds (CMR 2004). Demand is expected to grow by about 5% in the future because of growth in the production of polyphenylene sulfide resin, an engineering plastic that is used mainly for its insulating and dielectric properties. U.S. imports of 1,4-dichlorobenzene reached a low of slightly less than 900,000 kg (2 million pounds) in 1990, increasing to almost 22 million kilograms (50 million pounds) in 2007. U.S. exports of 1,4-dichlorobenzene declined from a high of over 12 million kilograms (27 million pounds) in 2000 to slightly more than 0.5 million kilograms (1.2 million pounds) in 2005 (USITC 2009). According to reports filed under the U.S. Environmental Protection Agency’s Toxic Substances Control Act Inventory Update Rule, U.S. production plus imports of 1,4-dichlorobenzene totaled 10 million to 50 million pounds in 1986 and 50 million to 100 million pounds between 1990 and 2002, decreasing to 10 million to 50 million pounds in 2006 (EPA 2004, 2009).			
Life cycle description:	In 2007, it was used primarily as an intermediate in the production of polyphenylene sulfide, a plastic used in the electrical and electronics industries (52%), in the production of 1,2,4-trichlorobenzene room deodorant (22%), and for moth control (15%) (CMR 2004).			
Number of sites:	In 2009, 1,4-dichlorobenzene was produced by 32 manufacturers worldwide, including 1 each in the United States and Canada, 2 each in Mexico and East Asia, 4 in Europe, 9 in India, and 13 in China (SRI 2009), and it was available from 63 suppliers, including 22 U.S. suppliers (ChemSources 2009).			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	assessment or report uses high quality data with no indication of flaws.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	Low	Data is for an occupational scenario that is not in scope, but information may be helpful for occupational scenarios within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	data is between 10 and 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	limited discussion on uncertainty
Overall Quality Determination		Medium		

Study Citation:	NIOSH, (1978). Occupational health guideline for p-dichlorobenzene.			
HERO ID:	8408530			
Conditions of Use:	Industrial and commercial use			
EXTRACTION				
Parameter	Data			
Life cycle description:	Formulation for use in moth control; as a deodorant for garbage and rest rooms; as an insecticide for control of fruit borers and ants; use in organic synthesis for preparation of dye intermediates; as an insecticide; as an air deodorant; as a moth and mildew preventive; and as a household fumigant (page 3 of 6)			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	The report is more than 20 years old
	Metric 5:	Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty
Overall Quality Determination			High	

Study Citation:	NTP, (2021). Report on carcinogens, fifteenth edition.			
HERO ID:	10182531			
Conditions of Use:	Air care products			
EXTRACTION				
Parameter	Data			
Life cycle description:	”1,4-Dichlorobenzene has been used primarily as a space deodorant in products such as room deodorizers and toilet deodorant blocks and as a fumigant for moth control (accounting for about 35% to 55% of the 1,4-dichlorobenzene produced)(ATSDR 1998).” Implied from text that this may be in the past. Since 2007, p-DCB’s use in room deodorants accounts for 22% of its total PV. (page 1 of 3)			
Comments:	To access, go to ”profiles” folder and then ”dichlorobenzene” folder			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for air care products, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Medium	Report is based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions. [2007]
	Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.
Overall Quality Determination			High	

Study Citation:	NTP, (2021). Report on carcinogens, fifteenth edition.			
HERO ID:	10182531			
Conditions of Use:	Processing a reactant (intermediate)			
EXTRACTION				
Parameter	Data			
Life cycle description:	p-DCB is used primarily as an intermediate in the production of polyphenylene sulfide (52% of total PV). page 1 of 3			
Comments:	To access, go to "profiles" folder and then "dichlorobenzene" folder			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Data are from the U.S.	
	Metric 3: Applicability	High	Data are for processing as a reactant (intermediate), an in-scope occupational scenario.	
	Metric 4: Temporal Representativeness	Medium	Report is based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions. [2007]	
	Metric 5: Sample Size	Low	Sample distribution is characterized by no statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.	
Overall Quality Determination		High		

Study Citation:	NTP, (2021). Report on carcinogens, fifteenth edition.			
HERO ID:	10182531			
Conditions of Use:	Processing - incorporation into article.			
EXTRACTION				
Parameter	Data			
Life cycle description:	p-DCB is incorporated into moth control products, accounting for 15% of its total PV.			
Comments:	To access, go to "profiles" folder and then "dichlorobenzene" folder			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Report is based on current industry conditions and data no more than 10 years old.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Data are from the U.S.	
	Metric 3: Applicability	High	Data are for processing - incorporation into article, an in-scope occupational scenario.	
	Metric 4: Temporal Representativeness	Medium	Report is based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions. [2007]	
	Metric 5: Sample Size	Low	Sample distribution is characterized by no statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.	
Overall Quality Determination		High		

Study Citation:	NTP, (2021). Report on carcinogens, fifteenth edition.			
HERO ID:	10182531			
Conditions of Use:	Import			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	p-DCB Imports to the U.S. in 2017 were 94.5million lbs. Table on page 1 of 3, see paragraph in text for additional context of manu/import history.			
Comments:	Note the CDR data presented in the document was not recorded here. To access, go to "profiles" folder and then "dichlorobenzene" folder			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Data are from the U.S.	
	Metric 3: Applicability	High	Data are for Import, an in-scope occupational scenario.	
	Metric 4: Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old. [2017]	
	Metric 5: Sample Size	Low	Sample distribution is characterized by no statistics.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.	
Overall Quality Determination		High		

Study Citation:	NTP, (2021). Report on carcinogens, fifteenth edition.			
HERO ID:	10182531			
Conditions of Use:	Manufacture			
EXTRACTION				
Parameter	Data			
Number of sites:	PDF Pg. 1”1,4-Dichlorobenzene was first produced commercially in the United States in 1915 (IARC 1982). Demand is expected to grow by about 5% in the future because of growth in the production of polyphenylene sulfide resin, an engineering plastic that is used mainly for its insulating and dielectric properties. In 2009, 1,4-dichlorobenzene was produced by 32 manufacturers worldwide, including 1 each in the United States and Canada, 2 each in Mexico and East Asia, 4 in Europe, 9 in India, and 13 in China (SRI 2009), and it was available from 63 suppliers, including 22 U.S. suppliers (ChemSources 2009).”			
Comments:	No info for any OES regarding lifecycle, throughput, chemical concentration, or process description. To access, go to ”profiles” folder and then ”dichlorobenzene” folder			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for manufacture, and in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Medium	Report is based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions. [2009]
	Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.
Overall Quality Determination			High	

Study Citation:	NTP, (1987). NTP technical report on the toxicology and carcinogenesis studies of 1,4-dichlorobenzene (CAS no. 106-46-7) in F344/N ats and B6C3F1 mice (gavage studies).
HERO ID:	5160105
Conditions of Use:	manufacture

EXTRACTION	
Parameter	Data
Production, import, or use volume:	The production of 1,4-DCB was estimated to be 33 million kg in 1982 (USITC, 1983). No imports of 1,4-DCB were reported in 1982 (U.S. Department of Commerce, 1983). U.S. exports of all dichlorobenzenes were reported to be 17 million kg in 1980 (U.S. Department of Commerce, 1981).
Throughput:	1,4-Dichlorobenzene is used primarily as a space deodorant (55%) and for moth control (35%) (IARC, 1982). Solid 1,4-dichlorobenzene is commonly used to mask odors in toilets. Other applications (10%) include use as an intermediate in organic syntheses. The most important synthetic product is the dye intermediate 2,5-dichloroaniline. 1,4-Dichlorobenzene is also used in the synthesis of polyphenylene sulfide resins that are used in the electronic and electrical industries. It is registered for use as an animal repellent.

EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.

Overall Quality Determination

Medium

Study Citation:	OECD, (2011). Emission scenario document on the chemical industry.		
HERO ID:	6306753		
Conditions of Use:	Processing as a reactant		
EXTRACTION			
Parameter	Data		
Life cycle description:	In the chemical industry we are dealing with emissions of certain substances at: 1. the manufacture of this substances, which is either an end product or an intermediate (life cycle stage Production) 2. the conversion of this substances (an intermediate) into another substance, which is either an end product or another intermediate (life cycle stage Industrial use) 3. the application of the substance as a processing aid in one or more unit operations in CPI (life cycle stage Industrial use).		
Process description:	In general, the process in chemical industry includes: storage of the starting materials and processing aids, filling of reactor and reaction taking several hours, filtration, extraction of the filtered mixture (present after reaction) with water and separation of the two liquid layers (to remove residue and by-products), distillation of the mixture, recrystallisation, washing, drying, fractionation (distillation), transfer to storage or packaging, incineration of distillation residue, wastewater treatment in an STP		
Comments:	Extracted information is a brief overview, source contains additional details		
EVALUATION			
Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	Report uses high quality data and/or techniques or sound methods that are from frequently used sources (e.g., European Union or OECD reports).
Domain 2: Representativeness	Metric 2: Geographic Scope	Medium	Article is from an OECD country
	Metric 3: Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	High	the article is less than 10 years old
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.
Overall Quality Determination		High	

Study Citation:	Products, Convenience (2016). Safety Data Sheet (SDS): Touch ’n Foam Mouse Shield.			
HERO ID:	6294050			
Conditions of Use:	Use of adhesives and sealants			
EXTRACTION				
Parameter	Data			
Chemical concentration:	5-10%			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	SDS information is primary data from the supplier. SDS does not appear to have quality issues.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Product is from a US supplier.
	Metric 3:	Applicability	High	SDS is applicable to an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	Source is from March 2016, which is less than 10 years old.
	Metric 5:	Sample Size	Medium	Characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Source just provides concentration and does not document how this value was obtained.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Variability addressed by providing a range of potential concentrations. Uncertainty not addressed.
Overall Quality Determination			High	

Study Citation:	Ren, Z., Lu, Y., Li, Q., Sun, Y., Wu, C., Ding, Q. (2018). Occurrence and characteristics of PCDD/Fs formed from chlorobenzenes production in China. Chemosphere 205:267-274.			
HERO ID:	4912589			
Conditions of Use:	manufacture			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	1) 78.6 kilotons; 2) 5033 kilotons			
Process description:	1) Deep catalytic chlorination; 2) Crystallization and distillation			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	Low	non-OECD country
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	High	data less than 10 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination			High	

Study Citation:	RIVM, (1991). Integrated criteria document chlorobenzenes. :281.			
HERO ID:	5159927			
Conditions of Use:	manufacture			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Imported by Netherland - 354 tonnes/yr; exported - 28 tonnes/yr. the amount consumed (326 tonnes/yr) is for toilet blocks, urinal tablets, mothballs			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Medium	Report uses high quality data that are not from a frequently used source
Domain 2: Representativeness	Metric 2:	Geographic Scope	Medium	OECD country
	Metric 3:	Applicability	Medium	The report is for an occupational scenario that is similar to an occupational scenari- owithin the scope of the risk evaluation, in terms of the type of industry, operations, and workactivities.
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	Low	no statistics
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination		Medium		

Study Citation:	SCI Engineering,, Inc., (2024). Paradichlorobenzene occupational exposure: Willert Home Products, 4044 Park Avenue, St. Louis, Missouri.			
HERO ID:	12190316			
Conditions of Use:	Processing – incorporation into formulation, mixture or reaction product			
EXTRACTION				
Parameter	Data			
Life cycle description:	Raw p-DCB is stored at the facility and then moved to the processing areas, in which the chemical is handled and processed. Finished product (moth balls, toilet bowl deodorizers, etc.) is then packaged at the facility. Page 6 has some information.			
Throughput:	PDF Pg. 6“Willert Home Products processes approximately ten million pounds of p-DCB per year.”			
Comments:	PV not given in the document.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Data are from the U.S.	
	Metric 3: Applicability	High	Data are for manufacture of air care products, an in-scope occupational scenario.	
	Metric 4: Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old.	
	Metric 5: Sample Size	N/A	[2024] process description	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	Process description	
Overall Quality Determination		High		

Study Citation:	Stangroom, S. J., Collins, C. D., Lester, J. N. (1998). Sources of organic micropollutants to lowland rivers. Environmental Technology 19(7):643-666.			
HERO ID:	659430			
Conditions of Use:	manufacturing			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	In 1992, production was 35,757 tons			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination			High	

Study Citation:	Supelco, (2022). Certificate of Analysis - Certified Reference Material: EPA 502/524 Volatiles Organic Calibration Mix (without gases).				
HERO ID:	13172198				
Conditions of Use:	Use of Laboratory Chemicals				
EXTRACTION					
Parameter	Data				
Chemical concentration:	1999 ± 32 µg/mL (raw material purity 99.9%)				
EVALUATION					
Domain	Metric	Rating	Comments		
Domain 1: Reliability	Metric 1: Methodology	High	CoA information is primary data from the supplier. CoA does not appear to have quality issues.		
Domain 2: Representativeness	Metric 2: Geographic Scope	High	Product is from a US supplier.		
	Metric 3: Applicability	High	SDS is applicable to an occupational scenario within the scope of the risk evaluation.		
	Metric 4: Temporal Representativeness	High	Source is from 2022, which is less than 10 years old.		
	Metric 5: Sample Size	Medium	Mean and standard deviation are provided, but no discrete data provided.		
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	CoA cites that GC is used to characterize the constituents of the mixture, then provides a methods section describing the process.		
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	High	Variability is addressed by the range of potential concentrations. Uncertainty is addressed by explaining the 95% confidence interval of the GC analysis.		
Overall Quality Determination		High			

Study Citation:	Supelco, (2025). Safety Data Sheet (SDS): EPA 502/524 Volatiles Organic Calibration Mix (without gases).				
HERO ID:	13172384				
Conditions of Use:	Use of Laboratory Chemicals				
EXTRACTION					
Parameter	Data				
Chemical concentration:	>= 0.1 - <= 1				
EVALUATION					
Domain		Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	SDS information is primary data from the supplier. SDS does not appear to have quality issues.	
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	Product is from a US supplier.	
	Metric 3:	Applicability	High	SDS is applicable to an occupational scenario within the scope of the risk evaluation.	
	Metric 4:	Temporal Representativeness	High	Source is from 2025, which is less than 10 years old.	
	Metric 5:	Sample Size	Medium	Characterized by a range with uncertain statistics.	
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Low	Source just provides concentration and does not document how this value was obtained.	
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Medium	Variability addressed by providing a range of potential concentrations. Uncertainty not addressed.	
Overall Quality Determination			High		

Study Citation:	U.S. BLS, (2023). U.S. Census Bureau of Labor Statistics Data from 2021.			
HERO ID:	11138808			
Conditions of Use:	All			
EXTRACTION				
Parameter	Data			
Number of sites:	Used to develop a method to estimate number of sites and workers.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	BLS is expected to use reliable survey methods.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	U.S. based economic data	
	Metric 3: Applicability	High	These economic data cover all industry and occupation types in scope for all chemicals.	
	Metric 4: Temporal Representativeness	High	The BLS OES data are from 2021	
	Metric 5: Sample Size	High	The BLS OES program provides detailed statistics and estimated relative standard error for each state, industry, and occupation survey conducted (https://www.bls.gov/oes/current/oes_research_estimates.htm).	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	BLS documents results and methods, but underlying survey results not accessible.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Medium	Limited discussion of variability and uncertainty in results.	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (2020). 2020 CDR: Commercial and consumer use.			
HERO ID:	10366189			
Conditions of Use:	Import			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Provides U.S. domestic imported PV and %PV to downstream uses.			
Number of sites:	Provides number of import sites.			
Chemical concentration:	Provides concentration.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	EPA is a trusted source.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	CDR is U.S. based data.	
	Metric 3: Applicability	High	CDR covers chemical importers, which are in scope for p-dcb	
	Metric 4: Temporal Representativeness	High	EPA used data from the 2020 CDR, which includes data reported for 2019.	
	Metric 5: Sample Size	Medium	Due to reporting threshold, statistical representativeness is unclear.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Submissions do not include method of how production volumes were determined. CDR industry sector codes, industrial processing and use codes, industrial function codes, and commercial product codes provide good metadata; but lack of clarifying information and narratives and occasional misreportings limit clarity of data.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	CDR data do not address variability or uncertainty in submitter provided data.	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (2026). Chemical Data Reporting (CDR): Reporting year 2024.			
HERO ID:	13246149			
Conditions of Use:	Manufacturing, Repackaging, Incorporation into formulation, mixture, or reaction product, plastics compounding, and use in solid air care products			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Provides PV for multiple OES.			
Life cycle description:	Provides %PV to downstream OES uses.			
Number of sites:	Provides number of sites for multiple OES.			
Chemical concentration:	Provides concentration for multiple OES.			
EVALUATION				
Domain	Metric	Rating		Comments
Domain 1: Reliability	Metric 1:	Methodology	High	EPA is a trusted source.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	CDR is U.S. based data.
	Metric 3:	Applicability	High	CDR covers multiple OES, which are in scope for the chemical.
	Metric 4:	Temporal Representativeness	High	EPA used data from the 2024 CDR.
	Metric 5:	Sample Size	Medium	Due to reporting threshold, statistical representativeness is unclear.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Submissions do not include method of how production volumes were determined. CDR industry sector codes, industrial processing and use codes, industrial function codes, and commercial product codes provide good metadata; but lack of clarifying information and narratives and occasional misreportings limit clarity of data.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	CDR data do not address variability or uncertainty in submitter provided data.
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (1995). AP-42: Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition.			
HERO ID:	46492			
Conditions of Use:	processing			
EXTRACTION				
Parameter	Data			
Process description:	Porosity media are used for creating voids in the finished wheels and consist of filler materials, such as p-DCB (moth ball crystals) or walnut shells, that are vaporized during firing. If there is a pore-inducing media in the mix such as p-DCB, it is removed in a steam autoclave.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	data are from the United States	
	Metric 3: Applicability	Medium	report is for an occupational scenario within the scope of the risk evaluation	
	Metric 4: Temporal Representativeness	Low	The report is more than 20 years old.	
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	N/A	N/A - information not dependent on metada	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	N/A	N/A - information not dependent on metada	
Overall Quality Determination		Medium		

Study Citation:	U.S. EPA, (2020). 2020 CDR data.			
HERO ID:	6275311			
Conditions of Use:	Manufacture and Import			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Provides U.S. domestic manufactured and imported PV and %PV to downstream uses.			
Number of sites:	Provides number of manufacturing and import sites.			
Chemical concentration:	Provides concentration.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1: Methodology	High	EPA is a trusted source.	
Domain 2: Representativeness	Metric 2: Geographic Scope	High	CDR is U.S. based data.	
	Metric 3: Applicability	High	CDR covers chemical manufacturers and importers, which are in scope for all chemicals.	
	Metric 4: Temporal Representativeness	High	EPA used data from the 2020 CDR, which includes data reported for 2019.	
	Metric 5: Sample Size	Medium	Due to reporting threshold, statistical representativeness is unclear.	
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	Medium	Submissions do not include method of how production volumes were determined. CDR industry sector codes, industrial processing and use codes, industrial function codes, and commercial product codes provide good metadata; but lack of clarifying information and narratives and occasional misreportings limit clarity of data.	
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	CDR data do not address variability or uncertainty in submitter provided data.	
Overall Quality Determination		High		

Study Citation:	U.S. EPA, (1995). Ap-42: Chapter 4.12 - Manufacture of rubber products.			
HERO ID:	7315841			
Conditions of Use:	Processing - Rubber Manufacturing			
EXTRACTION				
Parameter	Data			
Process description:	Process description of manufacturing of rubber product is provided on pages 1-2 out of 20 in the document "4.12 Manufacture of rubber products". The document does not list p-DCB as one of the ingredients. The manufacturing of rubber products involves six principal processing steps (mixing, milling, extrusion, calendering, curing, and grinding), with ancillary steps in between. The document "Emission Factor Documentation for AP-42" goes into more detail of each step.			
EVALUATION				
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Medium	The report is generally no more than 10 years old.
	Metric 5:	Sample Size	N/A	N/A-data not applicable to sample
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	Report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.
Overall Quality Determination			High	

Study Citation:	U.S. EPA, (2021). National analysis TRI dataset (TRI): Data used for TSCA risk evaluations, reporting year 2019.			
HERO ID:	8347325			
Conditions of Use:	Manufacturing/processing			
EXTRACTION				
Parameter		Data		
Number of sites:		25 unique facility IDs		
EVALUATION				
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from frequently used sources- TRI.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	no more than 10 years old.
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized. Sample size is sufficiently representative.
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Datasources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.
Overall Quality Determination			High	

Study Citation:	Vonrumker, R., Lawleww, E. W., Meiners, A. F. (1974). Production, distribution, use and environmental impact potential of selected pesticides.				
HERO ID:	3108349				
Conditions of Use:	manufacture				
EXTRACTION					
Parameter	Data				
Production, import, or use volume:	amount of pDCB used in industrial, commercial, and institutional sectors: 14 million pounds; usage proposed by Fed. govt. agencies (1972) for pDCB - 6 gallons; estimated 1972 production - 72 MM lbs. Of the total p-dichlorobenzene production, an estimated 25-30 million lbs/yr goes to moth control use (balls, crystal powders), 25-30 million for lavatory-space deodorant uses and the remainder for other purposes.				
Process description:	pDCB produced almost entirely as by-products of the production of monochlorobenzene				
Chemical concentration:	pDCB is sold in two purity levels: a product of>99% purity that is a solid at room temperature (the major impurity being the orthoisomer) ; and a product of < 99% purity which is a liquid.				
EVALUATION					
Domain	Metric	Rating	Comments		
Domain 1: Reliability	Metric 1:	Methodology	High	high quality data	
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data	
	Metric 3:	Applicability	High	report is for an occupational scenario within the scope of the risk evaluation	
	Metric 4:	Temporal Representativeness	Low	data greater than 20 years old	
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples	
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	N/A	N/A - information not dependent on metada	
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada	
Overall Quality Determination			High		

Study Citation:	Wallace, L. (1990). Major sources of exposure to benzene and other volatile organic chemicals. Risk Analysis 10(1):59-64.
HERO ID:	5253127
Conditions of Use:	use

EXTRACTION

Parameter	Data
Production, import, or use volume:	pDCB accounts for a fraction of the air freshener market (perhaps 10%). Assuming 25% of homes have p-DCB moth repellents and an additional 7% have p-DCB air fresheners, we may calculate that about a third of the 85 million homes in the U.S. contain p-DCB.
Life cycle description:	pDCB is almost exclusively an indoor air pollutant, outweighing outdoor air by more than 20 to 1.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability	Metric 1: Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2: Geographic Scope	High	US data
	Metric 3: Applicability	Uninformative	The report is from an occupational or non-occupational scenario that does not apply to any occupational scenario within the scope of the risk evaluation
	Metric 4: Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5: Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6: Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7: Metadata Completeness	Low	The report does not address variability or uncertainty.

Overall Quality Determination**Uninformative**

Study Citation:	Wallace, L. A. (1989). The total exposure assessment methodology (TEAM) study: an analysis of exposures, sources, and risks associated with four volatile organic chemicals. Journal of the American College of Toxicology 8(5):883-895.			
HERO ID:	1482637			
Conditions of Use:	Commercial use			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	About 12 million pounds annually is used to kill moths.			
Life cycle description:	Mask odors and to kill moths. Many schools, offices, hotels and other places with public restrooms also use p-DCB to mask odors. pDCB accounts for a fraction of the air freshener market (perhaps 10%).			
Comments:	Table 2 on page 887 (PDF pg 5/13) contains average p-DCB personal inhalation exposure and average outdoor p-DCB concentration but information about occupational exposure is lacking.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	Low	Data sources are not specified.
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	Low	The report is for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation, such as a consumer DIY
	Metric 4:	Temporal Representativeness	Low	Data is more than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	N/A	N/A - information not dependent on metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metadata
Overall Quality Determination		Low		

Study Citation:	Ware, G. W. (1988). Ortho-, meta-, and para-dichlorobenzene. Reviews of Environmental Contamination and Toxicology 106:51-68.			
HERO ID:	4912307			
Conditions of Use:	manufacture			
EXTRACTION				
Parameter	Data			
Production, import, or use volume:	Production of pDCB in 1981 was 15 million lbs (6.8 million kg)			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	data is greater than 20 years old
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	High	report clearly documents its data sources
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metada
Overall Quality Determination			High	

Study Citation:	Zaman, R. (1992). Solving air emissions problems from metal cleaning operations. The National Environmental Journal 2(4):44.			
HERO ID:	5489562			
Conditions of Use:	commercial use			
EXTRACTION				
Parameter	Data			
Process description:	The article talks about degreasing of metal parts, and p-DCB can be used as a degreaser. The metal parts cleaning process is as follows. • Parts are fed into a reservoir of solvent either in batch quantities, or continuously. • Parts are suspended in solvent vapor or immersed in liquid solvent for a given period of time. • Parts are removed from the reservoir and allowed to dry. The reservoir consists of a sump filled with solvent, an immersion heater in the sump for heating to vapor state, a vapor zone for vapor cleaning, a condenser for recycling of vapor, and a freeboard to prevent spilling of vapor to surrounding areas. Parts are typically allowed to dry in a room or chamber under ambient conditions with air vented to the atmosphere, although some solvents require the use of heated air. Heated air dryers present the additional problem of combustion of volatile solvents.			
EVALUATION				
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Methodology	High	report uses high quality data and/or techniques
Domain 2: Representativeness	Metric 2:	Geographic Scope	High	US data
	Metric 3:	Applicability	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	information greater than 20 years
	Metric 5:	Sample Size	N/A	N/A - information not dependent on samples
Domain 3: Accessibility/ Clarity	Metric 6:	Metadata Completeness	N/A	N/A - information not dependent on metadata
Domain 4: Variability and Uncertainty	Metric 7:	Metadata Completeness	N/A	N/A - information not dependent on metadata
Overall Quality Determination		High		