United States
Environmental Protection Agency

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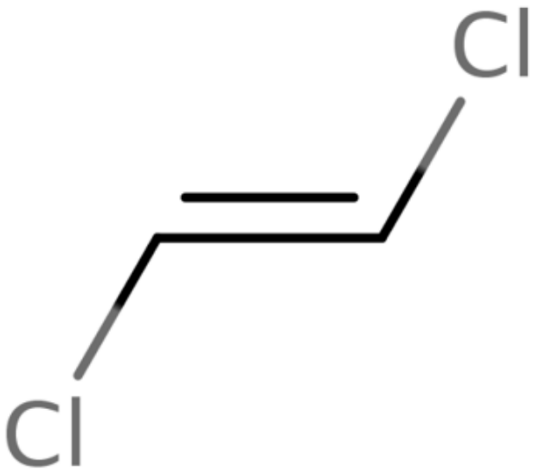
Office of Chemical Safety and
Pollution Prevention

Draft Data Quality Evaluation and Data Extraction Information for Environmental Release and Occupational Exposure for *trans*-1,2-Dichloroethylene

Systematic Review Support Document for the Draft Risk Evaluation

CASRN: 156-60-5



July 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 trans-1,2-Dichloroethylene* 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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664488	CDC, (2009). Fourth national report on human exposure to environmental chemicals.	**54**
61012	Cohr, K. H. (1986). Uptake and distribution of common industrial solvents. Progress in Clinical and Biological Research 220:45-60.	**55**
1441931	Dow Chemical, (1988). Mortality among Dow Chemical employees of a Texas operations per-tet manufacturing plant with cover letter dated 050389.	**56**
10610702	Glove,, Best (2021). [Redacted] Glove permeation data provided by Best Glove Corporation.	**57**
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3809069	NIOSH, (2014). In-depth survey report: Spray polyurethane foam chemical exposures during spray application, All About Kids, Crestwood, KY.	**60**
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3840001	U.S. EPA, (1980). Chapter 4.7: Waste solvent reclamation. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.	**172**
46492	U.S. EPA, (1995). AP-42: Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition.	**173**
7310513	U.S. EPA, (1995). Chapter 6: Organic chemical process industry. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.	**174**
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11182965	VI, (2020). Comment submitted by Vinyl Institute regarding EDC impurities.	**176**
11927540	VI, (2020). Comment submitted by Richard Krock, Vice President, Regulatory and Technical Affairs, The Vinyl Institute (VI) on 1,1-dichloroethane, trans-1,2-dichloroethylene, and 1,1,2-trichloroethane.	**177**

Study Citation: 3M, (2012). [Redacted] Air monitoring for the Novec fluids in Building 236 B173.
HERO ID: 10610701
Conditions of Use: Vapor Degreasing

EXTRACTION

Parameter	Data
Area sampling data:	[PDF Pg. 5] Analyzed with Method ETS-8-16-.5 Level 1F100 vapor degreaser: 12 (ppm)Branson vapor degreaser: 5.2 (ppm)F500 vapor degreaser: 5.8 (ppm)UKI degreaser: 12 (ppm)[PDF Pg. 5] Analyzed with Modified NIOSH Method 1400F100 vapor degreaser: 21 (ppm)Branson vapor degreaser: 6.2 (ppm)F500 vapor degreaser: 7.2 (ppm)UKI degreaser: 95 (ppm)

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 vapor degreasing, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Monitoring data are based on current industry conditions and data no more than 10 years old.
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Sample type and exposure type provided but missing exposure frequency and duration.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling multiple degreasing machines.

Overall Quality Determination High

Study Citation:	3M, (2010). [Redacted] Vapor degreaser exposure measurements using a Miran Sapphire air monitoring tool.
HERO ID:	10610703
Conditions of Use:	Vapor Degreasing

EXTRACTION

Parameter	**Data**
Personal sampling data:	Hourly Testing During Operation (in ppm) [PDF Pg. 7]Hour 1: 6Hour 2: 16Hour 3: 18Hour 4: 20Testing During Basket Withdrawal (average in ppm) [PDF Pg. 8]Raise 1: 21Raise 2: 22Raise 3: 55.5Raise 4: 22.5Raise 5: 100Raise 6: 41Raise 7: 82.5Raise 8: 45.5
Area sampling data:	Hourly Testing During Operation (in ppm) [PDF Pg. 7]Zone 1 = top right side above cleaning sumpZone 2 = top left side above boiling sumpZone 3 = operator breathing zone (documented in "Personal sampling data" section above)Zone 4 = in vapor zone of degreaserHour 1Zone 1: 412Zone 2: 122Zone 4: 7356Hour 2Zone 1: 422Zone 2: 160Zone 4: 7477Hour 3Zone 1: 418Zone 2: 189Zone 4: 7638Hour 4Zone 1: 407Zone 2: 162Zone 4: 7536Testing During Basket Withdrawal (in ppm) [PDF Pg. 8]At top right side 2" inside cleaning sumpRaise 1: 3410Raise 2: 3278.5Raise 3: 3621Raise 4: 2982Raise 5: 3689.5Raise 6: 4062.5Raise 7: 4276.5Raise 8: 4447.5Please see pages 6-8 for additional notes and context for these results.
Comments:	See page 4 of 9 for test conditions such as room size, and limited information on ventilation rate, temperature, humidity, etc.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	High	Sampling/analytical methodology is equivalent to an approved OSHA/NIOSH method.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for vapor degreasing, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Monitoring data are based on current industry conditions and data no more than 10 years old.
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Sample type and exposure type provided but missing exposure frequency and duration.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling multiple zones during degreasing operations.

Overall Quality Determination High

Study Citation:	3M, (2019). Comment submitted by Jonathan M. Gerber, Advanced Regulatory Specialist, Sustainability & Product Stewardship, 3M on initiation of prioritization under the Toxic Substances Control Act (TSCA).
HERO ID:	6305348
Conditions of Use:	Commercial Aerosol Products

EXTRACTION

Parameter	**Data**
Personal sampling data:	PDF Page 4NovecTM Electronic Degreaser# Samples: NAMean Concentration (ppm): NAStandard Deviation (ppm): NARange (ppm): 0.35 - 9.7NovecTM Electronic Degreaser (an aerosol) are from a direct reading instrument that sampled users for 25 minutes.

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	Data are for commercial aerosol 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	Medium	Product concentrations are described by a range.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	The underlying methods are not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability addressed by describing trans-1,2-DCE concentrations in multiple products but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	3M, (2019). Comment submitted by Jonathan M. Gerber, Advanced Regulatory Specialist, Sustainability & Product Stewardship, 3M on initiation of prioritization under the Toxic Substances Control Act (TSCA).
HERO ID:	6305348
Conditions of Use:	Not identified

EXTRACTION

Parameter	**Data**
Area sampling data:	PDF Page 4Draining/Flushing Equipment# Samples: 8Mean Concentration (ppm): 87Standard Deviation (ppm): 33Range (ppm): 59-130Milling & Operating Equipment# Samples: 33Mean Concentration (ppm): 19Standard Deviation (ppm): 22Range (ppm): 0.057 - 85Results represent 8-hour TWA values. Not clear if sampling results are area or personal breathing zone.

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	The data are from the US
	Metric 3:	Applicability	Medium	It is not certain what occupational scenario the data are for, but the data may be useful to an in scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	It is not certain when the data were collected.
	Metric 5:	Sample Size	Medium	A range is provided with mean and standard deviation.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	The lack of metadata limits the usability of the data.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	variability and uncertainty are not addressed

Overall Quality Determination Low

Study Citation:	3M, (2019). Comment submitted by Jonathan M. Gerber, Advanced Regulatory Specialist, Sustainability & Product Stewardship, 3M on initiation of prioritization under the Toxic Substances Control Act (TSCA).
HERO ID:	6305348
Conditions of Use:	Vapor Degreasing

EXTRACTION

Parameter	**Data**
Exposure route:	Inhalation.
Area sampling data:	PDF Page 4Vapor Degreasing# Samples: 4Mean Concentration (ppm): 11Standard Deviation (ppm): 7.6Range (ppm): 4.2-21Results represent 8-hour TWA values. Not clear if sampling results are area or personal breathing zone.

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 vapor degreasing, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	It is not known when the data were collected.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	The limited metadata provided restricts the usability of the data.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	3M, (2019). Comment submitted by Jonathan M. Gerber, Advanced Regulatory Specialist, Sustainability & Product Stewardship, 3M on initiation of prioritization under the Toxic Substances Control Act (TSCA).
HERO ID:	6305348
Conditions of Use:	Laboratory Chemicals

EXTRACTION

Parameter	**Data**
Exposure route:	Inhalation.
Area sampling data:	PDF Page 4Lab Work# Samples: 1Mean Concentration (ppm): 0.51Standard Deviation (ppm): NARange (ppm): NAResults represent 8-hour TWA values. Not clear if sampling results are area or personal breathing zone.

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 laboratory chemicals, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	It is not certain when the measurements were made.
	Metric 5:	Sample Size	High	A single data point is presented
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	The limited metadata provided restricts the usability of the data.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	ATSDR, (1996). Toxicological profile for 1,2-dichloroethene.
HERO ID:	723873
Conditions of Use:	Disposal (Landfill)

EXTRACTION

Parameter	**Data**
Exposure route:	dermal, oral, and inhalation
Physical form:	Liquid
Area sampling data:	70-75,600 ppb

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	Medium	Sampling or analytical methodology is not equivalent to an approved OSHA or NIOSH method and EPA review of information indicates the methodology is acceptable. Differences inmethods are not expected to lead to lower quality 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 data are for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	Data is 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, 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	Low	The monitoring study does not address variability or uncertainty.

Overall Quality Determination Medium

Study Citation: Carbide,, Union (1988). Feasibility study on six chemicals with attachments and cover letter dated 081588.
HERO ID: 1332988
Conditions of Use: Disposal

EXTRACTION

Parameter	Data
Exposure route:	inhalation
Area sampling data:	possum road (center) - 0.02 (ppm) (Pg. 25) southeast - 1.5 (ppm) (Pg.27)Number of samples: 2. Sampling location: Possum road landfill (center) Possum road landfill (southeast).

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	High	Sampling/analytical methodology is equivalent to an approved OSHA/NIOSH method.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for disposal, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	Monitoring data are greater than 20 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (mean) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	Sample type provided but no other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	Diamond Shamrock Corp, (1983). Summary of the chlorinated hydrocarbon sampling program.
HERO ID:	1441902
Conditions of Use:	Manufacturing

EXTRACTION

Parameter	**Data**
Exposure route:	inhalation
Personal sampling data:	”Average: 1.8 ppm High/Low: 11.6 ppm / 0 ppm ” Number of samples: Possibly 50, unclear (Pg 38)

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	Medium	Data are for chloro methane manufacture, which is similar to the in-scope occupational scenario trans-12-DCE manufacture.
	Metric 4:	Temporal Representativeness	Low	Monitoring data are 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	Low	Sample type provided but no other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination **Low**

Study Citation:	Dickinson,, Becton (2023). Becton Dickinson usage of tDCE.
HERO ID:	11327998
Conditions of Use:	Cleaning and degreasing

EXTRACTION

Parameter	**Data**
Personal sampling data:	Site #2BD Medical-selected employee working with the extraction solvent inside a laboratory fume hood: <0.31 ppmSite #3Employee 1: 19 ppmEmployee 2: 23 ppm
Area sampling data:	Site #2Area outside fume hood: <0.38 ppmSite #320' from process: 2.2 ppmAt process: 4.3 ppmSite #4Branson Ultrasonic Cleaning Process - Based on the results of laboratory analysis, air samples collected on April 27, 2023, were below OSHA's 8-hour TWA-PELs for trans-1,2-dichloroethylene used in the Branson Ultrasonic cleaning process. The sampling was a good representation of the filling process of the two ultrasonic cleaners: 5.2 ppm.
Number of workers:	Site #1Two associates for the Lube Lab area. One associate in needlemanufacturing.Site #2Approximately 40Site #3Currently, 12 people daily; 3 operators, 1 setup/mechanic pershift. 3 shifts total. 9 Operators: low exposure 3 Setup/mechanic: medium to high exposure.Site #4One associate for the ultrasonic cleaner. Ports and Lifestream approximately five associates.
Personal protective equipment:	Site #1 Personal protectiveequipment (PPE) such as gloves and safety glasses are provided.Site #2PPE such as gloves, laboratory coat and safety glasses are provided.Site #3PPE such as safety glasses and gloves are provided.Site #4PPE such as safety glasses and gloves are provided.
Engineering control:	Site #1There is a local exhaust ventilation system. Site #2The chemical is applied to the syringe barrel using a micropipete within a laboratory fume hood. PSite #3There is an exhaust ventilation system connected to theultrasonic cleaner. Insulin syringe lines had stacks that tied intothe central exhaust system, drawing fumes away from personnelto the outdoors.Site #4Hood over ultrasonic cleaner, hood or local exhaust used for benchtop work for Lifestream

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 US.
Metric 3:	Applicability	High	Data are for cleaning and degreasing, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	Monitoring data are no more than 10 years old.
Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Medium	Sample type and exposure type provided but missing exposure duration and frequency.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Variability addressed by sampling multiple processes at different sites but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	Dow Chemical, (1992). Letter from Dow Chem Co submitting several studies with trichloroethylene and other chemicals in humans with attachments (sanitized).
HERO ID:	4214362
Conditions of Use:	Intermediate in all other basic organic chemical manufacturing

EXTRACTION

Parameter	**Data**
Worker activity description:	see exposure concentrations cell
Exposure route:	inhalation
Personal sampling data:	Trichloroethylene and Anhydrous Hydrochloric Acid plants - Eight-hour time-weighted average exposures for 1,2-dichloroethylene (cis and trans) were ”well below the recommended exposure guidelines” (p. 8, 15).

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	Medium	Applicable to manufacturing or processing, in scope occupational scenarios, but actual process unclear
	Metric 4: Temporal Representativeness	Low	Monitoring data are greater than 20 years old (early 1990s)
	Metric 5: Sample Size	Low	no sample information provided
Domain 3: Accessibility/ Clarity			
	Metric 6: Metadata Completeness	Uninformative	No monitoring data provided - only indicates levels are below recommended exposure limits, which are not stated.
Domain 4: Variability and Uncertainty			
	Metric 7: Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Uninformative

Study Citation:	Exponent,, Inc., (2023). [Sanitized] Occupational inhalation exposure assessment for trans-1,2-dichloroethylene.
HERO ID:	11316394
Conditions of Use:	Manufacturing-Domestic Manufacturing

EXTRACTION

Parameter	**Data**
Worker activity description:	The reference describes various worker activities on pages 108-120
Exposure route:	Inhalation
Physical form:	Liquid/Vapor
Personal sampling data:	The reference contains 66 personal breathing zone measurements for this COU on pages 118-120
Exposure duration:	The reference provides exposure duration details on pages 108-120
Exposure frequency:	The reference provides exposure frequency details on pages 108-120
Number of workers:	The reference indicates the number of workers who are potentially exposed at one facility on pages 108-120
Personal protective equipment:	The reference provides information about the PPE used at one facility on pages 108-120
Engineering control:	The reference provides information about the engineering controls used at one facility on pages 108-120

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Sampling and Analytical Methodology	High	The sampling and analytical methods used a modified NIOSH method.
Domain 2: Representativeness			
	Metric 2: Geographic Scope	High	The data are from the U.S.
	Metric 3: Applicability	High	The data are from domestic manufacturing, an in-scope occupational scenario.
	Metric 4: Temporal Representativeness	High	The data was collected in 2023.
	Metric 5: Sample Size	High	Individual measurements are provided.
Domain 3: Accessibility/ Clarity			
	Metric 6: Metadata Completeness	High	All appropriate metadata is provided.
Domain 4: Variability and Uncertainty			
	Metric 7: Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling over multiple shifts.

Overall Quality Determination High

Study Citation: Exponent,, Inc., (2023). [Sanitized] Occupational inhalation exposure assessment for trans-1,2-dichloroethylene.
HERO ID: 11316394
Conditions of Use: Processing-Purification

EXTRACTION

Parameter	Data
Worker activity description:	The reference describes various worker activities on pages 122-134
Exposure route:	Inhalation
Physical form:	Liquid/Vapor
Personal sampling data:	The reference contains 34 personal breathing zone measurements for this COU on pages 133-134
Exposure duration:	The reference provides exposure duration details on pages 122-134
Exposure frequency:	The reference provides exposure frequency details on pages 122-134
Number of workers:	The reference indicates the number of workers who are potentially exposed at one facility on pages 122-134
Personal protective equipment:	The reference provides information about the PPE used at one facility on pages 122-134
Engineering control:	The reference provides information about the engineering controls used at one facility on pages 122-134

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling and Analytical Methodology	High	The sampling and analytical methods used a modified NIOSH method.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	The data are from the U.S.
Metric 3:	Applicability	High	The data are from processing-purification, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	The data was collected in 2023.
Metric 5:	Sample Size	High	Individual measurements are provided.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All appropriate metadata is provided.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling over multiple shifts.

Overall Quality Determination High

Study Citation:	Exponent,, Inc., (2023). [Sanitized] Occupational inhalation exposure assessment for trans-1,2-dichloroethylene.
HERO ID:	11316394
Conditions of Use:	Processing– Incorporation into formulation, mixture, or reaction product – Solvents(for cleaning or degreasing)

EXTRACTION

Parameter	**Data**
Worker activity description:	The reference describes various worker activities on pages 19-26 and 96-105
Exposure route:	Inhalation
Physical form:	Liquid/Vapor
Personal sampling data:	The reference contains 55 personal breathing zone measurements for this COU on pages 25-26 and 105
Area sampling data:	The reference contains 8 area measurements for this COU on pages 26 and 105
Exposure duration:	The reference provides exposure duration details on 19-26 and 96-105
Exposure frequency:	The reference provides exposure frequency details on 19-26 and 96-105
Number of workers:	The reference indicates the number of workers who are potentially exposed at two facilities on pages 19-26 and 96-105
Personal protective equipment:	The reference provides information about the PPE used at two facilities on pages 19-26 and 96-105
Engineering control:	The reference provides information about the engineering controls used at two facilities on pages 19-26 and 96-105

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	High	The sampling and analytical methods used a modified NIOSH method.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	The data are from the U.S.
	Metric 3:	Applicability	High	The data are from processing– incorporation into formulation, mixture, or reaction product – solvents(for cleaning or degreasing), an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	The data was collected in 2023.
	Metric 5:	Sample Size	High	Individual measurements are provided.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	All appropriate metadata is provided.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling over multiple shifts at 2 facilities.

Overall Quality Determination High

Study Citation:	Exponent,, Inc., (2023). [Sanitized] Occupational inhalation exposure assessment for trans-1,2-dichloroethylene.
HERO ID:	11316394
Conditions of Use:	Processing – Incorporation into formulation, mixture, or reaction product – Foam blowing additive

EXTRACTION

Parameter	**Data**
Worker activity description:	The reference describes various worker activities on pages 86-94
Exposure route:	Inhalation
Physical form:	Liquid/Vapor
Personal sampling data:	The reference contains 23 personal breathing zone measurements for this COU on page 94
Area sampling data:	The reference contains 8 area measurements for this COU on page 94
Exposure duration:	The reference provides exposure duration details on pages 86-94
Exposure frequency:	The reference provides exposure frequency details on pages 86-94
Number of workers:	The reference indicates the number of workers who are potentially exposed at one facility on pages 86-94
Personal protective equipment:	The reference provides information about the PPE used at one facility on pages 86-94
Engineering control:	The reference provides information about the engineering controls used at one facility on pages 86-94

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling and Analytical Methodology	High	The sampling and analytical methods used a modified NIOSH method.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	The data are from the U.S.
Metric 3:	Applicability	High	The data are from processing – incorporation into formulation,mixture, or reaction product – foam blowing additive, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	The data was collected in 2023.
Metric 5:	Sample Size	High	Individual measurements are provided.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All appropriate metadata is provided.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling over multiple shifts.

Overall Quality Determination High

Study Citation:	Exponent,, Inc., (2023). [Sanitized] Occupational inhalation exposure assessment for trans-1,2-dichloroethylene.
HERO ID:	11316394
Conditions of Use:	Processing – Incorporation into formulation, mixture, or reaction product – Additive for use in polyurethane systems

EXTRACTION

Parameter	**Data**
Worker activity description:	The reference describes various worker activities on pages 51-57
Exposure route:	Inhalation
Physical form:	Liquid/Vapor
Personal sampling data:	The reference contains 17 personal breathing zone measurements for this COU on page 57
Exposure duration:	The reference provides exposure duration details on pages 51-57
Exposure frequency:	The reference provides exposure frequency details on pages 51-57
Number of workers:	The reference indicates the number of workers who are potentially exposed at one facility on pages 51-57
Personal protective equipment:	The reference provides information about the PPE used at one facility on pages 51-57
Engineering control:	The reference provides information about the engineering controls used at one facility on pages 51-57

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling and Analytical Methodology	High	The sampling and analytical methods used a modified NIOSH method.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	The data are from the U.S.
Metric 3:	Applicability	High	The data are from processing – incorporation into formulation,mixture, or reaction product – additive for use in polyurethane systems, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	The data was collected in 2023.
Metric 5:	Sample Size	High	Individual measurements are provided.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All appropriate metadata is provided.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling over multiple shifts.

Overall Quality Determination High

Study Citation:	Exponent,, Inc., (2023). [Sanitized] Occupational inhalation exposure assessment for trans-1,2-dichloroethylene.
HERO ID:	11316394
Conditions of Use:	Industrial/Commercial Use –Solvents(for cleaning or degreasing) – Vapor degreaser

EXTRACTION

Parameter	**Data**
Worker activity description:	The reference describes various worker activities on pages 59-70
Exposure route:	Inhalation
Physical form:	Liquid/Vapor
Personal sampling data:	The reference contains 12 personal breathing zone measurements for this COU on pages 68-70
Exposure duration:	The reference provides exposure duration details on pages 59-70
Exposure frequency:	The reference provides exposure frequency details on pages 59-70
Number of workers:	The reference indicates the number of workers who are potentially exposed at one facility on pages 59-70
Personal protective equipment:	The reference provides information about the PPE used at one facility on pages 59-70
Engineering control:	The reference provides information about the engineering controls used at one facility on pages 59-70

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling and Analytical Methodology	High	The sampling and analytical methods used a modified NIOSH method.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	The data are from the U.S.
Metric 3:	Applicability	High	The data are from industrial/commercial use – solvents(for cleaning or degreasing) – vapor degreaser, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	The data was collected in 2023.
Metric 5:	Sample Size	High	Individual measurements are provided.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All appropriate metadata is provided.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling over multiple shifts.

Overall Quality Determination High

Study Citation:	Exponent,, Inc., (2023). [Sanitized] Occupational inhalation exposure assessment for trans-1,2-dichloroethylene.
HERO ID:	11316394
Conditions of Use:	Industrial/Commercial Use –Solvents(for cleaning or degreasing) – Aerosol degreaser/cleaner

EXTRACTION

Parameter	**Data**
Worker activity description:	The reference describes various worker activities on pages 59-70 and 79-84
Exposure route:	Inhalation
Physical form:	Aerosol
Personal sampling data:	The reference contains 21 personal breathing zone measurements for this COU on pages 68-70 and 83-84
Area sampling data:	The reference contains 4 area measurements for this COU on pages 83-84
Exposure duration:	The reference provides exposure duration details on pages 59-70 and 79-84
Exposure frequency:	The reference provides exposure frequency details on pages 59-70 and 79-84
Number of workers:	The reference indicates the number of workers who are potentially exposed at two facilities on pages 59-70 and 79-84
Personal protective equipment:	The reference provides information about the PPE used at two facilities on pages 59-70 and 79-84
Engineering control:	The reference provides information about the engineering controls used at two facilities on pages 59-70 and 79-84

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling and Analytical Methodology	High	The sampling and analytical methods used a modified NIOSH method.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	The data are from the U.S.
Metric 3:	Applicability	High	The data are from industrial/commercial use – solvents(for cleaning or degreasing) – aerosol degreaser/cleaner, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	The data was collected in 2023.
Metric 5:	Sample Size	High	Individual measurements are provided.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All appropriate metadata is provided.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling over multiple shifts at multiple facilities.

Overall Quality Determination High

Study Citation:	Exponent,, Inc., (2023). [Sanitized] Occupational inhalation exposure assessment for trans-1,2-dichloroethylene.
HERO ID:	11316394
Conditions of Use:	Industrial/Commercial Use –Solvents(for cleaning or degreasing) – Non-aerosol degreaser/cleaner

EXTRACTION

Parameter	**Data**
Worker activity description:	The reference describes various worker activities on pages 28-49 and 59-77
Exposure route:	Inhalation
Physical form:	Aerosol
Personal sampling data:	The reference contains 58 personal breathing zone measurements for this COU on pages 28-49 and 59-77
Area sampling data:	The reference contains 10 area measurements for this COU on pages 28-40 and 77
Exposure duration:	The reference provides exposure duration details on pages 28-49 and 59-77
Exposure frequency:	The reference provides exposure frequency details on pages 28-49 and 59-77
Number of workers:	The reference indicates the number of workers who are potentially exposed at five facilities on pages 28-49 and 59-77
Personal protective equipment:	The reference provides information about the PPE used at five facilities on pages 28-49 and 59-77
Engineering control:	The reference provides information about the engineering controls used at five facilities on pages 28-49 and 59-77

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling and Analytical Methodology	High	The sampling and analytical methods used a modified NIOSH method.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	The data are from the U.S.
Metric 3:	Applicability	High	The data are from industrial/commercial use – solvents(for cleaning or degreasing) – aerosol degreaser/cleaner, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	The data was collected in 2023.
Metric 5:	Sample Size	High	Individual measurements are provided.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All appropriate metadata is provided.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling over multiple shifts at multiple facilities.

Overall Quality Determination High

Study Citation:	Kamarrudin, N., Zulkafli, N. H., Sikirman, A., Mahayuddin, N. M., Sigau, B. A., Hamid, K., Akhbar, S. (2013). Concentration and toxicological study on sanitary landfill gases at drilling point closed cell. :333-338.
HERO ID:	2228550
Conditions of Use:	Disposal

EXTRACTION

Parameter	**Data**
Worker activity description:	Drilling
Exposure route:	Inhalation
Physical form:	Gas
Area sampling data:	0.079-1.269 (mg/m^3) (Pg. 5)Number of samples: 5. Analytic Method: The gas collected at the landfill site was analyzedby using two methods of gas chromatography which are In-House Method (GC-MSD) and In-House Method-TPH (GSMSD)in order to identify the volatile organic compounds(VOCs) gases.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	Medium	Sampling/analytical methodology is not an approved OSHA/NIOSH method but is an acceptable methodology.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Low	Data are from Malaysia, a non-OECD country.
	Metric 3:	Applicability	High	Data are for disposal, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Monitoring data are no more than 10 years old (2013).
	Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Sample type and exposure type provided but missing most other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability addressed by comparing to NIOSH values, but uncertainty is not addressed.

Overall Quality Determination Medium

Study Citation:	Tsiliyannis, C. A. (1999). Report: Comparison of environmental impacts from solid waste treatment and disposal facilities. Waste Management & Research 17(3):231-241.
HERO ID:	660588
Conditions of Use:	Disposal (landfill biogas emissions)

EXTRACTION

Parameter	**Data**
Exposure route:	inhalation
Area sampling data:	3.81 ppm (mean); 27.00 ppm (max); 12 mg/m3 (all dichloroethenes) present in biogas from landfill of municipal solid waste - additional details may be found in referenced sources: WMI, 1994 and Zannikos, 1992per footnote, table 2: 42 sites/142 samples

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	Low	Sampling/analytical methodology is not specified - data originated from different source
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Medium	Data are from Greece, an OECD country.
	Metric 3:	Applicability	High	Data are for Disposal, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old (1998) and industry conditions that are expected to be outdated.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (min, max, mean) but discrete samples not provided and distribution not fully characterized. Additional details may be available in referenced sources
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	Variability addressed by 42 sites and 142 samples, but uncertainty is not addressed. Additional details may be available in referenced sources

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (1988). Preliminary results summary: Indoor air monitoring phase II & data for warehouse and navy yard & evaluation of selected heating, ventilation & air conditioning system with attachments.
HERO ID:	1481714
Conditions of Use:	Office Building and Day Care Center

EXTRACTION

Parameter	**Data**
Worker activity description:	Office rooms and day care center at an office building (EPA Washington DC Office)
Exposure route:	Inhalation
Physical form:	Vapor
Area sampling data:	Sampling results are provided on PDF Pgs. 19-28; however, the sampling results are too unclear to read.

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	The data are from the United States.
	Metric 3:	Applicability	Uninformative	The data are from an occupational or non-occupationalscenario that does not apply to any occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	Data is more than 20 years old and expected sources are likely to be outdated.
	Metric 5:	Sample Size	Uninformative	Discrete samples provided but was unreadable.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	The COU and sampling techniques used could be obtained from the report. But, the sampling results was unreadable.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is addressed by sampling multiple rooms within the office but uncertainty is not addressed.

Overall Quality Determination Uninformative

Study Citation:	Frasch, H. F., Bunge, A. L. (2015). The transient dermal exposure II: post-exposure absorption and evaporation of volatile compounds. Journal of Pharmaceutical Sciences 104(4):1499-1507.
HERO ID:	3230538
Conditions of Use:	All - Dermal Exposure

EXTRACTION

Parameter	**Data**
Dermal exposure data:	mathematical representation of post-exposure absorption and evaporation of chemicals in the skin after exposure.

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	High	Model can be applied to all occupational scenarios.
	Metric 4:	Temporal Representativeness	High	Model is based on current industry conditions and based on data no more than 10 years old.
Domain 3: Accessibility/ Clarity				
	Metric 5:	Metadata Completeness	High	Model approach, equations, and choice of parameter values are transparent. Rationales for choice of approach, equations, and parameter values provided.
Domain 4: Variability and Uncertainty				
	Metric 6:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

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:	May apply to more than 1 COU

EXTRACTION

Parameter	Data
Exposure route:	hand/object to mouth (inadvertent ingestion)
Physical form:	liquid and powder
Dermal exposure data:	pg. 2/13: "Overall, direct transfer from the hands to the oral cavity was significantly higher (mean Transfer Efficiencies, TE = 51.6) than indirect transfer from the hands to the oral cavity via the perioral area by licking the lips (mean TE = 11.5)."Pg. 8/13: "Three transfer coefficient (TEs) are reported for indirect transfer: hand-to-perioral, perioral-to-oral, and hand-to-oral. The hand-to-oral TE describes the overall indirect transfer from the hand to the oral cavity. Liquids transferred from the perioral to the oral areamore readily than solids (mean TE liquids = 100.0%, solids = 71.2%; p = 0.029). But from the hands to the oral area there were no significant differences between transfer for solids and liquids for both direct and indirect transfer."For Solid:Hand-to-oral direct transfer mean TE%: 56.6Hand-to-perioral mean TE%: 17.4Perioral-to-oral mean TE%: 71.2Hand-to-oral (via perioral) mean TE%: 13.2Bare hands direct transfer hand to oral mean TE%: 69.7Bare hands indirect transfer hand-to-perioral mean TE%: 17.6Nitrile direct transfer hand to oral mean TE%: 70.0Nitrile indirect transfer hand-to-perioral mean TE%: 12.0 Cotton direct transfer hand to oral mean TE%: 47.7Cotton indirect transfer hand-to-perioral mean TE%: 4.8 For Liquid:Hand-to-oral direct transfer mean TE%: 36.8Hand-to-perioral mean TE%: 6.5Perioral-to-oral mean TE%: 100Hand-to-oral (via perioral) mean TE%: 6.5Bare hands direct transfer hand to oral mean TE%: 36.8Bare hands indirect transfer hand-to-perioral mean TE%: 6.5Nitrile direct transfer hand to oral mean TE%: 41.4Nitrile indirect transfer hand-to-perioral mean TE%: 8.9Cotton direct transfer hand to oral mean TE%: 31.0Cotton indirect transfer hand-to-perioral mean TE%: 5.9 For soluble powder:Hand-to-oral direct transfer mean TE%: 69.7Hand-to-perioral mean TE%: 17.6Perioral-to-oral mean TE%: 96.4Hand-to-oral (via perioral) mean TE%: 17.0For insoluble powder:Hand-to-oral direct transfer mean TE%: 50.0Hand-to-perioral mean TE%: 17.3Perioral-to-oral mean TE%: 58.6Hand-to-oral (via perioral) mean TE%: 11.3For fine MC:Hand-to-oral direct transfer mean TE%: 39.0Hand-to-perioral mean TE%: 17.8Perioral-to-oral mean TE%: 57.8Hand-to-oral (via perioral) mean TE%: 10.6For rough MC:Hand-to-oral direct transfer mean TE%: 61.0Hand-to-perioral mean TE%: 16.8Perioral-to-oral mean TE%: 59.4Hand-to-oral (via perioral) mean TE%: 12.0All of the TEs from contaminated hands to the perioral area while putting a respirator on and taking it off were below 0.5%. Two of the four transfer TEs from contaminated respirators to the perioral area were below <0.5% and the range of TEs was <0.5%–3.1%. Because the results from experiments with olive oil were considered unreliable only one scenario was assessed: transfer of calcium acetate from the pen to the oral cavity. There was therefore no scope for statistical comparison of groups. The TEs measured ranged from <0.8 to 117.7%, showing potential for a very wide range of TEs.Transfer When Wiping the Perioral Area with the Arm or a Cotton SleeveFor Vinegar: Bare Arms Arm-to-Perioral mean TE%: 13.1Cotton Sleeve Arm-to-Perioral mean TE%: 1.0For Calcium Acetate: Bare Arms Arm-to-Perioral mean TE%: 26.8Cotton Sleeve Arm-to-Perioral mean TE%: 5.0All of the TEs from contaminated hands to the perioral area while putting a respirator on and taking it off were below 0.5%. Two of the four transfer TEs from contaminated respirators to the perioral area were below <0.5% and the range of TEs was <0.5%–3.1%. Because the results from experiments with olive oil were considered unreliable only one scenario was assessed: transfer of calcium acetate from the pen to the oral cavity. There was therefore no scope for statistical comparison of groups. The TEs measured ranged from <0.8 to 117.7%, showing potential for a very wide range of TEs.Transfer When Wiping the Perioral Area with the Arm or a Cotton SleeveFor Vinegar: Bare Arms Arm-to-Perioral mean TE%: 13.1Cotton Sleeve Arm-to-Perioral mean TE%: 1.0For Calcium Acetate: Bare Arms Arm-to-Perioral mean TE%: 26.8Cotton Sleeve Arm-to-Perioral mean TE%: 5.0
Exposure frequency:	pg. 2/13: Observational studies of adults have shown average hand-to-mouth contact frequencies of 2–5 contacts per hour
Comments:	This data source contains laboratory measurements of the transfer efficiency associated with exposure resulting from inadvertent ingestion because of hand/object -to-mouth transfer. The reported transfer efficiencies pertain to surrogate chemicals. An equation is given for calculating exposure resulting from inadvertent ingestion from these transfer efficiencies. pg. 12/13: "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."

EVALUATION

Domain	Metric	Rating	Comments

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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: May apply to more than 1 COU

			EVALUATION	
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The equation for amount inadvertently ingested is reasonable. The method of measuring transfer efficiency is sound.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	N/A	The geographic attribute is not relevant in the case of a mathematical model and data obtain via laboratory experiments.
	Metric 3:	Applicability	High	Inadvertent digestion is tentatively in scope (EPA will consider this scenario according to the Scope Documents.)
	Metric 4:	Temporal Representativeness	High	The data were generated less than 10 years ago.
Domain 3: Accessibility/ Clarity				
	Metric 5:	Metadata Completeness	High	Meta data is complete.
Domain 4: Variability and Uncertainty				
	Metric 6:	Metadata Completeness	High	Variability and uncertainty are well characterized.

Overall Quality Determination High

Study Citation:	Zhao, D., Little, J. C., Hodgson, A. T. (2002). Modeling the reversible, diffusive sink effect in response to transient contaminant sources. Indoor Air 12(3):184-190.
HERO ID:	2889887
Conditions of Use:	General Occupational Indoor Environments

EXTRACTION

Parameter	**Data**
Exposure route:	inhalation
Comments:	Equation to model sink-effect of diffusion controlled indoor materials.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Model is free of mathematical errors and based on sound approaches/methods; however, choice of equations and parameters are not specific to chemical of interest.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Model can be applied to indoor air concentration, in-scope for multiple occupational scenarios.
	Metric 4:	Temporal Representativeness	Medium	Model 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.
Domain 3: Accessibility/ Clarity				
	Metric 5:	Metadata Completeness	Medium	Model approach, equations, and choice of parameter values are transparent. Rationales for choice of approach, equations, and parameter values are not provided.
Domain 4: Variability and Uncertainty				
	Metric 6:	Metadata Completeness	Medium	Variability addressed by modeling different scenarios, but uncertainty is not addressed.

Overall Quality Determination — High

Study Citation:	OECD, (2011). Emission scenario document on coating application via spray-painting in the automotive refinishing industry.
HERO ID:	3808976
Conditions of Use:	Urethane coatings (Adhesives and Sealants)

EXTRACTION

Parameter	**Data**
Worker activity description:	Transferring and mixing liquid products, container cleaning, transferring mixed coating to application equipment, overspray
Exposure route:	Dermal and inhalation
Personal sampling data:	Dermal: Provides methods for modeling exposures to non-volatile liquids Inhalation: Provides methods for modeling exposures to mists
Exposure frequency:	250 (default value)
Number of workers:	8 workers/site
Personal protective equipment:	Air-purifying respirators or air-supplied respirators, Gloves (typically latex or nitrile), paint suits, and face masks/eye protection

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	Low	Assessment is based on data greater than 20 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	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 coating types.

Overall Quality Determination High

Study Citation:	OECD, (2009). Emission scenario document on adhesive formulation.
HERO ID:	3827299
Conditions of Use:	Processing: Adhesives and sealants

EXTRACTION

Parameter	**Data**
Worker activity description:	Unloading, container cleaning, mixing operations, sampling, equipment cleaning, packaging
Exposure route:	Dermal and inhalation
Area sampling data:	Inhalation: Provides methods for modeling exposures to both solids and volatile liquids.
Dermal exposure data:	Dermal: Provides methods for modeling exposures to both solids and non-volatile liquids.
Number of workers:	22 workers/site

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 an in-scope occupational scenario; 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	Distribution of samples is 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 and types of adhesives.

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:	Industrial Use: Adhesives and sealants

EXTRACTION

Parameter	**Data**
Worker activity description:	unloading, container cleaning, adhesive application, equipment cleaning, curing/drying
Exposure route:	Dermal and inhalation
Area sampling data:	Inhalation: Provides methods for modeling exposures to mists and volatile liquids
Dermal exposure data:	Dermal: Provides methods for modeling exposures to solids and non-volatile liquids.
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	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 an in-scope occupational scenario; 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 various chemical functions, types of adhesives, and end use markets.

Overall Quality Determination High

Study Citation:	OECD, (2010). Emission scenario document on formulation of radiation curable coatings, inks and adhesives.
HERO ID:	3840003
Conditions of Use:	Formulation of Coatings, inks, and adhesives

EXTRACTION

Parameter	**Data**
Worker activity description:	Unloading, container cleaning, sampling, equipment cleaning, filter media changeout, packaging
Exposure route:	Dermal and inhalation
Area sampling data:	Dermal: Provides methods for modeling exposures to both solids and non-volatile liquids. Inhalation: Provides methods for modeling exposures to both solids and volatile liquids
Exposure frequency:	up to 250
Number of workers:	18-39 workers/site (Table 5-2)
Personal protective equipment:	Fabric or non-woven long sleeved shirts and pants, coveralls, and neoprene or rubber gloves. Barrier creams may be used to facilitate hand washing when materials or products penetrate gloves or other PPE. A rubber apron or rubber suit and rubber boots may also be worn in cases where there is potential for splashing on or penetration through clothing

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 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	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 various chemical functions and types of UV curable products.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (2002). Flexographic ink options: A cleaner technologies substitutes assessment. Volume 1.
HERO ID:	10293388
Conditions of Use:	Carrier solvent in adhesives, coatings, inks, lubricants, and silicones

EXTRACTION

Parameter	**Data**
Worker activity description:	Pumping ink from 55-gallon drum into 5-gallon cans; operating the printing press; adjusting the inks in the 5-gallon cans next to the ink press.
Exposure route:	dermal and inhalation. Mass balance models were used to calculate the amount of a chemical in the room. Some of the results are provided in table 3.10 of the pdf (page 154).
Physical form:	liquid
Dermal exposure data:	A dermal contact model provided upper and lower ”bounding” estimates of dermal exposure. Some of the results are provided in table 3.10 of the pdf (page 154).
Exposure duration:	Pumping ink: 48 minutes per formulation shift.Operating printing press: 7.5 hour shift.Adjusting ink cans: 1-2.5 hours per shift.
Personal protective equipment:	Gloves and barrier creams.
Engineering control:	Local exhaust ventilation.

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	The data are from the United States and are representative of the industry being evaluated.
Metric 3:	Applicability	Medium	The assessment is for an occupational scenario within the scope of the risk evaluation, but data is general and not specific to the chemical.
Metric 4:	Temporal Representativeness	Low	Assessment is based on data greater than 20 years old.
Metric 5:	Sample Size	Medium	Worker durations characterized by range.
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 is addressed by discussing different worker activities, uncertainty is not addressed.

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:	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.
Personal sampling data:	Inhalation: Provides methods for modeling exposures to non-volatile and volatile liquids and solids.
Dermal exposure data:	Dermal: Provides methods for modeling exposures to non-volatile and volatile liquids and solids.
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:	Unloading transport containers, container cleaning, equipment cleaning, loading of transport containers.
Exposure route:	Dermal, Inhalation
Physical form:	Liquid or solid
Area sampling data:	Inhalation: Provides methods for modeling exposures to non-volatile and volatile liquids and solids
Dermal exposure data:	Dermal: Provides methods for modeling exposures to non-volatile and volatile liquids and solids
Exposure duration:	8-12 hr/day
Exposure frequency:	The number of operating days is given in a range of 174-260 days/yr with an EPA default of 260 days/yr.
Number of workers:	3 workers/facility and 1 ONUs/facility (total number of employees and facilities given in Table 5-3)
Personal protective equipment:	Commonly used PPE includes safety glasses, face shields, aprons, and gloves.
Engineering control:	Local exhaust ventilation

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 are for an in-scope occupational scenario; however, data is general and not specific to a chemical.
	Metric 4:	Temporal Representativeness	Medium	Assessment 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.
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized (discrete use amounts provided).
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 worker activities.

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:	Plastics compounding

EXTRACTION

Parameter	**Data**
Worker activity description:	Unloading and charging additives to process, container cleaning, equipment cleaning, and compounding processes.
Exposure route:	Dermal and inhalation.
Personal sampling data:	Inhalation: Provides methods for modeling exposures to both solids and volatile liquids
Dermal exposure data:	Dermal: Provides methods for modeling exposures to both solids and non-volatile liquids.
Exposure frequency:	148-264 days/yr.
Number of workers:	24 workers/site.
Engineering control:	Forced ventilation.
Comments:	This generic scenario will address compounding operations. Polymer manufacturing will not be included in this scenario.

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	High	Data are for plastics compounding which is in-scope or similar to an in-scope occupational scenario..
	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	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 plastic types, additive types, and worker activities.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2003). Transportation equipment cleaning - Generic scenario for estimating occupational exposures and environmental releases (draft).
HERO ID:	6385708
Conditions of Use:	Disposal

EXTRACTION

Parameter	**Data**
Worker activity description:	The greatest potential for worker exposure to materials last transported occurs during heel removal.
Personal protective equipment:	Facility personnel typically wear coveralls, safety shoes, protective glasses, and gloves during tank cleaning.

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 are for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
	Metric 4:	Temporal Representativeness	Medium	Assessment 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.
	Metric 5:	Sample Size	N/A	N/A - only qualitative information provided.
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	N/A	No scope to address variability and uncertainty.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2014). Use of additives in the thermoplastic converting industry - generic scenario for estimating occupational exposures and environmental releases.
HERO ID:	6385711
Conditions of Use:	Extraction solvent for thermoplastics

EXTRACTION

Parameter	**Data**
Worker activity description:	Unloading and charging compounded resins to process, converting processes, converting equipment cleaning, trimming processes.
Exposure route:	Dermal and inhalation.
Personal sampling data:	Inhalation: Provides methods for modeling exposures to both solids and volatile liquids.
Dermal exposure data:	Dermal: Provides methods for modeling exposures to both solids and non-volatile liquids.
Exposure frequency:	137-254 days/yr.
Number of workers:	30-69 workers/site.

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 is for an in-scope occupational scenario; 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	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 plastic types, additive types, and worker activities.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2004). Spray coatings in the furniture industry - generic scenario for estimating occupational exposures and environmental releases: Draft.
HERO ID:	6385719
Conditions of Use:	Industrial/Commercial Use: Urethane coatings

EXTRACTION

Parameter	**Data**
Worker activity description:	unloading, spray application, equipment cleaning
Exposure route:	dermal and inhalation. Provides methods for estimating dermal exposures to liquid and inhalation exposure to mists.
Exposure frequency:	250 days/yr
Number of workers:	12-98 workers/site
Personal protective equipment:	Air-supplied full face piece respirator; Disposable overalls and head covering; Gloves specific to the chemicals used; and boots and boot coverings
Engineering control:	Spray booths

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 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	Distribution of samples is 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 and wood vs metal furniture uses.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2014). Use of additive in plastic compounding - generic scenario for estimating occupational exposures and environmental releases: Draft.
HERO ID:	6385748
Conditions of Use:	Plastics Compounding

EXTRACTION

Parameter	**Data**
Worker activity description:	Unloading and charging additives to process, container cleaning, equipment cleaning, and compounding processes
Exposure route:	dermal and inhalation
Personal sampling data:	”dermal: Provides methods for modeling exposures to both solids and non-volatile liquids Inhalation: Provides methods for modeling exposures to both solids and volatile liquids”
Exposure frequency:	148-264 days/yr
Number of workers:	24 workers/site
Engineering control:	forced ventilation

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 is for an in-scope occupational scenario; 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	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 plastic types, additive types, and worker activities.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2004). Additives in plastics processing (converting into finished products) -generic scenario for estimating occupational exposures and environmental releases. Draft.
HERO ID:	6549571
Conditions of Use:	Additives in Plastics Processing (Converting into Finished Products)

EXTRACTION

Parameter	Data
Worker activity description:	Receipt of compounded resin, Forming (Heating), Molding/Shaping, Trimming, Finishing (including coating)
Exposure route:	Inhalation and Dermal
Physical form:	Exposure to solids during unloading of compounded resin from transport containers and charging to forming operation; Exposure to dusts generated from converting processes; Exposure to liquids during equipment cleaning of equipment; Exposure to solids during trimming activities.
Personal sampling data:	Exposure from Unloading and Charging Compounded Resin; Exposure from Converting Processes; Exposure from Trimming Processes: Inhalation exposure = OSHA PEL x breathing rate x hours x fraction of additive in resin x fraction of chemical in additive (if applicable)Exposure from Converting Equipment Cleaning: Not expected, particles are expected to be contained in water.
Dermal exposure data:	Exposure from Unloading and Charging Compounded Resin:Plastics are transported as pellets, sheets, films or pipes (Kirk-Othmer), which consist of large particles sizes (although some dust may be generated during transportation). Additives are incorporated into the plastic material. Some surface contact may occur; however, dermal exposure is non-quantifiable.Exposure from Converting Processes: Not expected, converting processes typically take place at high temperatures.Exposure from Converting Equipment Cleaning: Dermal Exposure = liquid amount on skin x area of skin x # of incidents x fraction of chemical in additive x fraction of additive in resin x fraction of resin in waterExposure from Trimming Processes: Additives are incorporated into the plastic material. Some surface contact may occur; however, dermal exposure is non-quantifiable.
Exposure duration:	8 hours/day assumed for inhalation calculations
Exposure frequency:	CEB standard assumption, 250 days per year based on 5 day work week and two weeks per year of operation shut down.
Number of workers:	Overall, there were 736,698 workers employed in the Plastic Product Manufacturing industry in 2001. Table 1 provides Number of Workers for subcategories of NAICS 3261 Plastic Product Manufacturing.
Engineering control:	Water: According to the Development Document for Effluent Limitation Guidelines for the Plastics Molding and Forming Point Source Category (1984), approximately 31% of surveyed sites that use process water directly discharged their process water; 44% indirectly discharged (POTW); and 25% had a zero discharge. Zero discharge methods include recycling, evaporation pond, septic tank with leach field, evaporation from equipment, land application, and contract haul. Types of on-site treatment include settling, pH adjustment, activated sludge, activated carbon adsorption, filtration, and vacuum filtration.Air: The Emissions Scenario Document on Plastic Additives suggests that bag filters used to collect particulate emissions are 99% efficient. However, the prevalence of bag filter use was not available.

EVALUATION

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The assessment uses high quality data that are from a frequently used source 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 assessment is for an occupational scenario within the scope of the risk evaluation. However, data are not chemical specific.
	Metric 4:	Temporal Representativeness	Low	Data are greater than 20 years old.

Continued on next page ...

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Study Citation:	U.S. EPA, (2004). Additives in plastics processing (converting into finished products) -generic scenario for estimating occupational exposures and environmental releases. Draft.
HERO ID:	6549571
Conditions of Use:	Additives in Plastics Processing (Converting into Finished Products)

			EVALUATION	
Domain		Metric	Rating	Comments
	Metric 5:	Sample Size	N/A	Sample size criteria are not applicable to data extracted.
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 in worker activities is captured through identification of various NAICS codes associated with plastic additive use, but uncertainty associated with number of workers is not characterized.
Overall Quality Determination			**High**	

Study Citation:	U.S. EPA, (2021). Application of spray polyurethane foam insulation - Generic scenario for estimating occupational exposures and environmental releases - Final.
HERO ID:	8674805
Conditions of Use:	Blowing Agent

EXTRACTION

Parameter	**Data**
Worker activity description:	Foam application, trimming, cleanup, chemical transfers, maintenance, disturbing foam during renovation and end-of-life activities.
Exposure route:	Dermal and inhalation.
Personal sampling data:	Inhalation: Provides MDI, amine catalyst, blowing agent, and inhalable/respirable particulate exposure data.
Area sampling data:	Inhalation: Provides MDI, amine catalyst, blowing agent, and inhalable/respirable particulate exposure data.
Number of workers:	253,700 total workers in industry.

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 is for an in-scope occupational scenario; 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 mean with no other 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 components and particle sizes.

Overall Quality Determination High

Study Citation:	3M, (2005). [Redacted] Air concentrations produced by Novec™ Contact Cleaner and Novec™ Electronic Degreaser.
HERO ID:	10610700
Conditions of Use:	Aerosol spray cleaner/degreaser

EXTRACTION

Parameter	**Data**
Engineering control:	Ventilation hoods [PDF Pg. 4]

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. and other OECD countries.
	Metric 3:	Applicability	High	Data are for Aerosol spray cleaning/degreasing, 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	N/A - engineering controls.
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	N/A - engineering controls

Overall Quality Determination High

Study Citation:	Bello, A., Xue, Y., Gore, R., Woskie, S., Bello, D. (2019). Assessment and control of exposures to polymeric methylene diphenyl diisocyanate (pMDI) in spray polyurethane foam applicators. International Journal of Hygiene and Environmental Health 222(5):804-815.
HERO ID:	6134670
Conditions of Use:	Polyurethane Foam Building Insulation

EXTRACTION

Parameter	**Data**
Worker activity description:	SPF spraying with a spray gun; foam shaving against studs with a powered blade saw; spray gun cleaning; site cleaning (p, 805)
Exposure duration:	most sites <2hr. Large projects 6-8hr of spraying (p. 807)
Number of workers:	Currently, there are an estimated 60,000 insulation workers in the US (U.S. Bureau of Labor Statistics, 2018). A large number of insulation workers using the resin systems are self-employed or work for small contractors. (p. 806)
Personal protective equipment:	various PPE listed on p. 805; differences between large contractors and small contractors discussed on p. 806.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Assessment 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	High	Data are for PU foam, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	Assessment is based on current industry conditions and data no more than 10 years old.
Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being 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 - This metric is not applicable to the data being extracted

Overall Quality Determination High

Study Citation:	Burgess, W. A. (1991). Potential exposures in the manufacturing industry—Their recognition and control. :595-674.
HERO ID:	1267867
Conditions of Use:	Vapor Degreasing

EXTRACTION

Parameter	**Data**
Exposure duration:	6 hr/day
Engineering control:	Manual covers, reduced condenser temperature, reduced room draft, automated cover

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 vapor degreasing, which is an in-scope occupational scenario; however, the data are not specific to this chemical.
	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	N/A	N/A - no sample data.
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	N/A	N/A - no sample data.

Overall Quality Determination Medium

Study Citation:	CDC, (2009). Fourth national report on human exposure to environmental chemicals.
HERO ID:	664488
Conditions of Use:	Various

EXTRACTION

Parameter	**Data**
Worker activity description:	Workers involved in the production or use of these solvents may be exposed by inhalation or by dermal contact with the liquid solvents… Inhalation is the most common exposure route for the general population, including indoor sources from such as paints, adhesives, cleaning solutions, and aerosolized insecticide sprays; from industries producing these solvents; and from contaminated waste disposal sites (pg 488)
Exposure route:	inhalation/dermal
Physical form:	vapor/aerosol/liquid

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources (CDC).
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for various in-scope occupational scenarios.
	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.
	Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination High

Study Citation:	Cohr, K. H. (1986). Uptake and distribution of common industrial solvents. Progress in Clinical and Biological Research 220:45-60.
HERO ID:	61012
Conditions of Use:	All

EXTRACTION

Parameter	**Data**
Worker activity description:	N/A; correlation between experimental exposure and dermal uptake
Exposure route:	inhalation; dermal
Physical form:	vapor; liquid
Dermal exposure data:	correlations on pg 6 and 10 (graphs); not real exposure data but correlation between experimental exposures and uptake
Exposure duration:	30 minute

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Report uses high quality methods that are not from frequently-used sources and there are no known quality issues.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Medium	Data are from Denmark, an OECD country.
	Metric 3:	Applicability	Low	Not specific to an in-scope OES, but generic dermal exposure data potentially applicable to multiple OESs. No mention of trans-1,2-DCE.
	Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old (1986) and industry conditions that are expected to be outdated.
	Metric 5:	Sample Size	Low	Sample distribution is described qualitatively (graphical)
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 — Low

Study Citation:	Dow Chemical, (1988). Mortality among Dow Chemical employees of a Texas operations per-tet manufacturing plant with cover letter dated 050389.
HERO ID:	1441931
Conditions of Use:	Processing as an intermediate

EXTRACTION

Parameter	**Data**
Worker activity description:	Potential exposure to the feedstock, process chemicals, finished products and wastes have not been unique to any particular job classification. Anecdotal information indicated that before waste products were disposed of via a dosed tank, they were stored in open dumpsters, which resulted in potential for airborne exposure. This practice of waste disposal of the heavy chlorinated organics was discontinued in the late 1960's. At that time a dosed holding tank was built to store by-products that were then pumped through a closed system to a tank to be shipped to a thermal oxidizer.
Exposure route:	Inhalation
Physical form:	Vapor
Exposure duration:	Mean years of experience in the plant was 4.3 years
Number of workers:	270 white males (1944-1982)
Comments:	The article is a study of mortality among Dow Chemical employees of a Texas operations per-tet manufacturing plant.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Report appears to use high quality techniques/sound methods and was submitted to EPA by a company.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for processing as an intermediate, an in-scope occupational scenario.
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	N/A	N/A - no sample data
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	No scope to address variability and uncertainty.

Overall Quality Determination High

Study Citation:	Glove,, Best (2021). [Redacted] Glove permeation data provided by Best Glove Corporation.
HERO ID:	10610702
Conditions of Use:	Vapor Degreasing

EXTRACTION

Parameter	**Data**
Personal protective equipment:	Permeation testing of 50/50 blend of trans-1,2-DCE and HFE [PDF Pg. 3] Breakthrough time; Permeation rateBest Viton II 890 30 mil Viton/Butyl glove: 44 minutes; 4 ug/cm^2/minBest Chloroflex 723 28 mil Neoprene glove: Not testedBest Nitri Slve 730 15 mil Nitrile glove: 11 minutes; 4 ug/cm^2/minBest Butyl 874 14 mil Butyl gloves: 11 minutes; 772 ug/cm^2/minBest Nitri Solve 727 15 mil Nitrile gloves: 24 minutes; 74 ug/cm^2/minBest Viton II 892 12 mil Viton/Butyl glove: 11 minutes; 1193 ug/cm^2/minPermeation testing of trans-1,2-DCE [PDF Pg. 3] Breakthrough time; Permeation rateBest Viton II 890 30 mil Viton/Butyl glove: 238 minutes; 66 ug/cm^2/minBest Chloroflex 723 28 mil Neoprene glove: 6 minutes; 671 ug/cm^2/minBest Nitri Solve 730 15 mil Nitrile glove: 8 minutes; 552 ug/cm^2/minBest Butyl 874 14 mil Butyl gloves: 6 minutes; 808 ug/cm^2/minPermeation testing of HFE-7100 [PDF Pg. 4] Breakthrough time; Permeation rateBest Viton II 890 30 mil Viton/Butyl glove: >480 minutes; NDBest Ultraflex 32 supported neoprene glove: >480 minutes; NDBest Nitri Solve 730 15 mil Nitrile glove: >480 minutes; NDBest N-Dex 8005 8 mil disposable nitrile glove: >480 minutes; NDBest Butyl 874 14 mil Butyl gloves: >480 minutes; NDPermeation testing of HFE-7200 [PDF Pg. 4] Breakthrough time; Permeation rateBest Viton II 890 30 mil Viton/Butyl glove: >480 minutes; NDBest Ultraflex 32 supported neoprene glove: >480 minutes; NDBest Nitri Solve 730 15 mil Nitrile glove: >480 minutes; NDBest N-Dex 8005 8 mil disposable nitrile glove: >480 minutes; NDBest Butyl 874 14 mil Butyl gloves: >480 minutes; ND
Comments:	Dermal exposure data not included, only breakthrough of solvent during glove testing.

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. and other OECD countries.
Metric 3:	Applicability	High	Data are for vapor degreasing, 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	N/A - PPE
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	N/A - PPE

Overall Quality Determination High

Study Citation:	Misra, A., Hogan, J. D., Chorush, R. (2002). Trans-1,2-Dichloroethylene; Trans-LC.
HERO ID:	10186803
Conditions of Use:	Various

EXTRACTION

Parameter	**Data**
Exposure route:	Inhalation, Dermal
Physical form:	Vapor, liquid
Personal protective equipment:	Contact lenses should not be worn. Wear protective clothing, gloves (Viton, polyvinyl alcohol), and eye shields
Engineering control:	Chemical should be handled only in a hood.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	The assessment or report uses high quality data and/or techniques or soundmethods that are not from a frequently used source and associated information does notindicate flaws or quality issues.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	The data are from the United States
Metric 3:	Applicability	High	The information provided is general and can be applicable to multiple occupational scenarios.
Metric 4:	Temporal Representativeness	Low	Report published in 2002, more than 20 years old.
Metric 5:	Sample Size	N/A	Samples not applicable for extracted data.
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	N/A	Variability and uncertainty not applicable for extracted data.

Overall Quality Determination Medium

Study Citation:	NCBI, (2020). PubChem Annotation Record for Trans-1,2-Dichloroethylene.
HERO ID:	9642071
Conditions of Use:	All conditions of use

EXTRACTION

Parameter	**Data**
Exposure route:	Inhalation, dermal.
Physical form:	Liquid.
Personal protective equipment:	Gloves, bag-valve-mask.
Engineering control:	Positive-pressure ventilation.

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 all in-scope occupational scenarios.
	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	N/A - PPE, engineering controls, exposure route, and physical form.
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	N/A - PPE, engineering controls, exposure route, and physical form.

Overall Quality Determination High

Study Citation:	NIOSH, (2014). In-depth survey report: Spray polyurethane foam chemical exposures during spray application, All About Kids, Crestwood, KY.
HERO ID:	3809069
Conditions of Use:	Polyurethane foam building insulation

EXTRACTION

Parameter	**Data**
Worker activity description:	An existing Wal-Mart facility (46,000 ft2) was being renovated into a recreational facility, All About Kids, by Lichtefeld Inc., Louisville, KY. Lichtefeld had subcontracted to Bio-Foam Insulation System of Kentucky the application of SPF insulation to the facility's ceiling (p. 8)
Exposure route:	Inhalation
Physical form:	Vapors, aerosols, and dust
Personal protective equipment:	The sprayers wore the following personal protective equipment while spraying SPF: Tyvek coveralls with a hood, gloves, shoe covers, and a full-faced air purifying respirator using organic vapor and total particulate cartridges. The helper wore a half-faced respirator with organic vapor and total particulate cartridges (p. 20)
Engineering control:	Provide local exhaust ventilation sufficient to keep vapors below safe exposure limits.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Report (NIOSH) 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 Spray Polyurethane Foam, an in-scope occupational scenario. However, data is general and not specific to the 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	N/A	N/A - no sample data.
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	No scope to address variability and 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:	Manufacture and Import

EXTRACTION

Parameter	**Data**
Physical form:	Provides physical form.
Number of workers:	Provides estimate of 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.
	Metric 4:	Temporal Representativeness	High	EPA used data from the 2020 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, (2013). Updating CEB's method for screening-level estimates of dermal exposure.
HERO ID: 11224653
Conditions of Use: All

EXTRACTION

Parameter	Data
Dermal exposure data:	This document provides updates to the parameters used for dermal exposure estimates. Updated parameters are listed below:Routine, direct handling of solids with 2 handsResulting dermal contact: up to 3,100 mgRoutine contact with surfaces, 2 hands, solidsResulting dermal contact: up to 1,100 mgRoutine immersion, 2 hands, liquidsSurface area: 1,070 cm^2Amount retained on skin: 1.3-10.3 mg/cm^2Resulting dermal contact: up to 11,000 mgRoutine contact, 2 hands, liquidsSurface area: 1,070 cm^2Amount retained on skin: 0.7-2.1 mg/cm^2Resulting dermal contact: up to 2,200 mgIncidental contact, 2 hands, liquidsSurface area: 1,070 cm^2Amount retained on skin: 0.7-2.1 mg/cm^2Resulting dermal contact: up to 2,200 mgIncidental contact, 1 hand, liquidsSurface area: 535 cm^2Amount retained on skin: 0.7-2.1 mg/cm^2Resulting dermal contact: up to 1,100 mg

EVALUATION

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Document published by EPA.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are applicable to all COUs involving dermal contact.
	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.
	Metric 5:	Sample Size	N/A	N/A - Document describes general dermal exposure parameters. Sample size is not applicable.
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 describing dermal exposure parameters for different exposure scenarios but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2010). Toxicological review of cis-1,2-dichloroethylene and trans-1,2-dichloroethylene (CAS nos. cis: 156-592-2: trans- 156-60-5: mixture: 540-59-0). In support of summary information on the Integrated Risk Information System (IRIS).
HERO ID:	1740607
Conditions of Use:	May apply to more than 1 COU

EXTRACTION

Parameter	**Data**
Exposure route:	Dermal, Inhalation, Oral
Dermal exposure data:	Kp values of 1.07 × 10-2 and 1.55 × 10-2 cm/hour are obtained for cis- and trans-1,2-DCE, respectively (page 20 in PDF)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	High	EPA 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	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Low	Information is from more than 20 years ago.
	Metric 5: Sample Size	N/A	No sample data.
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	No scope to address variability and uncertainty.

Overall Quality Determination High

Study Citation:	VI, (2020). Comment submitted by Vinyl Institute regarding EDC impurities.
HERO ID:	11182965
Conditions of Use:	Manufacturing

EXTRACTION

Parameter	**Data**
Physical form:	Liquid [PDF Pg. 2]
Comments:	Engineering controls for trans-1,2-DCE are not 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 manufacture, 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	N/A - physical form.
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	N/A - physical form.

Overall Quality Determination High

Study Citation:	3M, (2005). [Redacted] Air concentrations produced by Novec™ Contact Cleaner and Novec™ Electronic Degreaser.
HERO ID:	10610700
Conditions of Use:	Aerosol spray cleaner/degreaser

EXTRACTION

Parameter	**Data**
Release or emission factors:	Novec Electronic Degreaser discharge rate [PDF Pg. 4]Ventilation Hood on: 19.4g/secVentilation Hood off: 21.3g/sec

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Methodology is known and expected to be accurate and cover all release sources at the site.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	Medium	Data are for aerosol spray cleaners/degreasers, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Report is 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	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is addressed by checking emissions with the fume hood on and off, uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	Arthur D. Little Inc, (1987). Evaluation of chemical air emissions from the Bristol plant production facilities, Rohm and Haas, Delaware Valley, Inc (final report) with attachments and cover letter dated 08/10/1989.
HERO ID:	1481094
Conditions of Use:	Domestic Manufacture

EXTRACTION

Parameter	**Data**
Release or emission factors:	Media: water; Non-detect (Pg. 122)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Methodology is known and expected to be accurate and cover all release sources at the site.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for manufacture, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	Data are greater than 20 years old.
	Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	Release media provided but no other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Uncertainty is addressed by QC of samples and multiple samples being taken. Variability is not addressed.

Overall Quality Determination Medium

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:	Landfill runoff
Release or emission factors:	ROAF landfill runoff: <0.20 ug/L
Waste treatment methods and pollution control:	Landfill

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	Medium	Data are from Norway, an OECD country.
Metric 3:	Applicability	High	Data are for disposal, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	Data is based on current industry conditions and data no more than 10 years old.
Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (mean) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Low	Release media provided but missing release frequency, waste treatment efficiency, and annual release quantity.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Variability is not addressed, uncertainty is addressed by the sampling method.

Overall Quality Determination Medium

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:	WWTP effluent
Release or emission factors:	WWTP effluent: Slammestad plant: <0.20 ug/L; Hamar plant: <0.20 ug/L

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Medium	Data are from Norway, an OECD country.
	Metric 3:	Applicability	High	Data are for disposal, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Data is based on current industry conditions and data no more than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (mean) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	Release media provided but missing release frequency, waste treatment efficiency, and annual release quantity.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Variability is addressed by sampling multiple WWTP effluents, uncertainty is addressed by the sampling method.

Overall Quality Determination High

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:	VOC emissions from WWTPs may occur mainly through the following mechanisms: * diffusive volatilization (driven by the concentration differences between the air and the contacting aqueous phase), * convective stripping (via agitation, forced-air flow, etc.), * evaporation (driven by the temperature difference between the air and the aqueous phase). (p. 3)
Release quantity:	calculated emissions for each process unit calculated on p. 8. 1270 E-05 t/yr total emissions for 1,2-Dichloroethylene.
Comments:	Release estimation method: AP-42 (Part 4.3) (p. 5)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site. [Typically used AP-42 emission factors to estimate emissions from various process units - may not cover all release sources at site]
Domain 2: Representativeness			
Metric 2:	Geographic Scope	Medium	Data are from Turkey, an OECD country.
Metric 3:	Applicability	High	Data are for disposal, an in-scope occupational scenario. [Wastewater Treatment]
Metric 4:	Temporal Representativeness	Medium	Data are greater than 10 years old but no more than 20 years old. [Published 2004]
Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics. [only single values for each process unit]
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Medium	Release media and release frequency (per year) provided but missing other metadata. [Provides estimates by process unit]
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed. [No variability/uncertainty - only looked at one plant in Turkey]

Overall Quality Determination Medium

Study Citation:	ATSDR, (1996). Toxicological profile for 1,2-dichloroethene.
HERO ID:	723873
Conditions of Use:	Can apply to more than 1 COU

EXTRACTION

Parameter	**Data**
Description of release source:	1,2-Dichloroethene may be released to the atmosphere in emissions from production facilities, contaminated waste waters, contaminated waste disposal sites, and the pyrolysis and combustion of polyvinyl chloride and some vinyl copolymers. It may also be released during its use as a solvent and extractant, in organic synthesis, and in the manufacture of perfumes, lacquers, and thermoplastics.
Release quantity:	According to the Toxics Release Inventory (TRI), an estimated total of 29,478 pounds of 1,2-dichloroethene representing >99.9% of the total environmental release was discharged to air from manufacturing and processing facilities in the United States in 1993.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for all in in-scope occupational scenarios.
Metric 4:	Temporal Representativeness	Low	Data are 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	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	Belpoggi, F., Chiozzotto, D., Lauriola, M. (2012). Unsaturated halogenated hydrocarbons. :129-229.
HERO ID:	4332198
Conditions of Use:	Manufacturing & Processing

EXTRACTION

Parameter	**Data**
Release quantity:	In 1997, releases of 1,2-DCE were 17 pounds in water and 7757 pounds in air.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from 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	Low	Data are greater than 20 years old (1997).
	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	Medium	Uncertainty is not addressed. Variability is addressed by giving releases to multiple medias.

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**
Release quantity:	Greater Houston, TX Area [PDF Pg. 17]Releases: 245 lbsWaste Transfers Sent Off-Site: 55,057 lbsWaste Received: 65,086 lbsMossville, LA Area [PDF Pg. 22]Releases: 2,200 lbsWaste Transfers Sent Off-Site: 6,163 lbsWaste Received: 33,988 lbsVeolia Es Technical Solutions LLC (Pot Arthur, TX) [PDF Pg. 56]Incoming Waste Transfer: 1,546.4 lbsOlin Blue Cube (Freeport, TX) [PDF Pg. 73]Air: 7.08 lbsOffsite Transfer: 37,723 lbsOxy Vinyls LP La Porte VCM Plant (Laporte, TX) [PDF Pg. 73]Air: 27.20 lbsOffsite Transfer: 16,854.54 lbsDow Chemical Co Freeport Facility (Freeport, TX) [PDF Pg. 73]Air: 202.40 lbsWater: 4.80 lbsLand: 0.40 lbsOffsite Transfer: 92.80 lbsAccella Polyurethane Systems (Spring, TX) [PDF Pg. 73]Offsite Transfer: 258.64 lbsClean Harbors Deer Park LLC (LaPorte, TX) [PDF Pg. 73]Air: 0.24 lbsIncoming Waste Transfer: 31,523.93 lbsOffsite Transfer: 128.88 lbsOxy Vinyls LP Deer Park VCM Plant (Deer Park, TX) [PDF Pg. 73]Air: 3.59 lbsBFI - Colonial Landfill (Freeport, TX) [PDF Pg. 73]Incoming Waste Transfer: 32,744.40 lbsBFI - Colonial Landfill (Robstown, TX) [PDF Pg. 73]Incoming Waste Transfer: 560 lbsClean Harbors La Porte LP (LaPorte, TX) [PDF Pg. 73]Incoming Waste Transfer: 258.64 lbsEagle US 2 LLC (Westlake, TX) [PDF Pg. 86]Air: 2,200 lbsIncoming Waste Transfer: 25,132 lbsOffsite Transfer: 6,163.38 lbsWestlake Lake Charles North (Westlake, LA) [PDF Pg. 86]Air: 0.40 lbsPPG Industries Inc - Lake Charles Co (Lake Charles, LA) [PDF Pg. 86]Incoming Waste Transfer: 8,856 lbsWestlake (formerly Axiall LLC) (Plaquemine, LA) [PDF Pg. 100]Air: 131.60 lbsOffsite Transfer: 4.80 lbsThe Dow Chemical Co - Louisiana Operations (Plaquemine, LA) [PDF Pg. 100]Air: 11.60 lbsOffsite Transfer: 10.40 lbsWestlake Vinyls Co (Geismar, LA) [PDF Pg. 100]Air: 19.20 lbsBlue Cube Operations LLC (Plaquemine, LA) [PDF Pg. 100]Air: 1.60 lbsOffsite Transfer: 0.40 lbs

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	Low	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 Disposal, an in-scope occupational scenario.
	Metric 4: Temporal Representativeness	High	Data are no more than 10 years old.
	Metric 5: Sample Size	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).
Domain 3: Accessibility/ Clarity			
	Metric 6: Metadata Completeness	Medium	Release media provided but no other metadata.
Domain 4: Variability and Uncertainty			
	Metric 7: Metadata Completeness	Medium	Variability addressed by data from multiple sites, but uncertainty is not addressed.

Overall Quality Determination — High

Study Citation:	Hsu, Y. C., Chen, S. K., Tsai, J. H., Chiang, H. L. (2007). Determination of volatile organic profiles and photochemical potentials from chemical manufacture process vents. Journal of the Air and Waste Management Association 57(6):698-704.
HERO ID:	608305
Conditions of Use:	Manufacturing; Processing; Industrial Use

EXTRACTION

Parameter	**Data**
Description of release source:	General chemical manufacture process vents
Release or emission factors:	Media: air; Emission factors (mg/Nm3) provided for overall VOC emissions (not 1,1-DCA specific) at various manufacturing process (mostly plastics manufacturing), with various air pollution control (p. 4-5). VOC emisison factors presented in g/kg for various process vents (p. 6-7). Estimated via chemical sampling of stacks
Release frequency:	assumes 330 operational days/yr (p. 4)
Waste treatment methods and pollution control:	Some comparison data between uncontrolled vs controlled (p. 5)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	Medium	Data are for chemical process emissions from plastics manufacturing facilities, but for all VOCs, not specifically trans-1,2-DCE, which is similar to in-scope industrial occupational scenarios (manufacturing, processing, use)
Metric 4:	Temporal Representativeness	Medium	Data are no more than 10 years old (2007)
Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Medium	Release media and release frequency provided (assume 330 days/yr) but missing specifics on process operations
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Variability addressed by type of chemical manufacturing facilities and some process streams but uncertainty is not addressed.

Overall Quality Determination Medium

Study Citation:	NYSDEC, (1984). 2-Chlorotoluene in Niagara R. effluents with transmittal letter dated 090784 (draft rept, incompl).
HERO ID:	1335412
Conditions of Use:	WWTP

EXTRACTION

Parameter	**Data**
Description of release source:	Effluent from 1 WWTP receiving waste from 31 significant users
Release quantity:	2.5 kg/day in effluent from WWTP (page 4)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Low	Methodology is not specified.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	Low	Data are for WWTP, which is similar to the the in-scope occupational scenario Disposal.
	Metric 4:	Temporal Representativeness	Low	Data are greater than 20 years old.
	Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	Release media provided but no other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination — Low

Study Citation:	OECD, (2011). Resource compendium of PRTR release estimation techniques, part 4: Summary of techniques for releases from products, version 1.0.
HERO ID:	7348917
Conditions of Use:	Commercial & Consumer Use

EXTRACTION

Parameter	**Data**
Description of release source:	Building and construction products, Electrical and electronic products, Furniture, Nanoproducts, Packages and plastic bags, personal care and cleaning products, Textile and leather products, Toys and low-cost jewelry (page 17/109). Releases typically occur during the first use of a product, when carrying out maintenance of the product, and due to wearing, exposure to heat or light or other ageing of the product (page 63/109).
Release or emission factors:	Table 23 contains emission factors and release estimation equations for various organic pollutants in end-use products (page 81/109).

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	Medium	OECD paper provides general methods and equations used to calculate emissions, but details aren't provided.
Domain 2: Representativeness			
	Metric 2: Geographic Scope	Medium	Data are provided by the OECD.
	Metric 3: Applicability	High	Data are for various consumer and commercial uses which are in scope of the risk evaluation.
	Metric 4: Temporal Representativeness	Medium	Paper was published in 2011, but most emission factor data is from 2003-2004, which is greater than 10 years old.
	Metric 5: Sample Size	Low	Emission factor data is characterized by no statistics.
Domain 3: Accessibility/ Clarity			
	Metric 6: Metadata Completeness	Medium	Release data include release source and emission factors. Formulas for release quantity are provided. Data lacks release frequency and waste treatment methods.
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:	Qiu, K., Yang, L., Lin, J., Wang, P., Yang, Y.,i, Ye, D., Wang, L. (2014). Historical industrial emissions of non-methane volatile organic compounds in China for the period of 1980-2010. Atmospheric Environment 86:102-112.
HERO ID:	2373425
Conditions of Use:	General

EXTRACTION

Parameter	**Data**
Description of release source:	Industrial processes; industrial solvent utilization; storage and transport; other
Release quantity:	Estimated annual NMVOC emissions (1980-2010) for various general processes compared with values from other articles (see Release Source column) (p. 110)
Release or emission factors:	media: air. NMVOC emission factors summarized in tables on p. 104-106. Estimation method: NMVOC emission factors for various source categories - mainly USEPA or European Environment Agency (p. 103-104)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness			
	Metric 2: Geographic Scope	Medium	Article calculated emissions in China (a non-OECD country), but emission factors primarily from USEPA and Europe (assigned mid score of 2)
	Metric 3: Applicability	Medium	Data are for general industrial processes, which is similar to the in-scope occupational scenario for MFG and PROC (but only on NMVOC level)
	Metric 4: Temporal Representativeness	Medium	EF dates vary from 1990s through 2000s (assigned mid score of 2)
	Metric 5: Sample Size	Low	EFs provided for various processes, but derivation not discussed in this document
Domain 3: Accessibility/ Clarity			
	Metric 6: Metadata Completeness	Low	EFs provided for various processes, but derivation not discussed in this document
Domain 4: Variability and Uncertainty			
	Metric 7: Metadata Completeness	Low	Discusses variability with other estimates of overall NMVOC emissions in China, but does not discuss varibility and uncertainty of EFs which are likely more relevant for risk assessment

Overall Quality Determination Low

Study Citation: Rice, R. G. (1997). Applications of ozone for industrial wastewater treatment: A review. Ozone: Science and Engineering 18(6):477-515.
HERO ID: 645742
Conditions of Use: Disposal

EXTRACTION

Parameter	Data
Description of release source:	Industrial Wastewater Treatment
Waste treatment methods and pollution control:	UV/Oxidation technology - Greater than 90% removal efficiencies were achieved for most volatile organic compounds (VOCs). The treated groundwater meets applicable discharge standards and no harmful emissions escape to the air. Specific organic compounds present at high concentrations and decomposed by this technique include... 1,2-trans-dichloroethylene (42-68 ug/L), although many other VOCs present at lower concentrations also are decomposed or removed (p. 33-34). More details may be available in referenced source (Lewis, 1990)
Comments:	Media: water

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	Medium	Data are for disposal, an in-scope occupational scenario, but effectiveness of UV/Oxidation treatment on wastewater only quantifies removal for general VOCs
Metric 4:	Temporal Representativeness	Low	Data are greater than 20 years old (1996)
Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics - more information may be available in referenced source
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Low	Release media provided but no other metadata - may be available in referenced source
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed - may be available in referenced source

Overall Quality Determination Low

Study Citation:	Tsiliyannis, C. A. (1999). Report: Comparison of environmental impacts from solid waste treatment and disposal facilities. Waste Management & Research 17(3):231-241.
HERO ID:	660588
Conditions of Use:	Disposal (landfill biogas emissions)

EXTRACTION

Parameter	**Data**
Description of release source:	Municipal Solid Waste Landfill (biogas emissions)
Release or emission factors:	Table 3 provides emission factors for two scenarios (Table 3 contains emission factors for "HCX", based on the context provided for Equation 15 this is presumably for Chlorinated Hydrocarbons, does not appear to be specific to any one chemical.)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Medium	Data is from Greece, an OECD country.
	Metric 3:	Applicability	High	Data are for disposal, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	Data are greater than 20 years old (1996)
	Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics - more information may be available in referenced source
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	Release media provided but no other metadata - may be available in referenced source
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is addressed by looking at multiple sites and uncertainty is addressed by looking at different types of landfills.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (2022). DMR Data for TCEP, formaldehyde, trans-1,2-dichloroethylene, 1,1-dichloroethane, and 1,2-dichloroethane.
HERO ID:	11181053
Conditions of Use:	All

EXTRACTION

Parameter	**Data**
Description of release source:	Provides company name and site location of release source.
Release quantity:	Provides annual and period release quantities.

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 less than 10 years old.
	Metric 5:	Sample Size	Medium	Universe is limited to NPDES permit holders; statistical representativeness is unclear.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	DMR includes release source and release quantity, but is missing emission factors, waste treatment information, and release frequency.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is addressed by including multiple years of DMR data. DMR does not address uncertainty in submitter provided data.

Overall Quality Determination High

Study Citation:	U.S. EPA, (1981). Chapter 4.6: Solvent degreasing. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.
HERO ID:	3045012
Conditions of Use:	Degreasing

EXTRACTION

Parameter	**Data**
Description of release source:	Waste solvent evaporation, solvent carryout (evaporation from wet parts), solvent bath evaporation, spray evaporation, agitation, diffusion and convection.
Release or emission factors:	All Units: 1000 kg VOC/Mg solventTotal Cold cleaner: 0.3 Mg VOC/yr/unit or 0.4 kg/hr/m2Cold cleaner, waste solvent loss: 0.165 Mg VOC/yr/unitCold cleaner, solvent carryout: 0.075 Mg VOC/yr/unitCold cleaner, bath and spray evaporation: 0.06 Mg VOC/yr/unitCold cleaner per capita emissions: 1.8 kg nonmethane VOC per capita per year or 5.8 g nonmethane VOC per capita per dayOTVD: 9.5 Mg VOC/yr/unit or 0.7 kg/hr/m2Conveyorized vapor: 24 Mg VOC/yr/unitConveyorized nonboiling: 47 Mg VOC/yr/unit
Release frequency:	313 days/year.
Waste treatment methods and pollution control:	Nearly all vapor degreasers are equipped with a waterseparator which allows the solvent to flow back into the degreaser.Cover or enclosed design, drainage facility, water cover, refrigerated chiller, carbon adsorption or high freeboard, solid spray stream, safety switches and thermostats.Using these controls provides a total emission reduction of 13-38% for cold cleaning, 20-60% for vapor degreasing, and 40-60% for conveyorized degreasing.Proper use of equipment, waste solvent reclamation, reduced exhaust ventilation, reduced conveyor or entry speed. These operating procedures provide a total emission reduction of 15-45% for cold cleaning, 15-40% for vapor degreasing, and 20-30% for conveyorized degreasing.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Methodology is known and expected to be accurate and cover all air release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	AP-42 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	Low	Assessment is based on data greater than 20 years old and prior to the latest NESHAP for halogenated solvent cleaning.
Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Medium	Release media, and emission factors provided but missing release frequency.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple degreasing methods.

Overall Quality Determination Medium

Study Citation: U.S. EPA, (2001). Sources, emission and exposure for trichloroethylene (TCE) and related chemicals. GRA and I:138.
HERO ID: 35002
Conditions of Use: Disposal

EXTRACTION

Parameter	Data
Description of release source:	Trans-1,2-dichloroethylene may be released to the environment in air emissions and wastewater during its production and use.
Release quantity:	In an EPA survey of wastewater from 4,000 industrial and publicly ownedtreatment works, the highest effluent concentration among several industries was for iron andsteel manufacturing at 3,013 ppb, with a median contamination of 2,265.9 ppb. Medianconcentrations in the effluents of other industries were: organics and plastics (14.6 ppb);inorganic chemicals (3.9 ppb); rubber processing (19.0 ppb); auto and other laundries (60.6 ppb);explosives (3.9 ppb); electronics (140.7 ppb); mechanical products (13.7 ppb); transportationequipment (29.3 ppb); POTWs (16.3 ppb) (Shackelford et al., Analyt Chem Acta, Vol. 146,1983; HSDB, 1996). In another survey of industrial occurrences, wastewater discharges had thefollowing mean concentrations: metal finishing (260 ppb); photographic equipment (2,200 ppbmaximum concentration); nonferrous metal manufacturing (75 ppb); rubber processing (150ppb).
Waste treatment methods and pollution control:	A method of disposal is incineration, preferably after mixing with another combustible fuel. Care must be exercised to assure complete combustion to prevent the formation of phosgene. An acid scrubber is necessary to remove the halo acids produced (Sittig. Handbook Toxic Hazard Chem & Carcinog, 2nd Ed., 1985). Trans-1,2-dichloroethylene is a potential candidate for rotary kiln incineration at a temperature range of 820 to 1,600°C and residence times of seconds for liquids and gases and hours for solids. It is also a potential candidate for fluidized bed incineration at a temperature range of 450 to 980°C and residence times of seconds for liquids and gases, and longer for solids and a potential candidate for liquid injection incineration at a temperature range of 650 to 1,600°C and a residence time of 0.1 to 2 seconds (USEPA. 1981. Engineering Handbook for Hazardous Waste Incineration). This compound should be susceptible to removal from wastewater by air stripping (USEPA/ORD. 1980. Innovative and Alternative Technology Assessment Manual). At the time of review, criteria for land treatment or burial (sanitary landfill) disposal practices are subject to significant revision. Prior to implementing land disposal of waste residue (Including waste sludge) consult with environmental regulatory agencies for guidance on acceptable disposal practices (HSDB Scientific Review Panel, HSDB, 1996) (p. 86 of 138 or p. 73)
Comments:	Dichloroethylenes can be found as breakdown products from the reduction dehalogenation of common industrial solvents such as trichloroethylene, tetrachloroethylene, and 1,1,2,2-tetrachloroethane under aerobic high organic mix conditions, that may exist in landfills, aquifers, or sediment. The cis isomer is the isomer found most. However, it mistakenly reported as the trans isomer because EPA standard methods analytical procedures do not distinguish between isomers (HSDB, 1996). See Section 4.0 (1,2-Dichloroethylene) for more information on environmental levels. (p. 86)

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	High	Data are for Disposal, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old (1980s) and
Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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 report does not address variability or uncertainty.

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Study Citation:	U.S. EPA, (2001). Sources, emission and exposure for trichloroethylene (TCE) and related chemicals. GRA and I:138.
HERO ID:	35002
Conditions of Use:	Disposal

		EVALUATION	
Domain	Metric	Rating	Comments
Overall Quality Determination		**Medium**	

Study Citation:	U.S. EPA, (1980). Chapter 4.7: Waste solvent reclamation. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.
HERO ID:	3840001
Conditions of Use:	Treatment/Recycling of Spent Solvents

EXTRACTION

Parameter	**Data**
Description of release source:	storage tank vents, condenser vents, incinerator stacks, and fugitive losses (equipment leaks, open solvent sources sludge, solvent loading, and solvent spills).
Release or emission factors:	Storage tank vents: 0.01 kg VOC/Mg solventCondenser vents: 1.65 kg VOC/Mg solventIncinerator stack: 0.01 kg VOC/Mg solvent and 0.72 kg particulates/Mg solventSpillage: 0.10 kg VOC/Mg solventLoading: 0.36 kg VOC/Mg solvent
Waste treatment methods and pollution control:	Section 4.7.2 is a description of Emissions and Controls

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Methodology is known and expected to be accurate and cover all release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	AP-42 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	Low	Assessment is based on data greater than 20 years old and prior to the latest NESHAP for Off-Site Waste and Recovery Operations
Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Medium	Release media, and emission factors provided but missing release frequency.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

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:	Industrial/Commercial Use: Vapor degreaser

EXTRACTION

Parameter	**Data**
Description of release source:	Diffusion and convection causing fugitive emissions of solvent.
Release or emission factors:	Open-top vapor degreasers: 10.5 tons/year/unit Conveyorized vapor degreaser: 26 tons/year/unit
Waste treatment methods and pollution control:	Cover or enclosed degreaser design; drainage facility;water cover, refrigerated chiller, carbon adsorption or high freeboard ratio; solid, fluid spray stream; safety switches and thermostats

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	Medium	Data are for vapor degreasing, an in-scope occupational scenario but are not specifically for this chemical.
Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old.
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	Medium	Variability is addressed by discussing multiple emission sources, uncertainty is not addressed.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (1995). Chapter 6: Organic chemical process industry. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.
HERO ID:	7310513
Conditions of Use:	Pharmaceutical and medicine manufacturing

EXTRACTION

Parameter	**Data**
Description of release source:	Emissions consist almost entirely of organic solvents that escape from dryers, reactors, distillation systems, storage tanks, and other operations. These emissions are exclusively nonmethaneorganic compounds. Emissions of other pollutants are negligible (except for particulates in unusual circumstances) and are not treated here
Release or emission factors:	Emissions percentage to different media are included in Table 6.13-1.
Waste treatment methods and pollution control:	Water- or brine-cooled condensers are the most common control devices, with carbon adsorbers in occasional use.

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	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	Low	The release data are for an occupational scenario that EPA has determined to be not included in the scope of the risk evaluation. However, the information might be useful for a similar condition of use like laboratory chemicals.
	Metric 4:	Temporal Representativeness	Low	Information is 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	Release data include release media but no other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is addressed by including different media but uncertainty is not addressed.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (1995). Chapter 4.10 commercial/consumer solvent use. AP-42: Compilation of air pollutant emission factors volume I: Stationary point and area sources.
HERO ID:	7310515
Conditions of Use:	Solvent Use

EXTRACTION

Parameter	**Data**
Description of release source:	Evaporation of an aerosol spray, evaporation after application, and direct release in the gaseous phase.
Release quantity:	National NonMethane VOC EmissionsAerosol products: 342,000 Mg/yrHousehold products: 183,000 Mg/yrToiletries: 132,000 Mg/yrRubbing compounds: 62,000 Mg/yrWindshield washing: 61,000 Mg/yrPolishes and waxes: 48,000 Mg/yrNonindustrial adhesives: 29,000 Mg/yrSpace deodorant: 18,000 Mg/yrMoth control: 16,000 Mg/yrLaundry detergent: 4,000 Mg/yr
Release or emission factors:	National Nonmethane VOC Emissions per CapitaAerosol products: 1.6 kg/person/yr or 4.4 g/person/dayHousehold products: 0.86 kg/person/yr or 2.4 g/person/dayToiletries: 0.64 kg/person/yr or 1.8 g/person/dayRubbing compounds: 0.29 kg/person/yr or 0.80 g/person/dayWindshield washing: 0.29 kg/person/yr or 0.77 g/person/dayPolishes and waxes: 0.22 kg/person/yr or 0.59 g/person/dayNonindustrial adhesives: 0.13 kg/person/yr or 0.36 g/person/daySpace deodorant: 0.09 kg/person/yr or 0.24 g/person/dayMoth control: 0.07 kg/person/yr or 0.19 g/person/dayLaundry detergent: 0.02 kg/person/yr or 0.05 g/person/day
Release frequency:	365 days/yr.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Methodology is known and expected to be accurate and cover all release sources at the site.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	AP-42 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	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	Medium	Release media, quantity, and frequency provided but missing controls.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Uncertainty addressed by addressing the inclusion of methane and nonreactive products in VOC estimates. Variability addressed by estimating emissions from multiple consumer and commercial product categories.

Overall Quality Determination High

Study Citation:	U.S. EPA, (1995). Chapter 4.2: Introduction to surface coating. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.
HERO ID:	7315820
Conditions of Use:	Industrial/Commercial Use: Urethane coatings

EXTRACTION

Parameter	**Data**
Description of release source:	The major pollutants from surface coating of plastic parts for business machines are VOC emissions from evaporation of organic solvents in the coatings used, and from reaction byproducts when the coatings cure. VOC sources include spray booth(s), flashoff area(s), and oven(s) or drying area(s). The relative contribution of each to total VOC emissions vary from plant to plant, but for an average coating operation, about 80 percent is emitted from the spray booth(s), 10 percent from the flashoff area(s), and 10 percent from the oven(s) or drying area(s).
Release or emission factors:	Emission factors for various plant sizes and coating types are given in the Section 4.2.2.14 file on PDF Pg. 11.
Waste treatment methods and pollution control:	Add-on controls applied to VOC emissions in other surface coating industries include thermal and catalytic incinerators, carbon adsorbers, and condensers.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Methodology is known and expected to be accurate and cover all release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	Medium	Data are for urethane coatings, an in-scope occupational scenario but are not specifically for this chemical.
Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old.
Metric 5:	Sample Size	Medium	Sample distribution characterized by a range.
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 is addressed by discussing multiple emission sources, uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	VI, (2020). Comment submitted by Vinyl Institute regarding EDC impurities.
HERO ID:	11182965
Conditions of Use:	Manufacturing

EXTRACTION

Parameter	**Data**
Release quantity:	A subset of 14 EDC/VCM manufacturing facilities reported releases of 6,214 lbs of 1,2-dichloroethylene to air and water. [PDF Pg. 5]

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Low	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 manufacturing, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Data are 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	Release media provided but no other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	Herrera, T. A., Lang, R., Tchobanoglous, G. (1989). A study of the emissions of volatile organic compounds found in landfill gas. :229-238.
HERO ID:	2802277
Conditions of Use:	Disposal

EXTRACTION

Parameter	**Data**
Description of release source:	landfill gas
Release or emission factors:	PDF pg 8: 0.453 g/m2-d for convective and diffusive flux equation, 0.357 g/m2-d for diffusive flux equation, 0.429 g/m2-d for diffusive flux equation
Comments:	media: air; mass balance modeling

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Model is free of mathematical errors and based on sound approaches/methods.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Model can be applied to disposal, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	Model is based on data greater than 20 years old and industry conditions that are expected to be outdated.
Domain 3: Accessibility/ Clarity				
	Metric 5:	Metadata Completeness	High	Model approach, equations, and choice of parameter values are transparent. Rationales for choice of approach, equations, and parameter values provided.
Domain 4: Variability and Uncertainty				
	Metric 6:	Metadata Completeness	Medium	Model approach, equations, and choice of parameter values are transparent. Rationales for choice of approach, equations, and parameter values provided.

Overall Quality Determination High

Study Citation:	OECD, (2011). Emission scenario document on coating application via spray-painting in the automotive refinishing industry.
HERO ID:	3808976
Conditions of Use:	Urethane coatings

EXTRACTION

Parameter	**Data**
Description of release source:	Container cleaning, equipment cleaning, coating application (overspray)
Release frequency:	250 days/yr
Waste treatment methods and pollution control:	Incineration; Prep stations, spray booths, or enclosed spray coating areas, general or local exhaust ventilation with dry filters: 96%

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	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 coating types.

Overall Quality Determination — High

Study Citation:	OECD, (2009). Emission scenario documents on coating industry (paints, lacquers and varnishes).
HERO ID:	3827298
Conditions of Use:	Processing and Use: Formulation of Coatings and Use of Coatings

EXTRACTION

Parameter	**Data**
Description of release source:	PROC: material loading, heat-up, surface evaporation, filling, miscellaneous operations, material storage, leaks, spills USE: Application losses, equipment residues, drum residues. Releases to water, air, land.
Release or emission factors:	Release/Emission Factors: PROC: Equipment residues: 0.5-1% (organic solvent-borne); 0.5-1% (water-borne); 0.5-1% (powder) Raw material packaging residues: 0.2-5% (organic solvent-borne); 0.2-5% (water-borne); 0.5% (powder) Air Emissions: 0.07-3.6% (organic solvent-borne); 0.03-2.25% (water-borne) Dust Emissions: 0.5-1% (organic solvent-borne); 0.5-1% (water-borne); 0.5-1.5% (powder) Flaking/crushing/transfer (powder only): 0.5-1.5% Cyclone Emissions (powder only): 2-5% Extruder waste (powder only): 1% USE: Equipment residues: 5% (wood); 1% (coil); 5% (aerospace); 5% (rail) container residues: 0.5% (wood); 3% (decorative); 1.5% (metal); 0.5-3% (coil) Application: 20-70% (wood spray); 1% (wood roll/curtain); 1% (decorative); 20-50% (automotive OEM); 50-60% (auto refinishing); 3% (metal); 35% (marine); 32% (aerospace); 10-25% (rail) Process scrap: 1% (metal) Quenching: 0.25% (coil) Sanding: 2% (rail) Volatiles only: 100% of chemical not released elsewhere.
Waste treatment methods and pollution control:	Incineration; Vessel extraction, LEV (95-97% capture efficiency for dusts), area ventilation, condensers, carbon adsorption, condensation, biological treatment, thermal incineration, catalytic incineration, air scrubbers (99% efficiency)

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	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 chemical functions and coating types.

Overall Quality Determination — High

Study Citation:	OECD, (2009). Emission scenario document on adhesive formulation.
HERO ID:	3827299
Conditions of Use:	Processing: Adhesives and sealants

EXTRACTION

Parameter	**Data**
Description of release source:	Container cleaning, dusts and volatiles from unloading containers, vented losses during mixing, sampling, equipment cleaning, volatiles from loading containers, off-spec products. Releases to water, air and land.
Release quantity:	Provides models for estimating various releases to air and non-air media during formulation of adhesives.
Release or emission factors:	Release/emission factors: Unloading solids: 0.5%, Container cleaning: 1% (solids), 0.2% (bulk liquids) 0.6% (small containers for liquids) 3% (drums for liquids), Compounding Volatiles: 0.002-0.05%, Equipment Cleaning: 2%, Off-spec: 1% of batches are off-spec
Waste treatment methods and pollution control:	Incineration; Baghous filters:>99% Cyclones/mechanical collectors: 80-99%

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 an in-scope occupational scenario; 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	Data 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 and types of adhesives.

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:	Industrial Use: Adhesives and sealants

EXTRACTION

Parameter	**Data**
Description of release source:	Container cleaning, unloading, equipment cleaning, application losses, curing/drying, trimming. Releases to water, air, and land.
Release or emission factors:	Container cleaning: 0.2% (bulk liquids) 0.6% (small containers for liquids) 3% (drums for liquids) Equipment Cleaning: 1-2% Application losses: 0% (syringe/bead), 10-80% (spray), 2-10% (roll/curtain) Curing: 100% of chemical not released elsewhere (volatiles only) trimming: 4%
Release frequency:	50-365 days/yr
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	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 an in-scope occupational scenario; 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 various chemical functions, types of adhesives, and end use markets.

Overall Quality Determination **High**

Study Citation:	OECD, (2010). Emission scenario document on formulation of radiation curable coatings, inks and adhesives.
HERO ID:	3840003
Conditions of Use:	Formulation of Coatings, inks, and adhesives

EXTRACTION

Parameter	**Data**
Description of release source:	Container cleaning, dusts and volatiles from unloading containers, vented losses during mixing, sampling, equipment cleaning, volatiles from loading containers, filter wastes
Release quantity:	Provides models for estimating various fugitive air releases
Release frequency:	250
Waste treatment methods and pollution control:	Incineration; Baghous filters:>99% Cyclones/mechanical collectors: 80-99%

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 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 various chemical functions and types of UV curable products.

Overall Quality Determination High

Study Citation:	OECD, (2010). Emission scenario document on chemicals used in the electronics industry.
HERO ID:	5079083
Conditions of Use:	Processing & Use: Electronics

EXTRACTION

Parameter	**Data**
Description of release source:	cleaning of components and equipment, excess materials used for joining components (adhesives, solder, wires, etc.), waste coating and packaging materials, carrier gas losses, dopant residues, filter wastes, leakage/spilling, container cleaning, disposal of old/off-spec materials, spent electroless bath materials, rinse water from plating tanks, etching vapors, drilling/routing dust, scrap board materials, spin-coating, unused film, etching wastes, solder wastes, recovery wastes. Releases to water, air, land.
Release or emission factors:	Release/Emission Factors: Solids: 0-20%Air: 0-100%water: 0-100%
Release frequency:	30-300 days/yr
Waste treatment methods and pollution control:	Incineration

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	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 operations, chemical functions, and facility sizes.

Overall Quality Determination High

Study Citation:	OECD, (2011). Emission scenario document on the chemical industry.
HERO ID:	6306753
Conditions of Use:	Manufacture, processing, use

EXTRACTION

Parameter	**Data**
Description of release source:	Stack Air: Reactor vents, distillation column vents, absorber units, strippers, sumps/decanters, dryers, cooling vents Fugitive Air: Valves, pump seals, compressor seals, pressure-relief valves, flanges/connections, open-ended lines, sampling connections Water: Drum cleaning, equipment cleaning, aqueous distillation streams, extraction, reaction water, absoprtion, solids-liquids separation, adsorption, condensation
Release or emission factors:	Emission factors: Stack Air: 0.02-2.2 kg total organic carbon (TOC)/tonne throughput Fugitive Air: 0.00023-0.228 kg TOC/hr/source Water: 0.019-3.06 wt% of vessel

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 are for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
Metric 4:	Temporal Representativeness	Low	Assessment from 2011 but is based on data greater than 20 years old.
Metric 5:	Sample Size	Medium	Data 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 presenting emission factors for multiple scenarios but uncertainty is not addressed.

Overall Quality Determination Medium

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

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 capcity-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:	Local Exhaust Ventilation, Filters, 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 mostly 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:	OECD, (2015). Emission scenario document (ESD) on industrial use of industrial cleaners.
HERO ID:	6414932
Conditions of Use:	Solvents (for cleaning and degreasing)

EXTRACTION

Parameter	**Data**
Description of release source:	Dragout, evaporation from openings of the washing tank, waste cleaning solution, drying
Release quantity:	Provides methodology to estimate releases based on various parameters including: opening area of cleaning equipment, physical-chemical properties of cleaner, air velocity, etc.
Waste treatment methods and pollution control:	Natural sedimentation device: 0-50% Coagulation-sedimentation equipment: 0-95% Microorganism decomposition device (aerobic): 0-95% Membrane filtration devive: 0-100% Activated carbon adsorption device: 0-90%

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	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	Distribution of samples is 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 cleaner types.

Overall Quality Determination **High**

Study Citation:	U.S. EPA, (2002). Flexographic ink options: A cleaner technologies substitutes assessment. Volume 1.
HERO ID:	10293388
Conditions of Use:	Carrier solvent in adhesives, coatings, inks, lubricants, and silicones

EXTRACTION

Parameter	**Data**
Description of release source:	Stack and fugitive emissions from solvent-based inks.
Release or emission factors:	The total amount volatilized averaged 6.23 g/sec. The average stack emissions (0.216 g/sec) were considerably lower than fugitive emissions (1.87 g/sec), reflecting the anticipated use of oxidizers with stack emissions. Therefore, of the total amount volatilized, only a portion would ultimately be released to the atmosphere.
Waste treatment methods and pollution control:	Thermal oxidizers

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Methodology is known and expected to be accurate but may not cover all release sources at the site.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	Medium	The release data are for an occupational scenario within the scope of the risk evaluation but data is general and not specific to the chemical.
Metric 4:	Temporal Representativeness	Low	Data are greater than 20 years old.
Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Low	Release media provided but no other metadata.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	Variability is addressed by discussing stack and fugitive emissions, uncertainty is not addressed.

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:	Laboratory Chemicals

EXTRACTION

Parameter	**Data**
Description of release source:	Container unloading, container cleaning, labware equipment cleaning, during laboratory analyses, waste disposal.
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.Local ventilation, accurate labeling of wastes, using secondary containment for hazardous wastes, and contacting specialty disposal companies.

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:	Transfer losses, container cleaning, equipment cleaning, transfer losses during loading.
Release quantity:	Provides methodology to estimate releases based on various parameters including: opening area of cleaning equipment, physical-chemical properties, air velocity, etc.
Release or emission factors:	Transfer losses of solid chemicals: 0.5%Container cleaning (liquids): 0.2%Equipment Cleaning (liquids): 2% Equipment Cleaning (solids): 1%
Release frequency:	The number of operating days is given in a range of 174-260 days/yr with an EPA default of 260 days/yr.
Waste treatment methods and pollution control:	Filters used for fugitive dust emissions are disposed of in landfills or by incineration. Wastewater is treated on-site or sent off to a POTW.Automated pumps and containment systems are used to control emissions. Containment methods include bunds, kerbs, drip trays or any other systems that will prevent a spilled product escaping are recommended.

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 is for an in-scope occupational scenario; 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 emissions from multiple activities.

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:	Plastics compounding

EXTRACTION

Parameter	**Data**
Description of release source:	Unloading containers, spillage, Container cleaning, dusts and fugitive emissions from compounding, equipment cleaning.
Release quantity:	Provides models for estimating various fugitive air releases.
Release or emission factors:	Unloading solids: 0.1-0.5%Spillage: 0.01%Container cleaning: 1% (solids), 0.2% (bulk liquids) 0.6% (small containers for liquids) 3% (drums for liquids)Compounding dusts: 0.01-0.05%Compounding Volatiles: 0.002-0.05%Equipment Cleaning: 2%
Release frequency:	148-264.
Waste treatment methods and pollution control:	Incineration. WWT: settling or clarification, neutralization, sludge treatment and/or dewatering, biological treatment, chemical precipitation, phase separation, adsorption.Air: Mechanical separation, settling or clarification, scrubbers, incineration/thermal destruction, condenser, adsorptionSolid waste streams: Settling or clarification, stabilization or chemical fixation prior to disposalNon-aqueous liquid waste streams: stabilization or chemical fixation prior to disposal, incineration/thermal destructionEfficiency: 0-100% depending on treatment method.
Comments:	This generic scenario will address compounding operations. Polymer manufacturing will not be included in this scenario.

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	High	Data are for plastics compounding which is in-scope or similar to an in-scope occupational scenario.
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	Data 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 types, and additive types.

Overall Quality Determination — High

Study Citation: U.S. EPA, (2003). Transportation equipment cleaning - Generic scenario for estimating occupational exposures and environmental releases (draft).
HERO ID: 6385708
Conditions of Use: Disposal

EXTRACTION

Parameter	Data
Description of release source:	Any water soluble heels that are compatible with the facility's treatment system and the conditions of the facility's wastewater discharge permit are usually combined with other wastewaters for treatment and discharge at the facility. Incompatible heels are segregated into drums or tanks for disposal by alternative means, which may include sale to a reclamation facility, landfill, or incineration. The TEC facility may reuse heels comprised of soaps, detergents, solvents, acids, or alkalis as tank cleaning solutions, as neutralizers for future heels, and for wastewater treatment.
Release or emission factors:	Between 35 and 1,124 gallons of wastewater per tank were reportedly generated during tank truck cleaning, between 76 and 2,399 gallons of wastewater per tank during rail tank car cleaning, and between 3,000 and 30,000 gallons of wastewater per tank during tank barge cleaning. Rail tank cars are more likely to be cleaned using steam than using caustic or detergent cleaning solutions and they typically generate between 3 and 121 gallons of heel. Tank trucks, intermediate bulk containers, and intermodal tank containers are generally considered empty when they arrive at the facility, but may contain between one quart and ten gallons of heel.
Waste treatment methods and pollution control:	Disposal methods for heel are presented in the scenario. Most facilities discharge treated wastewater to POTWs, and facilities with wastewater treatment typically include equalization, pH adjustment, physical settling, and oil/water separation.

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 are for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
Metric 4:	Temporal Representativeness	Medium	Assessment 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.
Metric 5:	Sample Size	Medium	Sample distributions characterized by ranges/estimations with uncertain statistics.
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	Medium	Uncertainty not addressed. Variability addressed by considering multiple container types and cleaning methods.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2014). Use of additives in the thermoplastic converting industry - generic scenario for estimating occupational exposures and environmental releases.
HERO ID:	6385711
Conditions of Use:	Extraction solvent for thermoplastics

EXTRACTION

Parameter	**Data**
Description of release source:	Container cleaning, spillage, dusts and fugitive emissions from converting, equipment cleaning, trimming wastes.
Release quantity:	Provides models for estimating various fugitive air releases.
Release or emission factors:	Container cleaning: 1%Spillage: 0.01%Unloading solids: 0.1-0.5%Converting dusts: 0.01%Converting Volatiles: 0.01-0.25%Equipment Cleaning: 2%Trimming: 2.5%
Release frequency:	137-254.
Waste treatment methods and pollution control:	Incineration. WWT: settling or clarification, neutralization, sludge treatment and/or dewatering, biological treatment, chemical precipitation, air or steam stripping, absorption, chemical reduction, evaporation, incineration/thermal destruction, phase separationAir: Mechanical separation, settling or clarification, scrubbers, incineration/thermal destruction, condenser, adsorption, biological treatment, electrostatic precipitator, absorber, phase separation, neutralizationSolid waste streams: stabilization or chemical fixation prior to disposal, evaporation, sludge treatment/dewatering, incineration/thermal destruction, chemical oxidationNon-aqueous liquid waste streams: stabilization or chemical fixation prior to disposal, incineration/thermal destruction, neutralization, evaporationEfficiency: 0-100% depending on treatment method

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 is for an in-scope occupational scenario; 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	Data 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 types, and additive types.

Overall Quality Determination — High

Study Citation:	U.S. EPA, (2004). Spray coatings in the furniture industry - generic scenario for estimating occupational exposures and environmental releases: Draft.
HERO ID:	6385719
Conditions of Use:	Industrial/Commercial Use: Urethane Coatings

EXTRACTION

Parameter	**Data**
Description of release source:	container cleaning, equipment cleaning, coating application (overspray), volatile air emissions
Release or emission factors:	Container cleaning: 3%Equipment Cleaning: 2%Application losses: 35-75% (spray)Volatile: 100% of chemical not released elsewhere
Release frequency:	250 days/yr
Waste treatment methods and pollution control:	incineration. spray booths with dry filters: 90-99%

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 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 various chemical functions and wood vs metal furniture uses.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2014). Use of additive in plastic compounding - generic scenario for estimating occupational exposures and environmental releases: Draft.
HERO ID:	6385748
Conditions of Use:	Plastics Compounding

EXTRACTION

Parameter	**Data**
Description of release source:	Unloading containers, spillage, Container cleaning, dusts and fugitive emissions from compounding, equipment cleaning
Release quantity:	Provides models for estimating various fugitive air releases
Release or emission factors:	”Unloading solids: 0.1-0.5% Spillage: 0.01% Container cleaning: 1% (solids), 0.2% (bulk liquids) 0.6% (small containers for liquids) 3% (drums for liquids) Compounding dusts: 0.01-0.05% Compounding Volatiles: 0.002-0.05% Equipment Cleaning: 2%”
Release frequency:	148-264
Waste treatment methods and pollution control:	incineration; ”WWT: settling or clarification, neutralization, sludge treatment and/or dewatering, biological treatment, chemical precipitation, phase separation, adsorption. Air: Mechanical separation, settling or clarigication, scrubbers, incineration/thermal destruction, condenser, adsorption Solid waste streams: Settling or clarification, stabilization or chemical fixation prior to disposal Non-aqueous liquid waste streams: stabilization or chemical fixation prior to disposal, incineration/thermal destruction Efficiency: 0-100% depending on treatment method”
Comments:	media: water, air, land

EVALUATION

Domain	Metric	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 is for an in-scope occupational scenario; 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	Data 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 types, and additive types.

Overall Quality Determination — High

Study Citation: U.S. EPA, (2004). Additives in plastics processing (converting into finished products) -generic scenario for estimating occupational exposures and environmental releases. Draft.
HERO ID: 6549571
Conditions of Use: Additives in Plastics Processing (Converting into Finished Products)

EXTRACTION

Parameter	Data
Description of release source:	1. Container residue from plastic resin transport container released to water, incineration, or landfill.2. Dust generation from forming processes released to water or landfill.3. Fugitive air emissions from forming and molding processes released to water or air.4. Equipment cleaning and cooling water from forming and molding processes released to water, incineration, or landfill.5. Solid waste from trimming operations released to water or landfill.
Release quantity:	Container Residue from Compounding Transport Container: Daily Release from Container Residue (kg/site-day) = Daily Use Rate (kg/site-day) x Loss FractionDust Generation from Converting Activities Released to Water or Landfill: Daily release of dust = daily use rate x loss fractionFugitive Air from Converting Activities Released to Water or Air: Daily release to water (or air) from volatilization = daily use rate x loss fractionResidual from Converting Equipment Cleaning: Daily release from equipment cleaning = daily use rate x loss fractionTrimming Waste: Daily release from trimmings = daily use rate x loss fraction
Release or emission factors:	Container Residue from Compounding Transport Container - Standard CEB estimate for solid container residue is 1% loss.Dust Generation from Converting Activities Released to Water or Landfill - 0.01% loss of daily use rate, OECD 2003, based on estimates for filler additives.Fugitive Air from Converting Activities Released to Water or Air - A release of 0.25% of the daily use rate is estimated (OECD 2003, loss rates are based on high (0.25%), medium (0.05%), and low (0.01%) volatility at 200C for typical plasticizers in open processes such as calendaring, blown film, and spread coating).Residual from Converting Equipment Cleaning - The release is based on CEB standard estimate for equipment cleaning of entire process (2% loss of daily use rate) released to water.Trimming Waste - Waste generated from trimming, filing, and grinding (off-spec products are reground and reintroduced into the converting process) are estimated to be 2.5-10% of production.
Release frequency:	CEB standard assumption, 250 days per year based on 5 day work week and two weeks per year of operation shut down.
Waste treatment methods and pollution control:	Finished plastic items have a typical expected lifetime. After use, plastic items in the consumer market are released back into the environment. Used plastic articles are disposed to land or incineration or they are recycled. According to EPA's Office of Compliance Sector Notebook for the Rubber and Plastics Industry approximately 1% of plastics are recycled. A more recent report from EPA's Office of Solid Waste estimates 5.5% of plastics is recycled. The OECD Emissions Scenario Document on Plastic Additives estimates that 8% of plastics are recycled and 17% of plastics are incinerated for thermal recovery in the UK.

EVALUATION

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The assessment uses high quality data and methods that are from a frequently used source 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 assessment is for an occupational scenario within the scope of the risk evaluation. However, data are not chemical specific.
	Metric 4:	Temporal Representativeness	Low	Data are 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				

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Study Citation: U.S. EPA, (2004). Additives in plastics processing (converting into finished products) -generic scenario for estimating occupational exposures and environmental releases. Draft.

HERO ID: 6549571

Conditions of Use: Additives in Plastics Processing (Converting into Finished Products)

		EVALUATION		
Domain		Metric	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	Variability is addressed by evaluation of various sources of release, but uncertainty in release estimation is not addressed.

Overall Quality Determination — High

Study Citation:	U.S. EPA, (2021). Application of spray polyurethane foam insulation - Generic scenario for estimating occupational exposures and environmental releases - Final.
HERO ID:	8674805
Conditions of Use:	Blowing Agent

EXTRACTION

Parameter	**Data**
Description of release source:	Container residues, air emissions during application, equipment cleaning, cutting/grinding wastes, spills/leaks, PPE disposal.
Release or emission factors:	Container cleaning: 1% (solids), 0.6% (small containers for liquids), 3% (drums for liquids) Equipment Cleaning: 2%.
Waste treatment methods and pollution control:	Incineration.

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 is for an in-scope occupational scenario; 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 one- and two-component foams.

Overall Quality Determination High

Study Citation:	Bardole, J., White, D. (2000). Paint and finish removers.
HERO ID:	6304163
Conditions of Use:	Industrial/Commercial Use: Cleaning and furnishing care products

EXTRACTION

Parameter	**Data**
Description of release source:	Waste after applying paint and finish removers
Waste treatment methods and pollution control:	Methylene chloride removers do not dissolve paint, but releasethe paint from the substrate, so it can easily be filtered and recovered from paint chips and other residue. This allows recovery of the liquid remover and its continued use. This increases the useful life of the remover because the used paint remover can be mixed with fresh remover eliminating the need for disposing of the used remover as a spent solvent (14).
Comments:	The extracted information stated above is not pertinent to trans-1,2 Dichloroethylene, especially the waste treatment methods and pollution control which pertains to Methylene Chloride.

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	Low	The information is for methylene chloride but may apply to a similar chlorinated hydrocarbon like trans-1,2-Dichloroethylene.
Metric 4:	Temporal Representativeness	Low	The report is more than 20 years old.
Metric 5:	Sample Size	N/A	No sample data.
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	No scope to address variability and uncertainty.

Overall Quality Determination Medium

Study Citation:	Boegel, J. V. (1989). Air stripping and steam stripping. :6.107-6.118.
HERO ID:	5475844
Conditions of Use:	Disposal

EXTRACTION

Parameter	**Data**
Description of release source:	Industrial aqueous wastes
Waste treatment methods and pollution control:	WWT; air stripping - limited to aqueous wastes with organics concentration <100 mg/L (pg 4); steam stripping; packed tower air stripper: >99% removal of volatile organics from water; steam stripping: 99% (pg 3)

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 disposal, an in-scope occupational scenario; however data is not specific to chemical (overall efficiency).
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	N/A	N/A - This metric is not applicable to the data being extracted
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	Medium	Variability addressed by discussing different stripping techniques/configurations, but uncertainty is not addressed.

Overall Quality Determination Medium

Study Citation:	CDC, (2009). Fourth national report on human exposure to environmental chemicals.
HERO ID:	664488
Conditions of Use:	Various

EXTRACTION

Parameter	**Data**
Description of release source:	These volatile halogenated solvents may be released into the air from facilities that produce or use them, from contaminated waste water, or from hazardous waste sites... Because of their volatility, these halogenated solvents generally do not persist in soil or water. (pg 487-88)
Comments:	media: air, land, water

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources (CDC).
Domain 2: Representativeness			
	Metric 2: Geographic Scope	High	Data are from the U.S.
	Metric 3: Applicability	High	Data are for various in-scope occupational scenarios.
	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.
	Metric 5: Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination High

Study Citation:	CEPE, (2020). SpERC fact sheet: Industrial application of coatings by spraying.
HERO ID:	10442901
Conditions of Use:	Application of Paints and Coatings

EXTRACTION

Parameter	**Data**
Release or emission factors:	Release factors for industrial spraying indoors of volatiles [PDF Pg. 3]Release factor for air: 95%Release factor for water: 0.00 %Release factor for soil: 0.00 %Release factor for waste: 5%
Release frequency:	225 days/year for typical industry situation of 5 working days a week, shutdown for vacation, and no need for continuous shift. [PDF Pg. 2]
Waste treatment methods and pollution control:	[PDF Pg. 2]80% of solvent inputs are emitted through an incinerator with an efficiency of 99%.

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 Belgium, an OECD country.
Metric 3:	Applicability	High	Data are for application of paints and coatings, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	Report is 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:	CEPE, (2020). SpERC fact sheet: Professional application of coatings and inks by spraying.
HERO ID:	10442902
Conditions of Use:	Application of Paints and Coatings

EXTRACTION

Parameter	**Data**
Release or emission factors:	Release factors for application of spray paint or coating indoors for volatiles [PDF Pg. 2-3]Release factor for air: 97%Release factor for water: 0.00 %Release factor for soil: 0.00 %Release factor for waste: 3%Release factors for application of spray paint or coating outdoors for volatiles [PDF Pg. 2-3]Release factor for air: 98%Release factor for water: 2%Release factor for soil: 0%Release factor for waste: 0%
Waste treatment methods and pollution control:	[PDF Pg. 2]Waste water from equipment cleaning discharges to standard municipal sewage plant.Process waste may be recycled or incinerated by local authority or waste disposal company.

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	Medium	Data are from Belgium, an OECD country.
Metric 3:	Applicability	High	Data are for application of paints and coatings, 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	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:	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:	Aircraft component production/R&D/testing (pg 22) [cleaning and degreasing solvents, pg 88]

EXTRACTION

Parameter	**Data**
Description of release source:	"Fire training burn pit [west end of property, pg 81], salvage yard underground sumps [west, east and northeast of building 23, pg 76-80], former drum storage area [west of building 947, pg 81], storm drain discharge area, building 12 clarifiers and test sump, building 15 utility trenches and sump [and clarifier, pg 75], buidling 14 clarifiers, Building 11 tanks [underground tanks west of building 11, pg 78], building 35 organics sump, underground tank south of buidling 5, underground tanks north of building 12, clarifier south of building 21 (pg 24-25); southwest corner of building 6 (liquid waste neutralization pit), west of building 11 (oil and grease pit area), area north of building 31 and south of runway (engine cleaning pits area), Building 32 Surface Runoff Area, Purged fuel storage area (west of building 45), Temporay drum storage area (building 29), Test site 2 and 3 (pg 73-81) "
Release or emission factors:	pg 98-267 has soil/groundwater sampling results, not emission factors but may be usable (also did not find any area sampling data which was tagged for this source, FT screener may have gotten the soil/water sampling results confused); more groundwater/soil sampling results presented throughout, e.g. App. B
Waste treatment methods and pollution control:	"6-well extraction system" to pump up and treat contaminated groundwater at site via air stripping (pg 22); more detail pg 26-7; pg 379-80 presents data on influent and effluent concentrations for groundwater air stripping, can likely be adapted for other COUs (since groundwater treatment is out of scope); pg 381 says 99.9% effective
Comments:	media: land (groundwater); fugitive air (volatilization)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Report uses high quality data/techniques/methods from frequently-used sources (TSCA submission; references EPA analytical methods for soli/grounderwater sampling analysis).
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for cleaning and degreasing solvents, an in-scope occupational scenario.
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	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).
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 considering multiple remediation/pollution prevention methods for each release source, but uncertainty is not addressed.

Overall Quality Determination — High

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: Foam blowing additive

EXTRACTION

Parameter	**Data**
Description of release source:	The initial bulk of emissions are typically released through process vents located at the foaming equipment, while the remaining 40 percent of emissions are released fugitively while the foam is being transported and stored.
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).

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 is for foam blowing additives, an in-scope occupational scenario however the data is general and not specific to the chemical.
Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old.
Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination High

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:	Counter-current flow diffused aeration: 97% removalAdsorption using Filtrasorb 300 GAC has been studied but no removal efficiencies given.

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	High	Data are for disposal, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	Low	Assessment is based on data greater than 20 years old.
Metric 5:	Sample Size	N/A	N/A - waste treatment methods.
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	N/A - waste treatment methods.

Overall Quality Determination High

Study Citation: Misra, A., Hogan, J. D., Chorush, R. (2002). Trans-1,2-Dichloroethylene; Trans-LC.
HERO ID: 10186803
Conditions of Use: Various

EXTRACTION

Parameter	Data
Waste treatment methods and pollution control:	Burn in a chemical incinerator equipped with and afterburner and scrubber. Obey local, state, and federal regulations. EPA Hazardous Waste Number: D001.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	The assessment or report uses high quality data and/or techniques or soundmethods that are not from a frequently used source and associated information does notindicate flaws or quality issues.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	The data are from the United States
	Metric 3:	Applicability	High	The information provided is general and can be applicable to multiple occupational scenarios.
	Metric 4:	Temporal Representativeness	Low	Report published in 2002, more than 20 years old.
	Metric 5:	Sample Size	N/A	Samples not applicable for extracted data.
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	N/A	Variability and uncertainty not applicable for extracted data.

Overall Quality Determination Medium

Study Citation: NCBI, (2020). PubChem Annotation Record for Trans-1,2-Dichloroethylene.
HERO ID: 9642071
Conditions of Use: All conditions of use.

EXTRACTION

Parameter	Data
Description of release source:	"In a comprehensive survey of wastewater from 4000 industrial and publicly owned treatment works (POTWs) sponsored by theEffluent Guidelines Division of the U.S. EPA, trans-1,2-dichloroethylene was identified in discharges of the following industrial categories (frequency of occurrence; median concentration in ppb): iron and steel mfg (2; 2265.9), organics and plastics (3; 14.6), inorganic chemicals (2; 3.9), rubber processing (2; 19.0), auto and other laundries (1; 60.6), explosives (1; 3.9), electronics (7; 140.7), mechanical products (2; 13.7), transportation equipment (1; 29.3), publicly owned treatment works (63; 16.3)." [PDF Pg. 23]
Waste treatment methods and pollution control:	Product formulations containing Trans-1,2-DCE may be burned in an incinerator. These would include rotary kilns for incineration at a temp range of 820-1600 C, fluidized bed incinerators at a temp range of 450-980 C, or liquid injection incineration at a temp of 650-1600 C. The compound may also be removed from wastewater via air stripping. The compound may be removed from groundwater or drinking water using granular activated carbon in combination with packed tower aeration.
Comments:	Number of release days and release or emission factors are 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 all in-scope occupational scenarios.
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	N/A - disposal methods and description of release source.
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	N/A - disposal methods and description of release source.

Overall Quality Determination High

Study Citation: Oil,, Shell (1982). Tertiary water treatment I. A preliminary assessment of active carbon sorption.
HERO ID: 1441911
Conditions of Use: Disposal: Wastewater treatment

EXTRACTION

Parameter	Data
Waste treatment methods and pollution control:	Filtration/Activated Carbon Technology - lab scale study of plant effluents to study effectiveness. 60-70% effective for TOC in lab-scale studies in first 300 hours (page 38), Strength of adsorption on active carbon is weak for trans-1,2-Dichloroethylene (page 45).

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	High	The report is for an occupational scenario within the scope of the risk evaluation.
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	N/A	No Sample data.
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	N/A	No scope to address variability and uncertainty.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (2010). Toxicological review of cis-1,2-dichloroethylene and trans-1,2-dichloroethylene (CAS nos. cis: 156-592-2: trans- 156-60-5: mixture: 540-59-0). In support of summary information on the Integrated Risk Information System (IRIS).
HERO ID:	1740607
Conditions of Use:	May apply to more than 1 COU

EXTRACTION

Parameter	**Data**
Description of release source:	Exposure to cis- and trans1,2-DCE may occur after the chemicals are released to the environment from industrial emissions, leached from landfills, or evaporated from wastewater streams.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	EPA 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	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	N/A	No sample data.
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	No scope to address variability and uncertainty.

Overall Quality Determination High

Study Citation:	OECD, (2011). Emission scenario document on coating application via spray-painting in the automotive refinishing industry.
HERO ID:	3808976
Conditions of Use:	Urethane coatings (Adhesives and Sealants)

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	54,633,000 total gallons automotive refinish coatings/yr 99,747 - 1,097,457 gallons coating/yr (depending on coating type)
Process description:	Repair/replace automotive surface, initial wash (water/detergent and/or solvent), sanding (dry or wet), mixing of primer coatings, spray paint (multiple layers of primer), curing/drying each layer, sanding (dry or wet), solvent wipe-down, mixing of each coating (basecoat and clearcoat), spray paint (multiple layes of basecoat and clearcoat), curing/drying each layer
Throughput:	0.25-12 gal coating/site-day, depending on number of jobs Also provides method for adjsuting the use rate based on the type of coating product used
Number of sites:	36,296
Chemical concentration:	15-25%

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	Low	Assessment is based on data greater than 20 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	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 coating types.

Overall Quality Determination High

Study Citation:	OECD, (2009). Emission scenario documents on coating industry (paints, lacquers and varnishes).
HERO ID:	3827298
Conditions of Use:	Processing and Use: Formulation of Coatings and Use of Coatings

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	3.2 million tonnes coating/yr
Process description:	PROC: Dispersion, milling, finishing, filling USE: Application via roller/brush, air spray systems, airless and air-assissted airless spray systems, electrostatic spray, electrodeposition/electrocoating and autodeposition, dip coating, flow and curtain coating, roll coating, and supercritical carbon dioxide coating systems
Throughput:	0.62-9.0 l/vehicle (auto refinishing); 1.1-5.1 g coating/can (metal can coating sites)
Number of sites:	60,330 automotive application sites; 33 metal coating application sites
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 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	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 chemical functions and coating types.

Overall Quality Determination — High

Study Citation:	OECD, (2009). Emission scenario document on adhesive formulation.
HERO ID:	3827299
Conditions of Use:	Processing: Adhesives and sealants

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	15.8-4,990 million kg adhesive/yr
Process description:	Unloading raw materials from containers into mixing vessel, mixing, packaging/on-site storage
Throughput:	Provides methodology for estimating throughput based on the amount of adhesive produced, and the concentration of the chemical in the adhesive
Number of sites:	Provides methodology for estimating number of sites based on chemical PV, the adhesive use rate, and the concentration of the chemical in the adhesive formulation
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 an in-scope occupational scenario; 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 various chemical functions and types of adhesives.

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:	Industrial Use: Adhesives and sealants

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	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 an in-scope occupational scenario; 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 various chemical functions, types of adhesives, and end use markets.

Overall Quality Determination High

Study Citation:	OECD, (2010). Emission scenario document on formulation of radiation curable coatings, inks and adhesives.
HERO ID:	3840003
Conditions of Use:	Formulation of Coatings, inks, and adhesives

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	0.7-69.87 million kg coating/ink/adhesive/yr (this is on a per use base and not a cumulative amount, see Table 3-2)
Process description:	Preheating (optional), Unloading raw materials from containers into mixing kettle, mixing, filtering, packaging
Throughput:	Provides methodology for estimating throughput based on the amount of product produced, and the concentration of the chemical in the formulation
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 formulation
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 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 various chemical functions and types of UV curable products.

Overall Quality Determination High

Study Citation:	OECD, (2010). Emission scenario document on chemicals used in the electronics industry.
HERO ID:	5079083
Conditions of Use:	Processing & Use: Electronics

EXTRACTION

Parameter	**Data**
Process description:	Provides process descriptions for manufacture of componenets and associated processes (e.g., laminates, photo-lithography, ethcing, solvents, spin coating, vapor deposition, solder, cleaning), assembly and associated processes, service life, and recovery
Number of sites:	18,000 sites in EU

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	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 operations, chemical functions, and facility sizes.

Overall Quality Determination — High

Study Citation:	OECD, (2011). Emission scenario document on the chemical industry.
HERO ID:	6306753
Conditions of Use:	Manufacture, processing, use

EXTRACTION

Parameter	**Data**
Process description:	General synthesis process consists of reaction, handling/transportation, isolation, handling/transportation, purification, handling/transportation, then either reaction to make another chemical or on to the next life cycle stage

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 are for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
	Metric 4:	Temporal Representativeness	Low	Assessment from 2011 but is based on data greater than 20 years old.
	Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted (process description only)
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	N/A - This metric is not applicable to the data being extracted (process description only)

Overall Quality Determination Medium

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

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	UK: 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 recylcing/cleaning or disporal 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 mostly 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:	OECD, (2015). Emission scenario document (ESD) on industrial use of industrial cleaners.
HERO ID:	6414932
Conditions of Use:	Solvents (for cleaning and degreasing)

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	1-12,961 tonne/yr (Japan)
Process description:	Provides descriptions for a variety of cleaning methods including ultrasonic, jet washing, oscillate (rotate) washing, mechanical vibration stirring, bubble washing, reduced pressure (vacuum) washing, jet (spray, shower) washing, steam washing
Chemical concentration:	Provides conc. estimates based on type of cleaner, 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	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	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 cleaner types

Overall Quality Determination — High

Study Citation:	U.S. EPA, (2002). Flexographic ink options: A cleaner technologies substitutes assessment. Volume 1.
HERO ID:	10293388
Conditions of Use:	Carrier solvent in adhesives, coatings, inks, lubricants, and silicones

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	Despite the small size of most individual flexographic printing companies, the industry overall used more than 513 million pounds of ink in 2000.
Process description:	Solvents are important in delivering the ink to the substrate. The solvent allows the ink to flow through the printing mechanism, and then evaporates so that the ink forms a solid coating on the substrate. Typically, inks are manufactured and transported in a concentrated form, and the printer must add solvent to the ink to attain the desired viscosity. A solvent must display several important characteristics. It must adequately disperse or dissolve the solid components of the ink, but must not react with the ink or with any part of the press. It must dry quickly and thoroughly, and have low odor. Finally, it is desirable for the solvent to have minimal flammability and toxicity concerns.
Number of sites:	The last Census recorded 914 commercial printing establishments in which flexographic printing was the primary print process.

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	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 but data is general and not specific to the chemical.
Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old.
Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A - This metric is not applicable to the data being extracted

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:	Laboratory Chemicals

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	Provides methodology to estimate annual use rate.
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:	255 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:	Table B-1 presents PMN data on repackaging rate in kg chemical/site-yr.
Process description:	Pre-manufacture notices (PMN) submitted from 2010 to 2020 under EPA's New Chemicals Program indicated imported and repackaged chemicals can be solids or liquids and may be neat or in solutions/mixtures and contained in various packaging types. After they arrive at the repackaging site, repackaging operations occur where the chemical is transferred from the transport container it was imported in to a new one of a different size in order to meet the customer's needs (JACO, 2021). Chemicals may also be transferred from original containers to intermediate storage containers before packaging into smaller containers (Cooke, 2013; NIOSH, 2009). Chemicals are expected to be received at repackaging sites in drums or larger bulk containers (supersacks, totes, tank trucks, etc.) (Cooke, 2013; NIOSH, 2009). The chemical of interest may be received in its final formulation and transferred directly from these large containers into smaller containers, charged to a temporary storage tank, or it may be charged to a mixing tank and diluted or mixed with other chemicals before it is repackaged. Once the chemical has been formulated to desired specifications, it can be repackaged. Workers may be potentially exposed during the unloading of chemicals from the original transport containers into temporary storage or new transport containers. Releases of chemicals may also occur during this stage, from open container surfaces (e.g., if the chemical is volatile), transfer operations (e.g., if the chemical is volatile or a powder), and original transport container disposal.Repackaging operations for liquid chemicals typically involve pouring or pumping the product from the original containers or mixing /storage tanks into the new containers. A study conducted by the Health and Safety Laboratory in the U.K. investigated two chemical repackaging sites (Cooke, 2013). At both of these sites the chemical was delivered to the site by road tanker and pumped into dedicated storage tanks. One of the sites, a hydrazine supplier, pumped the hydrazine into a mixing vessel where it was diluted with water and packaged into smaller containers for sale to customers. At the other site, trichloroethylene was pumped from storage tanks into a closed loop system where workers using a hydraulic lance connected to a semi-automated filling system transferred the chemical into new containers (Cooke, 2013). The usual process for repackaging solid chemicals differs from the processes for liquids. A NIOSH Health Hazard Evaluation Report (HHE) from 2009 investigated a repackaging facility that was transferring bulk shipments of silane-coated glass beads ranging between 0.2 – 1.2mm in diameter. At this facility, 2,200 lb supersacks of the product are lifted with a forklift over a metal bin, then cutting the bottom of the container with a knife to empty the beads into the bin. The metal bin is then lifted by a forklift, and the glass beads are poured into hoppers. From the hoppers the beads are gravity fed into smaller cardboard boxes or paper sacks that are shipped to customers (NIOSH, 2009). Workers may be potentially exposed during the transfer of chemicals from temporary storage into new transport containers. Releases of chemicals may also occur during this stage from open container surfaces (e.g., if the chemical is volatile), transfer operations (e.g., if the chemical is volatile or a powder), and cleaning any equipment that was used in during the process.
Number of sites:	Table 1-2 presents the number of repackaging sites based on 2019 U.S. Census data.
Chemical concentration:	A fraction of completed IRERs from 2010-2020 were reviewed, 21 submissions contained information on chemical repackaging. In these submissions, chemicals were repackaged at concentrations ranging from 1% to 100%, with a 50th percentile of 93%, a 95th percentile of 100%, and a mode of 100%.

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 are for an in-scope occupational scenario; however, data is general and not specific to a chemical.
Metric 4:	Temporal Representativeness	Medium	Assessment 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.

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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

			EVALUATION	
Domain		Metric	Rating	Comments
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized (discrete use amounts provided).
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 repackaging facilities.

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:	Plastics compounding

EXTRACTION

Parameter	**Data**
Process description:	Polymer pellets/resins received, blending/compounding into masterbatch, extrusion/shaping, packaging.
Throughput:	Provides methodology for estimating throughput based on the amount of plastic produced, and the concentration of the chemical additive in the plastic.
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.
Chemical concentration:	Provides conc. estimates based on additive function in various plastics, not chemical specific.
Comments:	This generic scenario will address compounding operations. Polymer manufacturing will not be included in this scenario.

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	High	Data are for plastics compounding which is in-scope or similar to an in-scope occupational scenario.
	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, (2003). Transportation equipment cleaning - Generic scenario for estimating occupational exposures and environmental releases (draft).
HERO ID:	6385708
Conditions of Use:	Disposal

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	EPA estimates 500,000 IBCs are cleaned annually in the United States. Of this amount, EPA believes 225,000 IBCs are cleaned by Transportation Equipment Cleaning facilities. The remaining 275,000 IBCs are cleaned by drum reconditioning facilities.
Process description:	Cleaning process generally include reviewing manifests, draining the tank heel, rinsing, washing or using material-specific cleaning methods, rinsing a second time, and drying. Cleaning processes vary between facilities depending on the available cleaning equipment and the commodities last transported in the tanks to be cleaned.
Throughput:	IBCs are portable plastic and metal containers with 450 liters (199 gallons) to 3,000 liters (793 gallons) capacity. Cleaning time for tank barges typically ranges from four to eight hours. On average, tank trucks, IBCs, or intermodal tank containers requires two hours for cleaning.

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 are for multiple in-scope occupational scenarios; however, data is general and not specific to a chemical.
	Metric 4:	Temporal Representativeness	Medium	Assessment 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.
	Metric 5:	Sample Size	Medium	Sample distributions characterized by ranges/estimations with uncertain statistics.
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	Medium	Uncertainty not addressed. Variability addressed by considering multiple container types and cleaning methods.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2014). Use of additives in the thermoplastic converting industry - generic scenario for estimating occupational exposures and environmental releases.
HERO ID:	6385711
Conditions of Use:	Extraction solvent for thermoplastics

EXTRACTION

Parameter	**Data**
Process description:	Compounded resins received, unloaded, forming/molding/shaping, trimming, finishing (including coating operations).
Throughput:	Provides methodology for estimating throughput based on the amount of plastic produced, and the concentration of the chemical additive in the plastic.
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. 137(average)-254 days/yr
Chemical concentration:	Provides conc. estimates based on additive function in various plastics, 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 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	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, (2004). Spray coatings in the furniture industry - generic scenario for estimating occupational exposures and environmental releases: Draft.
HERO ID:	6385719
Conditions of Use:	Industrial/Commercial Use: Urethane coatings

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	Metal: 5,000-446,600 L coating/yrWood: 4,326-4,372 L coating/yr
Process description:	Metal furniture: Metal cleaning, coating unloaded, coating mixing, coating application (spray booth, manual or automatic), flash-off, drying oven Wood furniture: coating unloaded, coating mixing, coating application (spray booth, manual or automatic), flash-off, drying oven, sanding and other finishing operations
Throughput:	250 days/yr. Metal: 20-1,786 L coating/dayWood: 17.3-17.4 L coating/day
Number of sites:	152-8,176
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 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	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 various chemical functions and wood vs metal furniture uses.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2014). Use of additive in plastic compounding - generic scenario for estimating occupational exposures and environmental releases: Draft.
HERO ID:	6385748
Conditions of Use:	Plastics Compounding

EXTRACTION

Parameter	**Data**
Process description:	Polymer pellets/resins received, blending/compounding into masterbatch, extrusion/shaping, packaging
Throughput:	Provides methodology for estimating throughput based on the amount of plastic produced, and the concentration of the chemical additive in the plastic
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
Chemical concentration:	Provides conc. estimates based on additive function in various plastics, not chemical specific.
Comments:	148-264 operating days/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	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	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, (2004). Additives in plastics processing (converting into finished products) -generic scenario for estimating occupational exposures and environmental releases. Draft.
HERO ID:	6549571
Conditions of Use:	Additives in Plastics Processing (Converting into Finished Products)

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	Table 2 presents the types of thermoplastic resins, common uses, and 2003 production volume.
Life cycle description:	The plastic manufacturing industry can be divided into four sections: polymer manufacturing, compounding, converting, and "in-house" manufacturing. This generic scenario will address converting operations. Polymer manufacturing will not be included in this scenario. Compounders produce masterbatches of plastic resins with specific properties by blending the polymer (resin), additives, fillers, and reinforcements. Converters receive the masterbatch of plastic resin from compounders and form finished plastic products. Compounding and converting may take place as the same facility ("in-house" manufacturing) or at separate facilities. This scenario assumes that compounding and converting take place at separate facilities; therefore, in-house manufacturing is not covered in this scenario.
Process description:	Various plastic processing operation descriptions are provided in Table 5, and a Process Diagram is provided on PDF pg. 10. More generally, polymer resin is received at the compounding sites from the resin manufacturer in the form of pellets. A compounding site blends the resin and additives to produce a masterbatch. The converting site then processes the masterbatch by shaping the plastic into the desired form for the final plastic product. The blending and forming may take place at the same facility ("in house" manufacturing) or separate facilities. As a conservative estimate, it is assumed that the compounding of the plastic resin and the converting of the resin into plastic products take place at separate facilities. Therefore, in-house manufacturing is not covered in this scenario. After shaping, finishing operations such as filing, grinding, sanding, polishing, painting, bonding, coating, engraving etc. are performed to complete the finished plastic product. This scenario covers the converting of plastic resins into finished products.
Throughput:	Daily use rate = amount of resin / # converting sites / days of operation x fraction of additive x fraction of chemical in additive
Number of sites:	Overall, there were 12,191 Plastic Product Manufacturing establishments in 2001. Table 1 provides Number of Establishments for subcategories of NAICS 3261 Plastic Product Manufacturing.
Chemical concentration:	Default values used to represent the weight fraction of various additives in plastic resin range from 0.001 - 0.5. These values are provided in Table 2 and Table 3.

EVALUATION

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The assessment uses high quality data that are from a frequently used source 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 assessment is for an occupational scenario within the scope of the risk evaluation. However, data is not chemical specific.
	Metric 4:	Temporal Representativeness	Low	Data are greater 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				

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Study Citation:	U.S. EPA, (2004). Additives in plastics processing (converting into finished products) -generic scenario for estimating occupational exposures and environmental releases. Draft.
HERO ID:	6549571
Conditions of Use:	Additives in Plastics Processing (Converting into Finished Products)

			EVALUATION	
Domain		Metric	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	Variability is addressed by evaluation of various plastic processing operations, as well as various additive fractions. However, uncertainty associated with data are not characterized.
Overall Quality Determination			**High**	

Study Citation:	U.S. EPA, (2021). Application of spray polyurethane foam insulation - Generic scenario for estimating occupational exposures and environmental releases - Final.
HERO ID:	8674805
Conditions of Use:	Blowing agent

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	365 million lbs of 2-component spray foam/yr and 55 million lbs of 1-component spray foam/yr.
Process description:	pre-spraying activities, SPF application, trimming, cleanup, chemical transfers, maintenance activities.

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 is for an in-scope occupational scenario; 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	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	Medium	Uncertainty not addressed. Variability addressed by considering one- and two-component foams.

Overall Quality Determination — High

Study Citation:	3M, (2012). [Redacted] Air monitoring for the Novec fluids in Building 236 B173.
HERO ID:	10610701
Conditions of Use:	Vapor Degreasing

EXTRACTION

Parameter	**Data**
Chemical concentration:	[PDF Pg. 4] 3M Novec 72DA fluid (66-70% 1,2-trans-dichloroethylene)

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 vapor degreasing, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Report is no more than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by a range.
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:	3M, (2019). Comment submitted by Jonathan M. Gerber, Advanced Regulatory Specialist, Sustainability & Product Stewardship, 3M on initiation of prioritization under the Toxic Substances Control Act (TSCA).
HERO ID:	6305348
Conditions of Use:	Vapor Degreasing

EXTRACTION

Parameter	**Data**
Process description:	PDF Pg. 2In a typical vapor degreasing operation, parts to be cleaned areimmersed in a continuously filtered and distilled fluid to dissolve contaminants (e.g., oils, greases, silicones, particulates, waxes, and/or flux) from the part surface. After cleaning, the parts typically undergo a brief vapor rinse and drying process, where the fluid condenses back into the vapor degreaser for reuse. The dried parts are then removed from the degreaser. Vapor degreasers are commonly employed to clean mechanical and electronic parts with complex geometries, to clean high numbers of parts rapidly, and/or to clean parts that require a low-temperature drying process. Precision cleaning can also be effected through immersion, hand-wipe application, and spraying with the t-DCE containing fluids.
Chemical concentration:	PDF Pg. 13M Novec 71DE Engineered Fluid (~50 wt.% t-DCE)3M Novec 71DA Engineered Fluid (~45 wt.% t-DCE)3M Novec 72DE Engineered Fluid (~70 wt.% t-DCE)3M Novec 72DA Engineered Fluid (~68 wt.% t-DCE)3M Novec 73DE Engineered Fluid (~85 wt.% t-DCE)3M Novec 72FL Engineered Fluid (~20 wt.% t-DCE, non-azeotropic mixture)3MTm NOVeCTM 71D90 Engineered Fluid (~90 wt.% t-DCE, non-azeotropicmixture)

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 vapor degreasing, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	The report is less than 10 years old and the products and processes are expected to be representative of current conditions.
	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	Medium	Variability addressed by describing trans-1,2-DCE concentrations in multiple products but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	3M, (2019). Comment submitted by Jonathan M. Gerber, Advanced Regulatory Specialist, Sustainability & Product Stewardship, 3M on initiation of prioritization under the Toxic Substances Control Act (TSCA).
HERO ID:	6305348
Conditions of Use:	Commercial Aerosol Products

EXTRACTION

Parameter	**Data**
Process description:	PDF Pg. 23M also offers four (4) aerosol-formatted industrial cleaning products which also include t-DCE and HFEs (and optionally othersolvents and components). These aerosol-formatted products are typically used in sensitive electronic and electrical cleaning applications, and for example, can be used to clean printed circuit boards, electrical contacts, relays, and switches, electromechanical devices, as well provide for solder cleaning, flux removal, and degreasing. The aerosol-formatted products include —95 wt.% combined solvent, a portion of which is tDCE.
Chemical concentration:	PDF Pg. 33M Novec Contact Cleaner / Lubricant (15-25 wt.% t-DCE)3M Novec Contact Cleaner Plus (15-24 wt.% t-DCE)3M Novec Flux Remover (55-70 wt.% t-DCE)3M Novec Electronic Degreaser (65-75 wt.% t-DCE)

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 commercial aerosol 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	Medium	Product concentrations are described by a range.
Domain 3: Accessibility/ Clarity			
	Metric 6: Metadata Completeness	Low	The underlying methods are not fully transparent.
Domain 4: Variability and Uncertainty			
	Metric 7: Metadata Completeness	Medium	Variability addressed by describing trans-1,2-DCE concentrations in multiple products but uncertainty is not addressed.

Overall Quality Determination — High

Study Citation:	Andersen, R., Kaiser, R. (1996). Replacement of CFC-113 by HFE-71DE azeotrope in missile control hardware cleaning operations. :717.
HERO ID:	5436279
Conditions of Use:	Solvent degreasing

EXTRACTION

Parameter	**Data**
Process description:	various details throughout
Chemical concentration:	25-55% DCE (pg 11)

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 solvent degreasing, an in-scope occupational scenario.
	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	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination High

Study Citation:	ATSDR, (1996). Toxicological profile for 1,2-dichloroethene.
HERO ID:	723873
Conditions of Use:	Manufacture

EXTRACTION

Parameter	**Data**
Process description:	1,2-Dichloroethene has been produced as a commercial end product by the direct chlorination of acetylene at about 40 °C or by a technique involving the dehydrochlorination of l,l,2trichloroethane at 500 °C (HSDB 1995). Such commercial preparations are mixtures of cis- and trans-l,2dichloroethene. The trans isomer is preferred in most industrial applications, which has tended to limit sales of the commercially available mixtures (HSDB 1995). 1,2-Dichloroethene is highly flammable and extremely corrosive, and yields the explosive compound chloroacetylene in the presence of copper or heated alkaline solutions.
Number of sites:	12

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	The data are from the United States and are representative of the industry being evaluated.
Metric 3:	Applicability	High	Data are for manufacturing, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old.
Metric 5:	Sample Size	N/A	N/A - process description info.
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	N/A - process description info.

Overall Quality Determination High

Study Citation:	Bardole, J., White, D. (2000). Paint and finish removers.
HERO ID:	6304163
Conditions of Use:	The COU is paint, coating and finish remover. This COU is not stated in the Scope Document.

EXTRACTION

Parameter	**Data**
Process description:	The term finish denotes the final process of manufacturing. Finishing operationsinclude addition of clear coat polymers such as varnishes or lacquers, painting,plating, anodizing, phosphatizing, galvanizing, and blueing, all of which takeplace at the terminal point of manufacturing. Finishing is defined as the process ofcoating or treating a surface for the purpose of protecting and/or decorating theproduct (1). The useful life of an object may be greater than the life of the finish.This results in an opportunity to remove and replace the finish. An organic orinorganic chemical solution or a mechanical process such as media blasting maybe used to lift or remove the finish.Antiques, household furniture, kitchen cabinets, pianos, aircraft, and buildings can have their useful life extended by removing the old coating and applying anew one. Original equipment manufacturers (OEMs) may remove coatings fromrejected parts to avoid scrapping the items. Removers are used to remove leadpaint from woodwork, windows, or entire buildings to reduce the risk of humanexposure to lead.Current formulas include approximately five classes of ingredients. These many include chlorinated hydrocarbons such as methylene chloride [75-09-2] or 1,2-dichloroethylene [156-60-5].

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	Medium	The report is for an occupational scenario that is NOT stated in 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	Process Description.
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	Process Description.

Overall Quality Determination High

Study Citation:	Belpoggi, F., Chiozzotto, D., Lauriola, M. (2012). Unsaturated halogenated hydrocarbons. :129-229.
HERO ID:	4332198
Conditions of Use:	Manufacturing

EXTRACTION

Parameter	**Data**
Process description:	1,2-DCE is synthesized by direct chlorination of acetylene at 40 C, by dehydrochlorination of 1,1,2-trichloroethane at 500 C, and by reduction of 1,1,2,2-tetrachloroethane with steam over an iron catalyst. The trans-isomer is separated from the mixture through fractional distillation.

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	High	Data are for manufacturing, 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	N/A - This metric is not applicable to the data being extracted
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 - This metric is not applicable to the data being extracted

Overall Quality Determination High

Study Citation:	Burgess, W. A. (1991). Potential exposures in the manufacturing industry—Their recognition and control. :595-674.
HERO ID:	1267867
Conditions of Use:	Vapor Degreasing

EXTRACTION

Parameter	**Data**
Process description:	Individual workpiece or racks of small parts to be cleaned are lowered into the hot vapor, the vapor condenses on the cold parts and the surface oils and greases are dissolved by the solvent. This oily condensate drops back into the liquid solvent sump at the base of the tank. The solvent is evaporated continuously to replace the condensed vapor and maintain the vapor blanket. Since the oils are not vaporized, they form a sludge in the bottom of the tank which must be removed periodically. (Other types of vapor degreasing also covered on PDF Pg. 7).

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 vapor degreasing, which is an in-scope occupational scenario; however, the data are not specific to this chemical.
	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	N/A	N/A - process description
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	N/A	N/A - process description

Overall Quality Determination Medium

Study Citation:	CEPE, (2020). SpERC fact sheet: Industrial application of coatings by spraying.
HERO ID:	10442901
Conditions of Use:	Application of Paints and Coatings

EXTRACTION

Parameter	**Data**
Throughput:	Substance use rate for any one substance based on sector knowledge is a maximum of 1000 kg product/day at any one location. [PDF Pg. 2]Maximum daily use of organic solvent/coalescent is 450 kg/day. [PDF Pg. 2]

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 Belgium, an OECD country.
	Metric 3: Applicability	High	Data are for application of paints and coatings, an in-scope occupational scenario.
	Metric 4: Temporal Representativeness	High	Report is 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:	CEPE, (2020). SpERC fact sheet: Professional application of coatings and inks by spraying.
HERO ID:	10442902
Conditions of Use:	Application of Paints and Coatings

EXTRACTION

Parameter	**Data**
Throughput:	Substance use rate for any one substance based on sector knowledge is a maximum of 100 kg product/day at any one location. [PDF Pg. 2]Maximum daily use of organic solvent/coalescent is 45 kg/day. [PDF Pg. 2]

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	Medium	Data are from Belgium, an OECD country.
	Metric 3: Applicability	High	Data are for application of paints and coatings, 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	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:	DeBusk, D., Lagendijk, A., Porter, C. (1995). Investigating a trans-dichloroethylene vapor cleaning process. Micro 13(8):39-43.
HERO ID:	5433791
Conditions of Use:	Solvent Vapor Degreasing

EXTRACTION

Parameter	**Data**
Process description:	Experimental process to use t-DCE as a solvent in vapor cleaning to remove organics and 3-D transition metals from semiconductor wafer surfaces. Nitrogen, oxygen, and t-DCE are heated and mixed to 700-800C and then reacted over the wafer, with the t-DCE donating the chlorine to the cleaning process. Performed in a small vertical thermal reactor.
Comments:	Experimental Procedure

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	High	The report is for an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	Low	Report is more than 20 years old.
	Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination Medium

Study Citation: Dickinson,, Becton (2023). Becton Dickinson usage of tDCE.
HERO ID: 11327998
Conditions of Use: Cleaning and degreasing

EXTRACTION

Parameter	Data
Production, import, or use volume:	Site #1: 60kg/yr Novec 71DA used.Site #2: 25 gal/yr Novec 71DA used.Site #3: Prior to spin-off, while used as a lube carrier, average annual Next 3000 usage was approximately 62,200 pounds. Currently, the site estimated average annual usage is 1,000 pounds per year.Site #4: Approximately 14 55-gallon drums of HFE72DE a year and five 5-gallon containers of HFE71DE a year.
Process description:	Site #1 (Novec 71DA)Novec 71DA is used in the Lube Lab, where it is used to clean thereaction vessel between making batches of hypodermic needlelube. Novec 71DA comes in a one-gallon container and isdispensed into a supply wash bottle the wash bottle with thecleaner is applied to the walls of the glass reactor at the end ofeach batch. The process is done using local exhaust ventilation inthe Lube Lab. The solvent is kept in a sealed container within acabinet of the laboratory when not in use.Site #2 (Novec 71DA)The chemical is used in the Quality Testing Laboratory to extractsilicone lubricant from syringe barrels to validate the amount ofthe lubricant applied to the barrel. The extraction solvent ofconcern is used as a quality control measure to remove excesssilicon from medical syringes which may have been le duringthe manufacturing process. The solvent is kept in a sealedcontainer within a cabinet of the laboratory when not in use.During quality control testing the solvent container istransferred by the operating technician to a fume hood and thesolvent is poured into a glass beaker. A pipet is used to transfer asmall amount of the solvent into the glass syringes. The syringesare then placed on a vibrator to distribute the solventthroughout the syringe with the excess solvent poured into asmall metal tray. This process is repeated with several syringesets throughout the day. Once completed, the metal trays areplaced under a heat lamp within the fume hood for 30 minutesto evaporate the excess solvent. Any solvent remaining in thebeaker at the end of the testing is poured back into the solventcontainer. This process can take between 30 to 60 minutes perset and four or five sets are done by an employee each shift.The fume hood flow rate is tested once a week with the sashfully open and with the sash at operating height.Site #3 (Novec 71DA/Next 3000)BD spun-off a portion of its Holdrege operations into a separateindependent publicly traded company called embecta.Prior to spin-off, Next 3000 was primarily used as a lube carrier,and had a secondary use as a cleaner. A lube mixture was madeof Next 3000 and other chemicals utilizing a mechanical mixerand pump. Following mechanical mixing, the lube mix waspumped into 5-gallon buckets and utilized in insulin syringeassembly as a lube carrier. Prior to Next 3000, the site utilized3M Novec 71DA. The transition from Novec to Next 3000 isestimated to have begun in 2017 and was completed in2019/2020. Operators and setups would also use the solventwith paper towels or other absorbent material to cleanequipment.Following spin-off, Next 3000 is used by the site solely as acleaner to remove buildup, typically from eclipse needleassembly racks. In eclipse assembly, cannula is affixed to hubsutilizing an adhesive. The hubs and cannula are held by racks.Over time, adhesive and other buildup on racks needs to becleaned. An ultrasonic cleaner, containing approximately twogallons of Next 3000 is the solvent used to clean racks.Site #4 (HFE-72DE/HFE 71DE)The Glens Falls, NY site uses HFE-72DE and HFE-71DE containing trans -1,2 dichloroethylene in Rival Lifestream production, in the Spring Guides Ultrasonic cleaner, and in the Port manufacturing process. Rival Lifestream: uses the HFE-72DE and small amounts of HFE-71DE to soak their silastic in prior to use in the production of the Lifestream product. Small amounts used (2-6 oz.). The team is looking for a replacement for the HFE71DE.Spring guides: The ultrasonic cleaners use the HFE-72DE for “degreasing” the spring guides (metal springs). The ultrasonic cleaner BOUC35-50 holds 82 gallons, and the BOUC15-50 holds 55 gallons of HFE. Approximately once a week HFE is added to the ultrasonic cleaners. The units are enclosed, so minimal evaporation occurs. Use is approximately 12 drums in a year.Ports: The HFE72DE is used to clean stainless steel and platinum parts. Use is less than 55 gallons for the year. The site is looking for replacement for the HFE72DE.
Chemical concentration:	Novec 71DA – 42 to 46% DCENovec 72DE – 68 to 72% DCENext 3000 – 25 to 50% DCE

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 US.
Metric 3:	Applicability	High	Data are for cleaning and degreasing, an in-scope occupational scenario.

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Study Citation: Dickinson,, Becton (2023). Becton Dickinson usage of tDCE.
HERO ID: 11327998
Conditions of Use: Cleaning and degreasing

			EVALUATION	
Domain		Metric	Rating	Comments
	Metric 4:	Temporal Representativeness	High	Report 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.
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 describing product use at 4 sites but uncertainty is not addressed.

Overall Quality Determination — High

Study Citation:	Dow Chemical, (1988). Mortality among Dow Chemical employees of a Texas operations per-tet manufacturing plant with cover letter dated 050389.
HERO ID:	1441931
Conditions of Use:	Processing as an intermediate

EXTRACTION

Parameter	**Data**
Process description:	The Per-Tet production plant was built in 1944. It produces carbon tetrachloride (CC4), percllloroethylene (PCE) and hydrochloric acid. Feedstocks for the Per-Tet thermochlorination reaction, excluding chlorine, consist of by-:product streams from other chlorinated hydrocarbon production units in Texas Operations (Table 1). While process changes have been few, the sources of feedstock have differed. The major feedstock has been propylene dichloride (PDC). Crude PDC was piped to a PDC Finishing Unit where heavy and light contaminants were removed by distillation. The finished PDC was then fed to the Per-Tet process;' (p. 7) trans-dichloroethylene mentioned on p. 17 as a feedstock.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Report appears to use high quality techniques/sound methods and was submitted to EPA by a company.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for processing as an intermediate, an in-scope occupational scenario.
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	N/A	N/A - no sample data
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 - Process description

Overall Quality Determination High

Study Citation:	Dreher, E. L., Beutel, K. K., Myers, J. D., Lübbe, T., Krieger, S., Pottenger, L. H. (2014). Chloroethanes and chloroethylenes. :1-81.
HERO ID:	4293766
Conditions of Use:	MFG

EXTRACTION

Parameter	**Data**
Process description:	Basic feedstocks for the production of chlorinated ethanes and ethylenes are ethane or ethylene and chlorine. HCl can be used as a chlorine source when oxychlorination or acetylene hydrochlorination are employed (Fig. 2). The availability of ethane and propane from natural gas and ethylene from naphtha feedstocks has shifted the production of chlorinated C2 hydrocarbons in the Western World from the old carbide–acetylene–vinyl chloride route toward the ethylene route since World War II. The use of ethanol derived from biomass as a starting material has become of interest to reduce the carbon dioxide footprint. Ethanol can be produced from syngas derived from coal gasification with subsequent catalytical dehydration of ethanol to ethylene... Because chlorine is usually needed as a second feedstock, most plants producing chlorinated hydrocarbons are connected to a chloralkali electrolysis unit. The chlorine value of the hydrogen chloride produced as a byproduct in most chlorination processes can be recovered by oxychlorination techniques, hydrochlorination reactions (for synthesis of methyl and ethyl chloride) or, less economically, by aqueous HCl electrolysis. A minor but highly valuable outlet is ultrapure-grade anhydrous HCl used for etching in the electronic industry. (pg 3-4)More detail pg 44

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. and other OECD countries.
	Metric 3:	Applicability	High	Data are for MFG, 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	N/A - This metric is not applicable to the data being extracted
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	N/A	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination — High

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: Foam blowing additive

EXTRACTION

Parameter	**Data**
Process description:	In expanded polystyrene (EPS) bead manufacturing, the blowing agent is typically contained in the raw polymer beads as they come from the supplier. This causes the beads to expand when exposed to heat. There are three general classes of emissions from this type of foam production: manufacturing emissions; prompt foam cell losses, which are losses that typically occur during storage and shipping; and banked emissions, which are losses that occur through slow diffusion of blowing agents out of the foam over the life of the product (EPA, 1990).

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 foam blowing additives, an in-scope occupational scenario, however data is general and not specific to the chemical.
	Metric 4: Temporal Representativeness	Low	Report is based on data greater than 20 years old.
	Metric 5: Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination High

Study Citation:	Galan, O., Gomes, V. G., Romagnoli, J., Ngian, K. F. (2009). Selective oxidation of ethylene in an industrial packed-bed reactor: Modelling, analysis and optimization. International Journal of Chemical Reactor Engineering 7(1):A32-A32.
HERO ID:	5433750
Conditions of Use:	Oxidation/Reducing Agent

EXTRACTION

Parameter	**Data**
Process description:	Description of an experimental use of DCE as a low concentration (PPM) additive to reactors performing selective oxidation of ethylene to enhance selectivity. It does not appear that this process exists beyond model or bench scale. (pg. 2/3)

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	Medium	Data are from Australia, an OECD country.
	Metric 3:	Applicability	Medium	Data are for use as a oxidation/reducing agent, which is similar to the in-scope occupational scenario chemical intermediate use.
	Metric 4:	Temporal Representativeness	Low	Report is based on industry conditions that are not expected to be in use.
	Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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:	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:	Manufacture

EXTRACTION

Parameter	**Data**
Process description:	A general schematic of industrial solvent manufacturing is shown on PDF Pg. 18.

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, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old.
	Metric 5:	Sample Size	N/A	N/A - 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	N/A - process description.

Overall Quality Determination High

Study Citation:	Mertens, J. A. (2000). Dichloroethylene.
HERO ID:	5348036
Conditions of Use:	Manufacture

EXTRACTION

Parameter	**Data**
Process description:	1,2-Dichloroethylene can be produced by direct chlorination of acetylene at 40°C. It is often produced as a by-product in the chlorination of chlorinated compounds (2) and recycled as an intermediate for the synthesis of more useful chlorinated ethylenes (3). 1,2-Dichloroethylene can be formed by continuous oxychlorination of ethylene by use of a cupric chloride–potassium chloride catalyst, as the first step in the manufacture of vinyl chloride [75-01-4] (4).

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	The data are from the United States and are representative of the industry being evaluated.
	Metric 3: Applicability	High	Data are for manufacturing, an in-scope occupational scenario.
	Metric 4: Temporal Representativeness	Low	Report is based on data greater than 20 years old.
	Metric 5: Sample Size	N/A	N/A - process description info.
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 info.

Overall Quality Determination High

Study Citation:	NCBI, (2020). PubChem Annotation Record for Trans-1,2-Dichloroethylene.
HERO ID:	9642071
Conditions of Use:	Manufacture

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	US production rates of Trans-1,2-DCE:1986: 10,000 - 500,000 lbs1990: >1,000,000 - 10,000,000 lbs1994: >1,000,000 - 10,000,000 lbs1998: 10,000 - 500,000 lbs2002: >1,000,000 - 10,000,000 lbs
Life cycle description:	"trans-1,2-Dichloroethylene is used in refrigerants and in solvents. It is also used as an intermediate in the production of polymers and other chemicals" [PDF Pg. 2]
Process description:	"Preparation of trans-form: Adler, United States of America patent 2440997 (1948 to Stockholms Superfosfot Fabriks Aktiebolag).Dichloroethylenes (cis: [156-59-2]; trans: [156-60-5]) often occur as an isomeric mixture during the production of chlorinatedhydrocarbons, where they are produced by sidereactions, e.g., by thermal decomposition of 1,1,2-trichloroethane or fromacetylene by chlorine addition. The isomers can be separated by fractional distillation. In the thermal dehydrochlorination of 1,1,2-trichloroethane, the 1,2-dichloroethylenes are obtained together with the 1,1-isomer. With increasing temperature, formation of the 1,2-isomers increases. The trans isomer is preferentially formed. With catalysts, the individual ratios can be varied to some extent." [PDF Pg. 38]
Number of sites:	Aggregated data from 2016 CDRWego chemical Group in Great Neck, NY is listed as an import site.Axiall Corp in Westlake, LA is listed as a domestic manufacturer.The data also includes 2 CBI facilities performing CBI activities.

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, an in-scope occupational scenario.
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	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	Medium	Variability addressed by giving production volumes from multiple years but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	Nunez, C., McMinn, B., Vitas, J. (1996). Barriers to the use of radiation-curable adhesives in the coated and laminated substrate manufacturing industry. Journal of Hazardous Materials 45(1):59-78.
HERO ID:	5466433
Conditions of Use:	Adhesives and sealants

EXTRACTION

Parameter	**Data**
Process description:	Section 3.3 on PDF Pg. 5.

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	High	Data are for adhesives and sealants, an in-scope occupational scenario.
	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	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination Medium

Study Citation:	Ress, N. B. (2002). NTP technical report on the toxicity studies of trans-1,2-dichloroethylene (CAS No. 156-60-5) administered in microcapsules in feed to F344/N rats and B6C3F1 mice.
HERO ID:	1739657
Conditions of Use:	Domestic Manufacturing

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	trans-1,2-Dichloroethylene is listed as a high-production-volume chemical by the U.S. Environmental Protection Agency (USEPA, 2001) because more than 1 million pounds are produced annually. In 1977, one United States company produced 10 to 50 million pounds and another produced 1 to 10 million pounds of cis,trans1,2-dichloroethylene. (p. 9) The trans isomer has more industrial uses than either the cis isomer or the mixture, and it has been identified in cleaning agents such as Freon MCA and Freon SMT (Hurtt et al., 1993; HSDB, 2000) (p. 9)
Process description:	1,2-Dichloroethylene is synthesized by direct chlorination of acetylene at 40° C, by dehydrochlorination of 1,1,2-trichloroethane at 500° C, and by reduction of 1,1,2,2-tetrachloroethane with steam over an iron catalyst. The trans isomer is separated from the mixture through fractional distillation (HSDB, 2000) (p. 9)
Number of sites:	see PV page 11-12

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality data from frequently-used sources (HSDB, USEPA, and ATSDR).
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for manufacturing, an in-scope occupational scenario.
	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	Provided data on specific company submission; sample size may not include all MFG companies.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Assessment results are provided but underlying methods, assumptions, and data sources are not fully transparent–referenced government sources.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability and uncertainty are not addressed–referenced government sources.

Overall Quality Determination High

Study Citation:	Snedecor, G., Hickman, J. C., Mertens, J. A. (2004). Chloroethylenes.
HERO ID:	3827414
Conditions of Use:	Manufacture

EXTRACTION

Parameter	**Data**
Life cycle description:	”1,2-Dichloroethylene can be used as a low temperatureextraction solvent for organic materials such as dyes, perfumes, lacquers, and thermoplastics (See ref. 52 for example). It is also used as a chemical intermediate in the synthesis of other chlorinated solvents and compounds (40). Recently several patents have been issued (53–56) describing the use of 1,2- dichloroethylene for use in blends of chlorofluorocarbons for solvent vapor cleaning. One patent describes a method for cleaning acetate-based photographic film with trans-dichloroethylene (57).”pg. 8/26
Process description:	”1,2-Dichloroethylene can be produced by direct chlorination of acetylene at 408C. It is often produced as a by-product in the chlorination of chlorinated compounds (40) and recycled as an intermediate for the synthesis of more useful chlorinated ethylenes (41). 1,2-Dichloroethylene can be formed by continuous oxychlorination of ethylene by use of a cupric chloride–potassium chloride catalyst, as the first step in the manufacture of vinyl chloride [75-01-4] (42)...1,2-Dichloroethylene is usually shipped in208-L (55 gal) and 112-L (30 gal) steel drums. Because of the corrosive products of decomposition, inhibitors are required for storage. The stabilized grades of the isomers can be used or stored in contact with most common construction materials, such as steel or black iron. Storage stabilized 1,2 dichloroethylene compositions have been reported (48). Contact with copper or its alloys and with hot alkaline solutions should be avoided to preclude possible formation of explosive monochloroacetylene. The isomers do have explosive limits in air (Table 1). ”pg. 6/26

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	Low	Data used in report is mostly over 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	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:	U.S. EPA, (2015). Flame retardants used in flexible polyurethane foam: An alternatives assessment update (Sections 1-6).
HERO ID:	10180886
Conditions of Use:	Propellant and blowing agent in flexible polyurethane foam

EXTRACTION

Parameter	**Data**
Process description:	Flexible foam is made either in large slabs ("slabstock") that are cut to shape, or in molds that have the shape of the finished product. The basic ingredients include polyols, isocyanates, blowing agents, and other additives (including flame retardants). In manufacturing slabstock, the ingredients are blended in a mixing head and deposited on a conveyor belt, where the polymerization reactions occur, and the foam is expanded by blowing agents into a large (e.g., 60 foot) "bun." The buns are cured before being cut into shapes for a finished product. In molded foam, the polymerization reactions occur within the mold, and are heated to accelerate curing.Furniture and other foam product manufacturers typically receive cured foam and do not directly handle flame retardant chemicals. Because slabstock is made in very large buns, uses requiring smaller pieces of foam may consist of off-cuts from larger buns. This may be why smaller polyurethane foam products may contain flame retardants, even when they are not required to do so by regulation.
Comments:	Exposure route is discussed only for flame retardants.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality [data/techniques/methods] from frequently-used sources (EPA).
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for propellant and blowing agent in flexible polyurethane foam, 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	N/A - 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	N/A - process description.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2020). 2020 CDR: Commercial and consumer use.
HERO ID:	10366189
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.
	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, (2022). DMR Data for TCEP, formaldehyde, trans-1,2-dichloroethylene, 1,1-dichloroethane, and 1,2-dichloroethane.
HERO ID:	11181053
Conditions of Use:	All

EXTRACTION

Parameter	**Data**
Number of sites:	The dataset provides the number of sites with NPDES permits that are required to report to DMR.

EVALUATION

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Data is from DMR, a frequently used EPA source.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	DMR data are from the U.S.
	Metric 3:	Applicability	High	Data are for all in-scope COUs.
	Metric 4:	Temporal Representativeness	High	Data are less than 10 years old.
	Metric 5:	Sample Size	N/A	Number of sites not based on sampling data.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Submissions do not include method of how number of sites were determined or reported. There may be sites that release the chemical of interest, but do not report to DMR.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is addressed by including number of site data from multiple reporting years. Uncertainty isn't addressed.

Overall Quality Determination — High

Study Citation:	U.S. EPA, (1981). Chapter 4.6: Solvent degreasing. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.
HERO ID:	3045012
Conditions of Use:	Degreasing

EXTRACTION

Parameter	**Data**
Process description:	In a typical cold cleaner, dirty parts are cleaned manually by spraying and then soaking in the tank. After cleaning, the parts are either suspended over the tank to drain or are placed on an external rack that routes the drained solvent back into the cleaner.A typical vapor degreaser is a sump containing a heater that boils the solvent to generate vapors. The height of these pure vapors is controlled by condenser coils and/or a water jacket encircling the device. Solvent and moisture condensed on the coils are directed to a water separator, where the heavier solvent is drawn off the bottom and is returned to the vapor degreaser. A ””freeboard”” extends above the top of the vapor zone to minimize vapor escape. Parts to be cleaned are immersed in the vapor zone, and condensation continues until they are heated to the vapor temperature. Residual liquid solvent on the parts rapidly evaporates as they are slowly removed from the vapor zone.
Physical form:	liquid/vapor

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	AP-42 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	Low	Assessment is based on data greater than 20 years old.
	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	Medium	Uncertainty not addressed. Variability addressed by considering multiple degreasing methods.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (2001). Sources, emission and exposure for trichloroethylene (TCE) and related chemicals. GRA and I:138.
HERO ID:	35002
Conditions of Use:	Domestic Manufacturing

EXTRACTION

Parameter	**Data**
Process description:	Trans-1,2-dichloroethylene is more widely used in industry than either the cis isomer or the commercial mixture (HSDB, 1996). It is used as a solvent for waxes, resins, and acetylcellulose. It is also used in the extraction of rubber, as a refrigerant, in the manufacture of pharmaceuticals and artificial pearls and in the extraction of oils and fats from fish and meat (Sittig. Handbook Toxic Hazard Chem & Carcinog, 2nd Ed., 1985). 1,2-dichloroethylenes obtained as byproducts are used as feed stock for the synthesis of tri- and perchloroethylene. In applications where dichloroethylenes could be used as solvents and for low temperature extraction processes, they have been replaced by methylene chloride (Ullmann's Encyc Indust Chem, 5th Ed., Vol. A1, 1985-present). Although this chemical has had use as a solvent and chemical intermediate, it has not developed wide industrial usage in the U.S., partly because of its flammability (Patty. Indus Hyg and Tox, 3rd Ed., Vol. 2A, 1981-82). (p. 85 of 138 or p. 72 of the document)

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	High	Source provides a general description of uses, which covers several in-scope occupational scenarios
	Metric 4: Temporal Representativeness	Low	Report is based on data greater than 20 years old (1980s) and industry conditions that are expected to be outdated.
	Metric 5: Sample Size	N/A	no quantitative data
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:	U.S. EPA, (1980). Chapter 4.7: Waste solvent reclamation. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.
HERO ID:	3840001
Conditions of Use:	Treatment/Recycling of Spent Solvents

EXTRACTION

Parameter	**Data**
Process description:	Section 4.7.1 contains a three plus page process description of waste solvent reclamation.
Chemical concentration:	Adequate recovery, solvent vapor concentration well above 20 mg/m3 is required.

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	AP-42 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	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	Low	Variability and uncertainty are not addressed.

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:	Industrial/Commercial Use: Vapor degreaser

EXTRACTION

Parameter	**Data**
Process description:	A typical vapor degreaser (Figure 4.6-1) is a sump containing a heater that boils the solvent to generate vapors. The height of these pure vapors is controlled by condenser coils and/or a water jacket encircling the device. Solvent and moisture condensed on the coils are directed to a water separator, where the heavier solvent is drawn off the bottom and is returned to the vapor degreaser. A "freeboard" extends above the top of the vapor zone to minimize vapor escape. Parts to be cleaned are immersed in the vapor zone, and condensation continues until they are heated to the vapor temperature. Residual liquid solvent on the parts rapidly evaporates as they are slowly removed from the vapor zone. Lip mounted exhaust systems carry solvent vapors away from operating personnel. Cleaning action is often increased by spraying the parts with solvent below the vapor level or by immersing them in the liquid solvent bath. Nearly all vapor degreasers are equipped with a water separator which allows the solvent to flow back into the degreaser.

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 is for vapor degreasing, an in-scope occupational scenario, but data is general and not specific to the chemical.
	Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old.
	Metric 5:	Sample Size	N/A	N/A - process description info.
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	N/A - process description info.

Overall Quality Determination High

Study Citation:	U.S. EPA, (1995). Chapter 6: Organic chemical process industry. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.
HERO ID:	7310513
Conditions of Use:	Pharmaceutical and medicine manufacturing

EXTRACTION

Parameter	**Data**
Process description:	In a typical batch process, solid reactants and solvent are charged to a reactor where they are held (and usually heated) until the desired product is formed. The solvent is distilled off, and the crude residue may be treated several times with additional solvents to purify it. The purified material is separated from the remaining solvent by centrifuge and finally is dried to remove the last traces of solvent. As a rule, solvent recovery is practiced for each step in the process where it is convenient and cost effective to do so. Some operations involve very small solvent losses, and the vapors are vented to the atmosphere through a fume hood. Generally, all operations are carried out inside buildings, so some vapors may be exhausted through the building ventilation system.

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	Low	Data are for pharmaceutical and medicine manufacturing, which EPA has determined not to be in-scope for trans-1,2-Dichloroethylene. However, the information can be similar to a condition of use like laboratory chemical use.
	Metric 4: Temporal Representativeness	Low	Report is based on data greater than 20 years old.
	Metric 5: Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (1995). Chapter 4.2: Introduction to surface coating. Compilation of air pollutant emission factors. Volume I: Stationary point and area sources, fifth edition, AP-42.
HERO ID:	7315820
Conditions of Use:	Industrial/Commercial Use: Urethane coatings

EXTRACTION

Parameter	**Data**
Process description:	The process of applying an exterior coating to a plastic part can include surface preparation, spray coating, and curing, with each step possibly being repeated several times. Surface preparation may involve merely wiping off the surface, or it could involve sanding and puttying to smooth the surface. The plastic parts are placed on racks or trays, or are hung on racks or hooks from an overhead conveyor track for transport among spray booths, flashoff areas, and ovens. Coatings are sprayed onto parts in partially enclosed booths. An induced air flow is maintained through the booths to remove overspray and to keep solvent concentrations in the room air at safe levels. Although low temperature bake ovens (60°C [140°F] or less) are often used to speed up the curing process, coatings also may be partially or completely cured at room temperature.

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 is for urethane coatings, an in-scope occupational scenario but data is general and not specific to the chemical.
Metric 4:	Temporal Representativeness	Low	Report is based on data greater than 20 years old.
Metric 5:	Sample Size	N/A	N/A - This metric is not applicable to the data being extracted
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	N/A - This metric is not applicable to the data being extracted

Overall Quality Determination High

Study Citation:	VI, (2020). Comment submitted by Vinyl Institute regarding EDC impurities.
HERO ID:	11182965
Conditions of Use:	Manufacturing

EXTRACTION

Parameter	**Data**
Process description:	"Impurities are contained in mixed chlorinated organics unintentionally produced during the catalytic oxychlorination of ethylene to make EDC, the raw material precursor for conversion by thermal cracking into vinyl chloride monomer (VCM). The EDC and VCM manufacturing processes often take place in integrated facilities that include direct chlorination of ethylene and, when combined, are known in the industry as "the balanced process." In the U.S., roughly equal volumes of EDC are produced using two production processes (direct chlorination and oxychlorination). Most U.S. producers use both processes at a facility, and this is termed a balanced operation. VI is aware of four operating direct chlorination facilities not integrated within a balanced facility. About 1.25 pounds of mixed chlorinated organic liquids are unintentionally produced per 100 pounds of EDC manufactured. Because these substances are impurities, the production process is designed to remove them from the finished product using a separation process based on differences between the boiling point of EDC and the boiling points of these three substances. [PDF Pg. 2]
Number of sites:	14 reporting facilities in TRI [PDF Pg. 5]
Chemical concentration:	Composition of Trans-1,2-DCE in Balanced EDC/VCM Process (weight %) [PDF Pg. 3]Light Ends: 0-9%Heavy Liquid Ends: 0%EDC Product: 0-<0.1%VCM Product: 0%Yield of Trans-1,2-DCE in Balanced EDC VCM Product (lb/100lb EDC produced) [PDF Pg. 4]Light Ends: 0-0.028Heavy Liquid Ends: 0EDC Product: 0-0.1VCM Product: 0

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, 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	Medium	Sample concentrations are given in a range.
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 giving compositions in light ends, heavy ends, EDC product, and VCM product but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	VI, (2020). Comment submitted by Richard Krock, Vice President, Regulatory and Technical Affairs, The Vinyl Institute (VI) on 1,1-dichloroethane, trans-1,2-dichloroethylene, and 1,1,2-trichloroethane.
HERO ID:	11927540
Conditions of Use:	Manufacturing

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	About 1.25 pounds of mixed chlorinated organic liquids are unintentionally produced per 100 pounds of EDC manufactured.
Process description:	...impurities are contained in mixed chlorinated organics unintentionally produced during the catalytic oxychlorination of ethylene to make EDC, the raw material precursor for conversion by thermal cracking into vinyl chloride monomer (VCM). More details are located on pages 2-3.
Chemical concentration:	Concentrations are listed in Tables 1 and 2.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
	Metric 1: Methodology	High	Report uses high quality industry data 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 manufacturing, which is an occupational scenario within scope.
	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	This metric is not applicable
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	This metric is not applicable

Overall Quality Determination High