United States
Environmental Protection Agency

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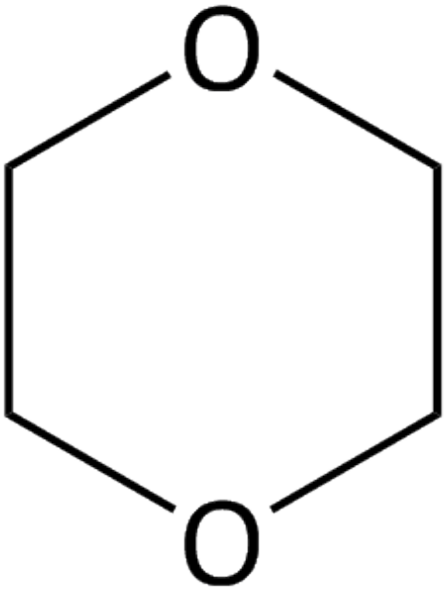
Office of Chemical Safety and
Pollution Prevention

Data Quality Evaluation and Data Extraction Information for Environmental Release and Occupational Exposure for 1,4-Dioxane (1,4-D)

Systematic Review Support Document for the Supplement to the Risk Evaluation

CASRN: 123-91-1



November 2024

This supplemental file contains information regarding the data extraction and quality evaluation results for data sources that were considered for the Supplement to the *Risk Evaluation for 1,4-dioxane (1,4-D)* and underwent systematic review. The systematic review steps are further described in Appendix C of the *Risk Evaluation for 1,4-dioxane (1,4-D)*. 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* (also referred to as the '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 ODQ is determined for each reference, as a whole, if it contains data from more than one evidence stream.

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9960770	U.S. EPA, (2016). Chemical Data Reporting (CDR): 1,4-Dioxane CAS Number 123-91-1.	**128**

Study Citation:	Americas,, DAK (2023). Comments of the DAK Americas LLC on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11328626
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Worker activity description:	a brief description of the worker task is listed for each breathing zone sample
Personal sampling data:	source includes multiple personal breathing zone sample results (ppm) from workers during PET manufacturing operations at multiple facilities (locations are Gaston, SC, Fayetteville, NC, Moncks Corner ,SC, Bay St. Louis, MS, and Montreal, QC Canada)
Exposure duration:	source provides a listed duration that may correspond to worker tasks (exposure duration) as well as sampling duration

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	High	Sampling/analytical methodology is either an approved NIOSH method (NIOSH 1602), OSHA method (GC/FID-OSHA 07), or equivalent to an approved OSHA/NIOSH method (ECHR-A-IH58-GC-89-2)
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for PET manufacture, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Monitoring data timing ranges from 1998-2023
	Metric 5:	Sample Size	High	Statistical distribution of samples is fully characterized (discrete sampling data provided).
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	All metadata provided.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by samples collected at multiple sites, on multiple visits to the same site, and multiple work tasks.

Overall Quality Determination High

Study Citation:	Belanger, P. L. (1980). Health hazard evaluation report no. HHE-80-21-721, Colgate-Palmolive Co., Berkeley, California.
HERO ID:	3859368
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Worker activity description:	1 operator monitors the transfer operation (p. 2). One operator monitors the liquid making operation (p. 2). the operator obtains a bulk sample of the detergent. There are four bottling lines of which 2-3 are operational three shifts per day (p. 3). operators are assigned to each line (p. 3). One employee monitors the bottle filling and· services the 1abel and cap machine, and the other employee monitors the packing operation (page 3).
Exposure route:	Inhalation
Personal sampling data:	Personal and area air samples were collected on the follow-up surveys during an 8-hour work shift in order to evaluate employees' exposure. Personal samples were attached to the workers' shirt collar in order to characterize breathing zone samples. Area samples were placed at a breathing zone height near the greatest source of exposure (p. 3)All the environmental air samples were below the limit of detection (page 6)
Personal protective equipment:	No special protective equipment is worn by any of the workers during chemical transfer (page 2). Workers in the liquid finishing area (bottling) are each assigned a plastic apron, latex arid cotton gloves, and safety glasses (page 3)
Engineering control:	Each filling line has local exhaust ventilation at the bottle washing and drying position. Line # 2 has a specially designed filler station which is enclosed with local exhaust ventilation. The liquid filling department has window exhaust fans and process exhaust fans which provide 4.5 air changes per hour (page 3)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	High	Sampling/analytical methodology completed by NIOSH
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	Medium	Data are for manufacture of dish soap, which is similar to the in-scope occupational scenario for the use of dish soap.
	Metric 4:	Temporal Representativeness	Low	Monitoring data are greater than 20 years old (1980)
	Metric 5:	Sample Size	Low	Sample distribution is only described qualitatively as "below the limit of detection"
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Sample type and exposure type provided but missing number of samples completed, sample durations, and sample location (worker activity)
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:	Harley, K. G., Calderon, L., Nolan, S., J.E., Maddalena, R., Russell, M., Roman, K., Mayo-Burgos, S., Cabrera, J., Morga, N., Bradman, A. (2021). Changes in Latina women's exposure to cleaning chemicals associated with switching from conventional to "green" household cleaning products: The LUCIR intervention study. Environmental Health Perspectives 129(9):97001.
HERO ID:	9551210
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Laundry detergent

EXTRACTION

Parameter	**Data**
Worker activity description:	Latina women using cleaning products on their homes. (Page 2/9)
Exposure route:	inhalation (Page 1/9)
Personal sampling data:	Before using green products, personal samples revealed mean dioxane exposure of 0.57+-3.60 ug/m3. After substitutions in cleaning products, exposures were 0.31+-3.07 ug/m3. (Page 6/9)
Number of workers:	50 women in the study. (Page 2/9)
Engineering control:	"Green" replacement products can be less harmful to users, as can homemade cleaning solutions like water, vinegar, and dish soap. (Page 3/9)
Comments:	Table 3.

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	Low	Data are for consumer use of laundry and dishwashing products, which is similar to the in-scope occupational scenario commercial use of laundry and dishwashing products.
	Metric 4:	Temporal Representativeness	High	Monitoring data are no more than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (mean, standard deviation, detection frequency) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Sample type and exposure type provided but missing exposure duration, frequency, and PPE.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Uncertainty is addressed in sampling/analytical methodology. Variability addressed by sampling the women on two difference occasions with different cleaning products.

Overall Quality Determination High

Study Citation:	HHS, (2016). 1,4-Dioxane: CAS No. 123-91-1.
HERO ID:	9960766
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Worker activity description:	Loading and control operators and tank-car unloaders. (Page 2/3)
Exposure route:	Inhalation, ingestion, dermal (Page 2/3)
Physical form:	Vapors (Page 2/3)
Area sampling data:	In 1968, the air concentration of 1,4-dioxane in the vicinity of storage tanks at three U.S. manufacturing facilities was as high as 800 ppm (2,883 mg/m3). When these facilities were monitored in the mid 1970s, the concentrations of 1,4-dioxane measured in workplace air ranged from 0.2 to 22 ppm (0.7 to 79.3 mg/m3). The maximum time-weighted-average occupational exposure concentrations were 16 ppm (57.6 mg/m3) in production areas, 22 ppm (79.3 mg/m3) in loading areas, 11 ppm (39.6 mg/m3) around storage tanks, and 108.9 ppm (392.4 mg/m3) for point-source emissions. Maximum personal monitoring samples ranged from 32 ppm (115.3 mg/m3) for loading and control operators to 16.8 ppm (60.5 mg/m3) for tank-car unloaders. (Page 2/3)
Number of workers:	The National Occupational Exposure Survey (conducted from 1981 to 1983) estimated that 430,000 workers, including 149,697 women, potentially were exposed to 1,4-dioxane. (Page 2/3)

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	Low	The data are for a non-occupational scenario that is similar to an occupational scenario within the scope of the risk evaluation
	Metric 4:	Temporal Representativeness	Low	Monitoring data are greater than 20 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (ranges, means, maximums) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Sample type and exposure type provided but missing exposure duration, frequency, engineering controls, and PPE.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is described by the presented statistics. Uncertainty isn't addressed.

Overall Quality Determination — Low

Study Citation:	Hills, B., Klincewicz, S., Blade, L. M., Sack, D. (1989). Health hazard evaluation report no. HETA-87-367-1987, BMY Corporation, A Division of Harsco Corporation, York, Pennsylvania.
HERO ID:	3859375
Conditions of Use:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Worker activity description:	Spray painting; Processors mainly use brushes and small cans of paint to perform the touch-up painting but occasionally use spray gun applicators for brief periods of time. However, the processors in the Small Parts Department did spray painting for most of their work shift (page 4)
Exposure route:	Inhalation, dermal
Physical form:	Vapor, liquid
Personal sampling data:	p-dioxane exposures ranged from non-detectable to 1.7 mg/m3 (page 12); full data table 3 (page 23-24)
Number of workers:	Spray-painted by 7 paint tunnel workers; 47 processors touch-up and perform quality checks (page 4)In the Small Parts Department, three employees (tapers) place masking tape on vehicle parts in preparation for spray painting. These parts are suspended from hooks and move on a conveyor system. Approximately 23 processors spray paint the parts as the conveyor moves the part in front of a spray booth. (page 5)
Personal protective equipment:	Half-face respirators with organic vapor cartridges are available to the painters but only a few workers wear them. These respirators provide adequate protection for exposure to solvents during brush painting, but are not adequate for spray painting. (page 4)page 17 gives recommendations (e.g. impervious gloves)
Engineering control:	The two rooms where Final Processing is performed are each approximately 42 feet wide by 180 feet long by 20 feet high. Each room has ceiling fans which exhaust 12,900 cubic feet of air per minute. There are also four supply air intake ducts per room that provide 12,500 cubic feet per minute (pg 5)page 17 gives recommendations (e.g. portable ventilation)
Comments:	Bulk air samples were collected on four standard charcoal tubes for organic solvents plus one Ambersorb XE-347 tube for ketones, at a flow rate of one liter per minute (lpm). The samples were desorbed with carbon disulfide and qualitatively analyzed by gas-chromatography/mass spectrometry (GC-MS).The organic solvent vapors were collected on standard (100/50 mg) charcoal tubes at a flow rate of 0.2 lpm. The samples were desorbed with carbon disulfide and analyzed by gas chromatography according to NIOSH Methods 1501, 1003, 1500, 1450, and 1602

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 paints and coatings, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	Monitoring data are greater than 20 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 metadata such as exposure frequency.
Domain 4: Variability and Uncertainty				

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Study Citation:	Hills, B., Klincewicz, S., Blade, L. M., Sack, D. (1989). Health hazard evaluation report no. HETA-87-367-1987, BMY Corporation, A Division of Harsco Corporation, York, Pennsylvania.
HERO ID:	3859375
Conditions of Use:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

			EVALUATION	
Domain		Metric	Rating	Comments
	Metric 7:	Metadata Completeness	Medium	Variability addressed by evaluation different painting steps/operations but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	Huntsman, (2023). Comments of the Huntsman International, LLC on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11332422
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Area sampling data:	The source provides 4 area samples, including the date collected, description of the sampling location, sampling duration, and sample results (page 6)
Personal protective equipment:	the source briefly describes PPE during the PET manufacturing process and states, "Huntsman requires workers to don all appropriate Personal Protective Equipment (PPE) during plant operations up to and including supplied air respirators for certainmaintenance activities."

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Sampling and Analytical Methodology	High	Sampling/analytical methodology is equivalent to an approved NIOSH method. the sources states, "The samples were analyzed in accordance with the Bureau Veritas method SOP-5 GC-FID, which is comparable with NIOSH 1602"
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for PET manufacturing byproduct, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	Monitoring data are no more than 10 years old. (data from 2019)
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	Monitoring data include most critical metadata, such as sample type and exposure type, but lacks additional metadata, such as exposure duration, exposure frequency, and/orworker activities.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Uncertainty is addressed in sampling/analytical methodology but variability is not addressed.

Overall Quality Determination High

Study Citation:	Lin, W. T., Chen, W. L., Cheng, W. C., Chang, H. C., Tsai, S. W. (2017). Determining the residual characteristics of alkylphenols, arsenic, and lead as well as assessing the exposures of 1,4-dioxane from household food detergents. Journal of AOAC International 100(4):1086-1093.
HERO ID:	3828958
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	Dermal (page 2/8)
Physical form:	Liquid (page 2/8)
Dermal exposure data:	Dermal exposure data
Exposure frequency:	2 washes/day (page 7/8)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	Medium	Assessment uses high quality techniques that are not from frequently-used sources and there are no known quality issues.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Low	Data are from Taiwan, a non-OECD country.
	Metric 3:	Applicability	Low	Data are for consumer use of dishwasher detergent, which is similar to the in-scope occupational scenario commercial use of dishwasher detergent.
	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 limited statistics (range, mean, median) 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	Variability is addressed by performing an ANOVA test. Uncertainty isn't addressed.

Overall Quality Determination Medium

Study Citation:	OSHA, (2020). Chemical Exposure Health Data (CEHD).
HERO ID:	6983058
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	Inhalation
Personal sampling data:	Data in the spreadsheet includes personal breathing zone data for various worker activities
Area sampling data:	Data in the spreadsheet includes area monitoring data for various facilities
Exposure duration:	Data in the spreadsheet provided includes sampling duration

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling and Analytical Methodology	High	OSHA and state inspectors are expected to use OSHA orNIOSH sampling methods. Samples sent to the OSHA SLTCare expected to be analyzed using OSHA or NIOSH analyticalmethods
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	Medium	The OSHA data include occupational scenarios within thescopes of the chemicals as identified by NAICS code and facilityname. However, some occupational scenarios are not clear andcannot be clearly mapped to conditions of use within scope.
	Metric 4:	Temporal Representativeness	High	Data provided by OSHA are not more than 10 years old.
	Metric 5:	Sample Size	High	Individual measurements are provided so the sample sets canbe fully statistically characterized.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	OSHA data include sample type and exposure type. Sampletimes also provided. Exposure frequency is inconsistently provided. Worker job descriptions provided, but often lacks sufficient clarity.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	OSHA data do not discuss variability or uncertainty.

Overall Quality Determination High

Study Citation:	Young, J. D., Braun, W. H., Gehring, P. J., Horvath, B. S., Daniel, R. L. (1976). 1,4-Dioxane and beta-hydroxyethoxyacetic acid excretion in urine of humans exposed to dioxane vapors. Toxicology and Applied Pharmacology 38(3):643-646.
HERO ID:	62953
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	Inhalation
Physical form:	Vapor
Personal sampling data:	All samples: 7.5 hr collection length for an 8 hr shift (8 hr TWA), PBZ collector:Worker A: exposed to 1ppm Dioxane over 1 sampleWorker B: exposed to 1.6 avg. ppm with+/- 0.5(SD) over 5 samplesWorker C: exposed to 2.0 avg. ppm with+/- 1.0(SD) over 4 samplesWorker D: exposed to 1.8 avg. ppm with+/- 0.4(SD) over 5 samplesWorker E: exposed to 1.1 avg. ppm with+/- 0.6(SD) over 5 samples
Exposure duration:	7.5 hr/day for the sample, unknown if full shift.

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	High	Data are from the U.S.
	Metric 3:	Applicability	Uninformative	Data are for Manufacturing 1,4-dioxane which is not in-scope or similar to an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	Monitoring data are greater than 20 years old. (1976)
	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 job descriptions, activities, etc.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed. Multiple samples are taken, but unknown variability (not discussed).

Overall Quality Determination Uninformative

Study Citation:	U.S. EPA, (2021). Use of additives in plastic compounding – Generic scenario for estimating occupational exposures and environmental releases (Revised draft).
HERO ID:	10366192
Conditions of Use:	Other:

EXTRACTION

Parameter	Data
Worker activity description:	Section 2.2 describes potential occupational exposure activities associated with the compounding process including: Container unloading, container cleaning, equipment cleaning, and filling containers
Exposure route:	Section 2.2 indicates potential for both inhalation and dermal exposures: A.Inhalation exposure to solids and dermal exposure to liquids and solids during unloading of additive chemicalsB.Inhalation exposure to solids and dermal exposure to liquids and solids during container cleaningC.Inhalation exposure to dusts generated during blending/compounding process operationsD.Dermal exposure to liquids during equipment cleaningE.Inhalation exposures to solids during packaging of compounded plastics containing additive chemical (only applicable to pellets, granules, flakes, and other similar shapes)
Physical form:	EPA expects most plastics additive chemicals to be non-volatile liquids or solids. For EPA new chemical assessments, volatile chemicals are considered to be those whose vapor pressures are above 0.001 torr (CEB, 2008). Based on a review of 71 PMNs submitted to EPA between 2007 and 2012, EPA found that 98% had vapor pressures below 0.001 torr. Only one PMN was for a chemical with a vapor pressure greater than 0.001 torr. The review also indicates that plastics additives are typically solids. Of the 71 PMNs, 65% were for solid plastics additives while the remaining 35% were for liquids.
Personal sampling data:	Table 5.1 and Section 5 in general, details various models for estimating exposure to workers in plastics compounding facilities. All models are based on generic models such as the "OSHA Total PNOR PEL-Limiting Model"
Dermal exposure data:	Dermal exposure data
Exposure duration:	Exposure duration are on a model basis, but the standard default is 8 hr/day
Exposure frequency:	Section 5.3 discusses exposure days, though the section assesses the EPA default of 250 days/yr.
Number of workers:	Section 5.2 details a calculated default number of workers in the industry and per site based on NAICS and US Census Bureau data:Number of employees in industry: 18,719Employees per facility: 45Employees with potential exposures:Total workers: 8,726Total ONUs: 2,880Workers per facility: 21 (rounded)ONUs per facility: 7 (rounded).
Personal protective equipment:	Within the plastics industry, suitable PPE should be worn, including gloves, hearing protection in areas of high noise levels, and eye protection (ILO, 2011). According to AP-42, most plants use forced ventilation techniques to reduce worker exposure to vapors (EPA, 2008). In areas where particulates or vapor may be formed, local exhaust ventilation (LEV) should be used (ILO, 2011) and, if ventilation is not an option or is insufficient, respiratory protection should be worn (Doney et al., 2008). IT should be noted that the occupational exposure estimates presented in this GS do not account for PPE

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Model is peer-reviewed and free of mathematical errors, based on sound approaches/methods, and uses appropriate equations and parameters.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	Medium	Model can be applied to Polyethylene Terephthalate (PET) Byproduct, an in-scope occupational scenario. Not specific to 1,4 Dioxane.
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			

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Study Citation:	U.S. EPA, (2021). Use of additives in plastic compounding – Generic scenario for estimating occupational exposures and environmental releases (Revised draft).
HERO ID:	10366192
Conditions of Use:	Other:

			EVALUATION	
Domain		Metric	Rating	Comments
	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	High	Uncertainty is addressed in Section 7.0 DATA GAPS/UNCERTAINTIES AND FUTURE WORK and by indicating that the modeling approach is conservative and estimates are likely to be higher, or at least higher than average, than amounts that might actually occur in real world practice. Variability addressed by ranges for many model inputs informed by industry and other data.

Overall Quality Determination High

Study Citation:	ATSDR, (2012). Toxicological profile for 1,4 dioxane.
HERO ID:	1787229
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	You may be exposed by breathing, eating, or drinking the substance, or by skin contact. (21/295)
Physical form:	1,4-Dioxane is a clear liquid with a faint pleasant odor. It mixes easily with water. (21/295)

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 all conditions of use, including those relevant to this risk assessment.
	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 limited statistics (productions, ranges) 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	The assessment provides only limited discussion of the variability and uncertainty in the results. Variability is discussed by including various metrics of exposure and release sources.

Overall Quality Determination High

Study Citation:	Eckhardt, A. (2018). Positive trends emerge in reducing exposure to 1,4-dioxane. Journal of the American Water Works Association 110(7):54-59.
HERO ID:	5078566
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Exposure route:	Inhalation, ingestion, dermal (page 3/6)
Area sampling data:	In one lethal case of exposure, the average concentration of dioxane was estimated to be 470 ug/L. (page 3/6)
Dermal exposure data:	Dermal exposure data

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Assessment uses high quality data/ from frequently-used sources.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Medium	Data is global, but the article was written in Germany, an OECD country.
	Metric 3:	Applicability	High	Data are for industrial use of laundry and dishwashing 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	Sample distribution characterized by limited statistics (averages, percentages) 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	Variability addressed by compiling data from multiple studies 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:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Worker activity description:	Transferring and mixing liquid products, container cleaning, transferring mixed coating to application equipment, overspray
Personal sampling data:	Inhalation: Provides methods for modeling exposures to mists"
Dermal exposure data:	Dermal exposure data
Exposure frequency:	250 days/yr
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 Medium

Study Citation:	OECD, (2017). Emission Scenario Document (ESD) on the use of textile dyes.
HERO ID:	3828838
Conditions of Use:	Industrial/Commercial Use: Arts, crafts, and hobby materials - Textile dye

EXTRACTION

Parameter	**Data**
Worker activity description:	Unloading, container cleaning, dyeing machine operation
Exposure route:	Dermal and inhalation
Personal sampling data:	Inhalation: Provides methods for modeling exposures to volatile liquids and solids
Dermal exposure data:	Dermal exposure data
Exposure frequency:	31-250 days/yr
Number of workers:	1-6 workers/site
Personal protective equipment:	Safety glasses, goggles, aprons, respirators, and/or masks

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 from 2015 but 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 multiple chemical functions

Overall Quality Determination Medium

Study Citation:	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.
HERO ID:	6385735
Conditions of Use:	Industrial/Commercial Use: Automotive care products - Antifreeze

EXTRACTION

Parameter	**Data**
Worker activity description:	"PROC: unloading, container cleaning, formulation, sampling, equipment cleaning, loadingUSE: Unloading, container cleaning"
Exposure route:	Dermal and inhalation
Personal sampling data:	Inhalation: Provides methods for modeling exposures to volatile liquids
Dermal exposure data:	Dermal exposure data
Exposure frequency:	"Processing: 203-360 days/yrUse: 253 days/yr"
Number of workers:	"PROC: 22 workers/siteUSE: 4 workers/site"
Personal protective equipment:	"PROC: Respirators, gloves, safety glassesUSE: gloves, protective footwear, protective headwear, dust masks or respirators"
Engineering control:	LEV

EVALUATION

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

Overall Quality Determination High

Study Citation:	OECD, (2011). Emission scenario document on the chemicals used in water-based washing operations at industrial and institutional laundries.
HERO ID:	6387321
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Laundry detergent

EXTRACTION

Parameter	**Data**
Worker activity description:	Unloading, container cleaning, handling dampl laundry/cleaning operations
Exposure route:	Dermal and inhalation
Personal sampling data:	Inhalation: Provides methods for modeling exposures to volatile liquids and solids
Dermal exposure data:	Dermal exposure data
Exposure frequency:	20-250 days/yr
Number of workers:	2-9 workers/sites
Personal protective equipment:	Gloves, face shield

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 multiple laundry product types, chemical functions, and types of launderers.

Overall Quality Determination Medium

Study Citation:	OECD, (2012). Emission scenario document on chemicals used in oil well production.
HERO ID:	6387322
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Worker activity description:	Unloading, container cleaning, equipment/storage tank cleaning
Physical form:	Dermal
Personal sampling data:	Dermal: Provides methods for modeling exposures to non-volatile liquids
Exposure frequency:	250 days/yr
Number of workers:	8 workers/site
Personal protective equipment:	Impervious gloves, clothing, safety glasses, masks or respirators

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	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 on- and off-shore wells and chemical functions.

Overall Quality Determination Medium

Study Citation:	P&G, (2023). Comments of The Procter & Gamble Company on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333406
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Worker activity description:	Among commercial employees, Food Service workers whose primary job is to wash dishes may have the highest exposure to hand dish detergent products. (4/17)
Exposure route:	Dermal, inhalation
Dermal exposure data:	Dermal exposure data
Exposure duration:	Hand dish washer personnel may have their hands in the sink water at an (excessively high) estimate of once per minute for an 8-hour shift (60 x 8 = 480 times per shift). We estimate 5seconds exposure each time to pull an item from the sink. Contact exposure to diluted hand dish wash water is calculated to be 40 minutes / shift. (6/17)
Exposure frequency:	P&G uses inputs of 250 days/yr for chronic assessments, and 3 days/yr for acute assessments (9/17).
Personal protective equipment:	Dishwashing gloves (4/17)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source (Consumer Exposure Model, NY product waiver data) and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
Metric 3:	Applicability	High	The assessment is for dish soap, an occupational scenario within the scope of the risk evaluation.
Metric 4:	Temporal Representativeness	High	Assessment is less than 10 years old.
Metric 5:	Sample Size	Low	Sample distribution isn't characterized, single values often provided.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, andassumptions.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Variability addressed by using different product concentrations and addressing different washing methods. Uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	P&G, (2023). Comments of The Procter & Gamble Company on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333406
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dishwasher detergent

EXTRACTION

Parameter	**Data**
Worker activity description:	The employee loads dirty dishes into a dish rack (Figure 8), they open the door to the machine, slide in the rack and close thedoor. The products are not dispensed until the door is closed, and by the time the cycle is completed, the dishware in the rack have been rinsed with clean water (3 step – wash, rinse, sanitize). The employee pulls the rack out by hand on the “clean side” and pushes in another dirty rack on the “dirty side” (these steps are automatic in a continuous rack machine). (12/17)For the Silverware presoak solution, employees (usually the table bussers) drop the dishware into the tubs as they bring back the dirty dishware to be washed. The employee loading the machine will walk over to the tub, grab a handful of silverware, andplace them in a silverware cup that goes in a rack with the dishes to be washed (Figure 8) (limited product/inhalation contact), or pull the silverware tray out of the tub and put it directly in the auto dish machine (Figure 9) (no product/inhalation contact). (13/17)
Exposure route:	Dermal, inhalation
Dermal exposure data:	Dermal exposure data
Exposure duration:	Auto dishwashing machines run in discrete cycles, each one lasting a couple minutes in length (loading rack, washing racks, emptying racks). An employee working 8 hours would run approximately 160 cycles over the shift where they would be exposed to anything in the vapor at the end of the wash when the door is opened. (13/17)P&G uses inputs of 480 minutes of use for chronic assessments, and 2 minutes of use for acute assessments. (15/17)
Exposure frequency:	P&G uses inputs of 250 days/yr for chronic assessments, and 160 days/yr for acute assessments (9/17).
Personal protective equipment:	nan
Engineering control:	Professional products are only sold in “closed loop” packages (1 and 5 gallon). Closed loop is designed to minimize exposure of end users to the finished product, which provides a safetybenefit, and ensures the products are properly dispensed at the correct dose/dilution during use to avoid under and overuse, which provides performance, cost, and safety benefits. The package contains a plug in the throat of the bottle that keeps product from flowing out when the bottle is turned over. It is only when the bottle is connected to the correct/unique mating cap (color coded) that the valve in the throat plug is opened by screwing on the mating cap, allowing product to be drawn from the bottle through a tube by mechanical suction (Venturi metering orperistaltic pumps) into the dish machines/sinks (Figure 6). The employee does not have access to full strength product, only the diluted use solutions for auto dishwashing (and that is only if they stick their hands in the wash solution in the machine, which cannot happen for dump and fill machines). The employee also does not wash/rinse out the product container when empty. They simply throw away/recycle the container following local disposal guidelines. Skin contact andinhalation of neat product does not occur for auto dishwashing products. (11/17)It is common (but not required) to have a Type II condensate hoodabove the machines to vent the humidity and heat outside the facility to reduce the HVAC load. These vents help reduce employee exposure to any product volatiles in the machine when thedoor is opened at the end of the cycle, but it does not remove it completely. (13/17)

EVALUATION

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source (Consumer Exposure Model, NY product waiver data) and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The assessment is for dishwasher detergent, an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	Assessment is less than 10 years old.

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Study Citation:	P&G, (2023). Comments of The Procter & Gamble Company on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333406
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dishwasher detergent

			EVALUATION	
Domain		Metric	Rating	Comments
	Metric 5:	Sample Size	Low	Sample distribution isn't characterized, single values often provided.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, andassumptions.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability addressed by using different product concentrations and addressing different washing methods. Uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2022). Emission scenario document on chemicals used in hydraulic fracturing (draft).
HERO ID:	10366193
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Worker activity description:	Container unloading, equipment cleaning, container cleaning,
Exposure route:	Dermal, Inhalation
Physical form:	Liquid
Personal sampling data:	Provides methods for modeling exposures to volatile liquids
Dermal exposure data:	Dermal exposure data
Exposure frequency:	14 days/yr (page 25)
Number of workers:	9 workers/well (page 48)

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 ESD 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 range of release quantities based on multiple sources.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2022). Chemicals used in furnishing cleaning products - Generic scenario for estimating occupational exposures and environmental releases (revised draft).
HERO ID:	10368811
Conditions of Use:	Industrial/Commercial Use: Cleaning and furniture care products - Surface cleaner

EXTRACTION

Parameter	**Data**
Worker activity description:	Container unloading (liquids and solids), application and use of cleaning products
Exposure route:	Inhalation, dermal
Physical form:	Liquid and solid
Personal sampling data:	Provides methods for modeling exposures to non-volatile and volatile liquids and solids
Dermal exposure data:	Dermal exposure data
Exposure duration:	8 hr/day (page 17)
Exposure frequency:	260 days/yr (page 17, 38)
Number of workers:	9 workers/company (page 37)
Personal protective equipment:	Safety glasses, safety goggles or face shield during prolonged handling or when splashing is possible (page 36)

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). Commercial use of automotive detailing products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).
HERO ID:	10480464
Conditions of Use:	Industrial/Commercial Use: Automotive care products - Antifreeze

EXTRACTION

Parameter	**Data**
Worker activity description:	Container unloading (liquids and solids), application and use of automotive detailing products.
Exposure route:	Dermal, Inhalation
Physical form:	Liquids, pastes, or clays/waxes (Page 13)
Personal sampling data:	Provides methods for modeling exposures to non-volatile and volatile liquids and solids
Dermal exposure data:	Dermal exposure data
Exposure duration:	8 hr/day
Exposure frequency:	260 days/yr (Page 39)
Number of workers:	3-4 workers/detailing facility (Page 38)
Personal protective equipment:	Particle respirators, ear plugs, safety glasses, aprons, knee pads, nitrile gloves, cooling towels, and face masks (page 37)
Engineering control:	Miscellaneous control technologies include performing vehicle detailing in areas where there are no floor drains, keeping container lids closed, avoiding the use of detergents, using sloping pavement around drains, using high-pressure and low-volume sprays, and labeling all containers. (p. 24) Industrial and commercial facilities often collect dust emissions in ventilation filters (page 27)

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). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).
HERO ID:	10480466
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Worker activity description:	Container unloading (liquids and solids), container cleaning, equipment cleaning, laboratory analyses, disposal of laboratory chemicals (page 39)
Exposure route:	Inhalation and dermal
Physical form:	Liquid and solids
Personal sampling data:	Inhalation: Provides methods for modeling exposures to non-volatile and volatile liquids and solids
Dermal exposure data:	Dermal exposure data
Exposure duration:	8-12 hr/day (page 17)
Exposure frequency:	250 days/yr (page 43)
Number of workers:	3 workers/facility (page 42)
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. (page 40-41)
Engineering control:	Local ventilation including fume hood (page 41)

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, (2018). Application of spray polyurethane foam insulation - Generic scenario for estimating occupational exposures and environmental releases -Draft.
HERO ID:	5079085
Conditions of Use:	Other:

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
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 one- and two-component foams.

Overall Quality Determination High

Study Citation:	Vallieres, M., Cockcroft, D. W., Taylor, D. M., Dolovich, J., Hargreave, F. E. (1977). Dimethyl ethanolamine-induced asthma. American Review of Respiratory Disease 115(5):867-871.
HERO ID:	6839929
Conditions of Use:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Worker activity description:	The studied worker worked in the paint shop of a window and door frame factory. (Page 1/5)
Exposure route:	Inhalation (Page 1/5)
Physical form:	Liquid (Page 1/5)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Report uses high quality techniques 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 Canada, an OECD country.
	Metric 3:	Applicability	High	Data are for industrial use of paint and floor lacquer, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	The report is based on data greater than 20 years old and industry conditions that are expected to be outdated.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (percentages) 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	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	ACC, (2023). Comments of the American Chemistry Council on Draft Supplement to the Risk Evaluation for 1,4-Dioxane.
HERO ID:	11333196
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	dermal
Dermal exposure data:	Dermal exposure data

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 (peer-reviewed studies) 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	Data are from the U.S.
	Metric 3:	Applicability	Low	Data is applicable to all COUs, but study data is for sunscreen (non-occupational scenario) and fragrances, which aren't in scope.
	Metric 4:	Temporal Representativeness	High	Report and all data cited are less than 10 years old.
	Metric 5:	Sample Size	Medium	Values are characterized as ranges with no other statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is addressed by comparing two skin load values from different studies. Uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	API, (2023). Comments of the American Petroleum Institute (API) on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11336489
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Dermal exposure data:	Dermal exposure data

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality data from frequently-used sources (ATSDR)
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for dermal, 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 distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Sample distribution characterized by limited statistics as discrete samples not provided and distribution not fully characterized.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Uncertainty is addressed by testing methods. Variability addressed by range of values.

Overall Quality Determination High

Study Citation:	Dow Chemical, (2023). Comments of Dow Chemical on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11334206
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Worker activity description:	procedures are included to describe worker tasks during reactor sampling, railcar sampling, sample analysis, and railcar loading that include frequency, duration, and PPE (21/25)
Personal sampling data:	8, 8-hr TWA sample results are provided from monitoring completed from 2017-2021 that range from less than 0.05ppm- 0.44 ppm (21/25).
Exposure duration:	reactor sampling: less than 1 minute; railcar sampling: 5 minutes; lab sample analysis: 20 minutes for GC and 10 minutes for titrator analysis; railcar loading: 1 hour per railcar (11~/25).
Exposure frequency:	reactor sampling: daily; railcar sampling: daily; lab sample analysis: 2 times per shift; railcar loading: daily (3-4 railcars). (11~/25).
Personal protective equipment:	reactor sampling: hard hat, safety glasses, chemical resistant gloves; railcar sampling: hard hat, face shield, goggles, chemical resistant suit, chemical resistant gloves, chemical resistant boots; lab sample analysis: safety glasses, chemical-resistant gloves, lab coat, close-toed shoes; railcar loading: hard hat, face shield, goggles, chemical resistant suit, chemical resistant gloves, chemical resistant boots (11~/25).
Engineering control:	reactor sampling: closed-loop sample box; lab sample analysis: fume hood; railcar: engineered load arm, nitrogen pad (11~/25).

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Low	Report does not specify the methods used.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for Ethoxylation byproduct, 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	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 worker activities involved.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	HCPA, (2023). Comments of the Household and Commercial Products Association (HCPA) on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation; Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11332911
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Engineering control:	Dispensing methods that reduce worker exposure, particularly to 1,4-dioxane in concentrated cleaning products prior to dilution, have been widely adopted including direct machine dispensing, closed loop-systems, and optimized wash/run cycle times. (3/8)

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 (NY DEC) 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	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for dish soaps and detergents, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Data are less than 10 years old.
	Metric 5:	Sample Size	N/A	N/A- qualitative information
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, andassumptions.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability in types of controls are addressed. Uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	HCPA, (2023). Comments of the Household and Commercial Products Association (HCPA) on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation; Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11332911
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Engineering control:	The surfactants industry is currently applying state-of-the art technology to mitigate the formation of 1,4-dioxane and to remove it in post-processing. For example, during sulfonation reactions to create sodium lauryl ether sulfate (SLES), several engineeringcontrols are being used to minimize the formation of 1,4-dioxane byproduct. These controls for SLES production include balancing the alcohol to sulfur trioxide gas ratio and rapid neutralization of the sulfation product with sodium hydroxide to prevent 1,4-dioxane formation in the ethoxylation process. (5/8)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	The assessment or report uses high quality data and/or techniques or sound methods that are not from a frequently used source and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for ethoxylation byproducts, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	Data are less than 10 years old.
Metric 5:	Sample Size	N/A	N/A- qualitative information
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Low	Underlying source for engineering control data aren't provided.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Variability in types of controls are addressed. Uncertainty isn't addressed.

Overall Quality Determination Medium

Study Citation:	HHS, (2016). 1,4-Dioxane: CAS No. 123-91-1.
HERO ID:	9960766
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	Inhalation, ingestion, dermal (Page 2/3)
Physical form:	Vapors (Page 2/3)
Number of workers:	The National Occupational Exposure Survey (conducted from 1981 to 1983) estimated that 430,000 workers, including 149,697 women, potentially were exposed to 1,4-dioxane. (Page 2/3)

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 all sectors, but can be applied to those in-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	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:	Kasting, B. G., Miller, M. A. (2006). Kinetics of finite dose absorption through skin 2: Volatile compounds. Journal of Pharmaceutical Sciences 95(2):268-280.
HERO ID:	5018573
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	Dermal exposure
Dermal exposure data:	Dermal exposure data

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	N/A	Geographic scope is not applicable to scientific researchof dermal exposures.
	Metric 3:	Applicability	High	Article studies transient dermal exposure of volatile chemicalsthat evaporate and absorb into skin simultaneously, which isapplicable to the scopes of multiple chemicals.
	Metric 4:	Temporal Representativeness	Medium	Article was published in 2006; more than 10 years but less than20 years old.
	Metric 5:	Sample Size	N/A	Article studies science of skin permeation and evaporation. Sample size is not applicable.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Article is well documented with methods, assumptions, andsources.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	High	Detailed discussion on variability/uncertainty

Overall Quality Determination — High

Study Citation:	Kilo, S., Wick, J., Vijayan, Mini, S., Göen, T., Horch, R. E., Ludolph, I., Drexler, H. (2020). Impact of physiologically relevant temperatures on dermal absorption of active substances - an ex-vivo study in human skin. Toxicology In Vitro 68:104954.
HERO ID:	6838266
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	Dermal
Physical form:	Liquid
Dermal exposure data:	Dermal exposure data
Comments:	Lots of potentially useful data, but nothing relevant to include in these data points.Useful for dermal model development.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	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 Germany, an OECD country.
	Metric 3:	Applicability	High	Data are for dermal exposure modeling for 1,4-dioxane exposure, 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 distribution characterized by limited statistics (provide mean, plus whisker plot) 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 is addressed by discussing how potential differences in results may be explained by relative hydration of the skin. Variability is not addressed.

Overall Quality Determination High

Study Citation:	NIH, (2021). PubChem: Dioxane.
HERO ID:	9959774
Conditions of Use:	Other:

EXTRACTION

Parameter	Data
Exposure route:	inhalation, dermal (Page 24/70)
Physical form:	liquid, vapor (Page 1/70)
Personal protective equipment:	Wear appropriate personal protective clothing to prevent skin contact. Wear appropriate eye protection to prevent eye contact. The worker should immediately wash the skin when it becomes contaminated. Remove work clothing that becomes wet should be immediately removed due to its flammability hazard. Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. Respirators with a full facepiece, helmet, or hood should be used for vapor concentrations 200 ppm or less. (Page 38/70)
Engineering control:	Prevent the generation of mists. Closed systems and ventilation can prevent exposures. (Page 39/70)

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 all conditions of use, and can be applied to those in 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	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	The report does not address variability or uncertainty.

Overall Quality Determination Medium

Study Citation:	U.S. BLS, (2016). May 2016 Occupational Employment and Wage Estimates: National Industry-Specific Estimates.
HERO ID:	5079087
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Worker activity description:	Provided data includes worker title
Number of workers:	Provided data used to develop a method to estimate number of sites and workers

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	These economic data cover all industry and occupation typesin scope for all chemicals.
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old (2016)
	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
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	BLS documents results and methods, but underlying surveyresults 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:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Physical form:	Liquid
Number of workers:	<10 workers were reported at all sites in the 2020 CDR.

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 paints and floor lacquers, 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	High	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 is addressed by including data from different sites. Uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2017). Technical fact sheet 1,4-dioxane.
HERO ID:	9959767
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Exposure route:	Worker exposures may include inhalation of vapors (page 3)
Physical form:	Worker exposures may include inhalation of vapors (page 3)

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 not for a specific COU, just in general.
	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	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	All data sources, methods, results, and assumptions are clearly documented.
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, (2016). Chemical Data Reporting (CDR): 1,4-Dioxane CAS Number 123-91-1.
HERO ID:	9960770
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Physical form:	Liquid
Number of workers:	One industrial site reported at least 50 but less than 100 exposed workers, and another reported at least 100 but less than 500 exposed workers. One commercial site reported at least 1,000 but less than 10,000 exposed workers.

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	The report uses high-quality data, Chemical Data Reporting by industry to the EPA.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	CDR is U.S. based data.
Metric 3:	Applicability	High	CDR data provides industrial and commercial use data, which is in-scope.
Metric 4:	Temporal Representativeness	High	EPA used data from the 2016 CDR, which includes data reported for 2015.
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:	Franklin Associates,, Ltd., (2020). Cradle-to-resin life cycle analysis of polyethylene terephthalate resin (final revised report).
HERO ID:	10893260
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Release or emission factors:	Release or emission factors

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	Data are from the U.S.
	Metric 3:	Applicability	Medium	Data are for PET manufacture, which is similar to the in-scope occupational scenario PET byproduct manufacture.
	Metric 4:	Temporal Representativeness	High	Assessment from 2018 but is based on data no more than 10 years old (2015).
	Metric 5:	Sample Size	Medium	Data characterized by a range with uncertain 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:	HHS, (2016). 1,4-Dioxane: CAS No. 123-91-1.
HERO ID:	9960766
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Release quantity:	Total environmental releases of 1,4-dioxane reported by EPA's Toxics Release Inventory from 1988 to 2009 ranged from 0.3 million to 1.3 million pounds (in 1993). In 2003, 53 facilities released 309,000 lb of 1,4-dioxane, of which 46% was released to air, 27% to surface water, and most of the remainder (26%) to off-site underground injection wells. (Page 2/3)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Data is from TRI, so the methodology is 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 all sectors, but can be applied to those in-scope.
	Metric 4:	Temporal Representativeness	Medium	Data are greater than 10 years old but no more than 20 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (ranges, release quantities) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Release media and quantity provided, but missing release source, emission factors, and waste treatment.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	IOGCC,, G.a. (2022). FracFocus: Chemical disclosure registry.
HERO ID:	10291772
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Release quantity:	The FracFocus data includes 1,000s of entries voluntarily submitted by companies completing hydraulic fracturing. Companies submit values for 'Percent HF Job', which indicates the percent of the ingredient in the total hydraulic fracturing volume. This can be used in combination with the submitted fields for volume of hydraulic fracturing fluid to calculate the release quantity from each well site.
Release frequency:	The FracFocus data includes 1,000s of entries voluntarily submitted by companies completing hydraulic fracturing. Companies submit values for job start date and job end date that indicates release duration.

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 hydraulic fracturing, 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	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:	NIH, (2021). PubChem: Dioxane.
HERO ID:	9959774
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Release or emission factors:	Release or emission factors
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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 all conditions of use, and can be applied to those in scope.
	Metric 4:	Temporal Representativeness	High	Data are no more than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (ranges, mean) but discrete samples not provided and distribution not fully characterized.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Release media, emission factors, and waste treatment provided, but missing release source and 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, (2022). Discharge Monitoring Report (DMR) data for 1,4-dioxane, 2013-2019.
HERO ID:	10480472
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Release quantity:	Submissions report release quantity
Release frequency:	Submissions report annual release quantity

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Low	Methodology used by submitters to estimate release data is notknown.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	DMR includes industries included in the scopes of multiplechemicals
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old (2013-2019)
	Metric 5:	Sample Size	Medium	Universe is limited to NPDES permit holders; statistical representativeness is unclear.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Low	DMR only includes release media but no other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	DMR does not address variability or uncertainty in submitterprovided data.

Overall Quality Determination Medium

Study Citation: U.S. EPA, (2022). Toxics Release Inventory (TRI) data for 1,4-dioxane, 2013-2019.
HERO ID: 10480474
Conditions of Use: Other:

EXTRACTION

Parameter	Data
Release quantity:	Data submissions are release quantities from different facilities
Release frequency:	Provided data is annual release quantity
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Low	Methodology used by submitters to estimate release data is notknown.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	TRI includes industries included in the scopes of multiplechemicals
Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old (2013-2019)
Metric 5:	Sample Size	Medium	Due to reporting requirements, statistical representativeness isunclear.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Low	TRI only includes release media but no other metadata.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	TRI does not address variability or uncertainty in submitterprovided data.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (2021). Use of additives in plastic compounding – Generic scenario for estimating occupational exposures and environmental releases (Revised draft).
HERO ID:	10366192
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Description of release source:	Table 4-1 and Section 4 in general outlines EPA models that provide estimates for releases from each process step at the facility, including equipment and container cleaning.
Release quantity:	Section 4 outlines the various models for releases during this process such as the ”EPA/OPPT Dust Emissions from Transferring Solids Model ” and the ”EPA/OPPT Drum Residual Model ”
Release or emission factors:	Release or emission factors
Release frequency:	Section 3.10 provides an estimate for the annual number of batches which is indicative of release frequency for most models. The default for compounding plastics is 248 days/yr.
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Model is peer-reviewed and free of mathematical errors, based on sound approaches/methods, and uses appropriate equations and parameters.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	Medium	Model can be applied to Polyethylene Terephthalate (PET) Byproduct, an in-scope occupational scenario. Not specific to 1,4 Dioxane.
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	High	Uncertainty is addressed in Section 7.0 DATA GAPS/UNCERTAINTIES AND FUTURE WORK and by indicating that the modeling approach is conservative and estimates are likely to be higher, or at least higher than average, than amounts that might actually occur in real world practice. Variability addressed by ranges for many model inputs informed by industry and other data.

Overall Quality Determination High

Study Citation: ATSDR, (2012). Toxicological profile for 1,4 dioxane.
HERO ID: 1787229
Conditions of Use: Other:

EXTRACTION

Parameter	Data
Description of release source:	1,4-Dioxane is released into the environment during its production, processing, use, and with its unintentional formation during the manufacture of ethoxylated surfactants (EC 2002). In the past, 1,4-dioxane was released into the environment with its use as a stabilizer for TCA. Since the use of TCA has been discontinued, current releases from this source are expected to be very low.
Release quantity:	According to the TRI, a total of 182,338 pounds (82,693 kg) of 1,4-dioxane were released to the environment in 2007 from facilities required to report to the TRI (TRI07 2009). In addition, an estimated 2,794 pounds (361 kg) were transferred off-site, including to POTWs (181/295). Estimated releases of 125,341 pounds of 1,4-dioxane to the atmosphere from 45 domestic manufacturing and processing facilities in 2007 accounted for about 69% of the estimated total on-site environmental releases from facilities required to report to the TRI (182/295). Estimated releases of 56,996 pounds of 1,4-dioxane to surface water from 45 domestic manufacturing and processing facilities in 2006 accounted for about 31% of the estimated total on-site environmental releases from facilities required to report to the TRI. (182/295)
Waste treatment methods and pollution control:	Waste treatment methods and pollution control
Comments:	Table 6-1. Releases to the Environment from Facilities

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 all conditions of use, including those relevant to this risk assessment.
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 limited statistics (productions, ranges) 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	The assessment provides only limited discussion of the variability and uncertainty in the results. Variability is discussed by including various metrics of exposure and release sources.

Overall Quality Determination High

Study Citation:	Eckhardt, A. (2018). Positive trends emerge in reducing exposure to 1,4-dioxane. Journal of the American Water Works Association 110(7):54-59.
HERO ID:	5078566
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Description of release source:	Very low concentrations are from shampoos, detergents, and cosmetics in wastewater. (page 2/6)
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Assessment uses high quality data/ from frequently-used sources.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	Medium	Data is global, but the article was written in Germany, an OECD country.
Metric 3:	Applicability	High	Data are for industrial use of laundry and dishwashing 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	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	The assessment does not address variability or uncertainty.

Overall Quality Determination Medium

Study Citation:	OECD, (2011). Emission scenario document on coating application via spray-painting in the automotive refinishing industry.
HERO ID:	3808976
Conditions of Use:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Description of release source:	Container cleaning, equipment cleaning, coating application (overspray)
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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 Medium

Study Citation:	OECD, (2009). Emission scenario documents on coating industry (paints, lacquers and varnishes).
HERO ID:	3827298
Conditions of Use:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Description of release source:	"PROC: material loading, heat-up, surface evaporation, filling, micellaneous operations, material storage, leaks, spillsUSE: Application losses, equipment residues, drum residues"
Release or emission factors:	Release or emission factors
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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 Medium

Study Citation:	OECD, (2017). Emission Scenario Document (ESD) on the use of textile dyes.
HERO ID:	3828838
Conditions of Use:	Industrial/Commercial Use: Arts, crafts, and hobby materials - Textile dye

EXTRACTION

Parameter	**Data**
Description of release source:	Unloading, container cleaning, disposal of spent dye bath, equipment cleaning
Release or emission factors:	Release or emission factors
Release frequency:	31-295 days/yr
Waste treatment methods and pollution control:	Waste treatment methods and pollution control
Comments:	media: water, air, land

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 from 2015 but is based on data greater than 20 years old.
Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple chemical functions

Overall Quality Determination Medium

Study Citation:	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.
HERO ID:	6385735
Conditions of Use:	Industrial/Commercial Use: Automotive care products - Antifreeze

EXTRACTION

Parameter	**Data**
Description of release source:	”PROC: unloading, container cleaning, blending, sampling, equipment cleaning, loadingUSE: unloading, container cleaning, disposal of spent lube oil”
Release quantity:	Provides models for estimating various fugitive air releases
Release or emission factors:	Release or emission factors
Release frequency:	”Processing: 203-360Use: 253”
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

EVALUATION

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

Overall Quality Determination — High

Study Citation:	OECD, (2011). Emission scenario document on the chemicals used in water-based washing operations at industrial and institutional laundries.
HERO ID:	6387321
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Laundry detergent

EXTRACTION

Parameter	**Data**
Description of release source:	Container cleaning, unloading, cleaning operations
Release or emission factors:	Release or emission factors
Release frequency:	20-365 days/yr
Waste treatment methods and pollution control:	Waste treatment methods and pollution control
Comments:	media: water, air, land

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 multiple laundry product types, chemical functions, and types of launderers.

Overall Quality Determination Medium

Study Citation: OECD, (2012). Emission scenario document on chemicals used in oil well production.
HERO ID: 6387322
Conditions of Use: Other:

EXTRACTION

Parameter	Data
Description of release source:	Container cleaning, equipment and storage vessel cleaning, additive in oil/water from separation processes
Release or emission factors:	Release or emission factors
Release frequency:	350 days/yr
Waste treatment methods and pollution control:	nan

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	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 on- and off-shore wells and chemical functions.

Overall Quality Determination Medium

Study Citation:	OECD, (2015). Emission scenario document (ESD) on industrial use of industrial cleaners.
HERO ID:	6414932
Conditions of Use:	Industrial/Commercial Use: Cleaning and furniture care products - Surface cleaner

EXTRACTION

Parameter	**Data**
Description of release source:	Draggout, 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:	Waste treatment methods and pollution control

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	Low	Methodology 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 cleaner types

Overall Quality Determination Medium

Study Citation: U.S. EPA, (2022). Emission scenario document on chemicals used in hydraulic fracturing (draft).
HERO ID: 10366193
Conditions of Use: Other:

EXTRACTION

Parameter	Data
Description of release source:	Container unloading, equipment cleaning, container cleaning, deep well injection, flowback and produced wastewater
Release or emission factors:	Release or emission factors
Release frequency:	14 days/yr for injection;350 days/yr for release for flowback and produced water, page 25
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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 ESD 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 range of release quantities based on multiple sources.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2022). Chemicals used in furnishing cleaning products - Generic scenario for estimating occupational exposures and environmental releases (revised draft).
HERO ID:	10368811
Conditions of Use:	Industrial/Commercial Use: Cleaning and furniture care products - Surface cleaner

EXTRACTION

Parameter	**Data**
Description of release source:	Container unloading, container cleaning, application and use of cleaning products
Release or emission factors:	Release or emission factors
Release frequency:	1 job day/yr (page 18)

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). Commercial use of automotive detailing products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).
HERO ID:	10480464
Conditions of Use:	Industrial/Commercial Use: Automotive care products - Antifreeze

EXTRACTION

Parameter	**Data**
Description of release source:	Container unloading, container cleaning, application and use of automotive detailing products (Page 24)
Release or emission factors:	Release or emission factors
Release frequency:	260 day/yr (page 16)
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).
HERO ID:	10480466
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Description of release source:	Container unloading, container cleaning, labware equipment cleaning, during laboratory analyses, waste disposal (page 23-24)
Release or emission factors:	Release or emission factors
Release frequency:	260 day/yr (page 17)
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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, (2018). Application of spray polyurethane foam insulation - Generic scenario for estimating occupational exposures and environmental releases -Draft.
HERO ID:	5079085
Conditions of Use:	Other:

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:	Release or emission factors
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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:	Dow Chemical, (2023). Comments of Dow Chemical on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11334206
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Description of release source:	1,4-dioxane is released in reactor wash water, railcar wash water, and during disposal of samples. the source provides water throughput of its wastewater treatment plant, but does not provide any 1,4-dioxane release quantities (10/25).
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Report uses high quality data 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 ethoxylation byproduct, 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 distribution characterized by a range with uncertain 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:	Health,, D.O. (2023). Comments of the Defend Our Health on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11335568
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Description of release source:	lists reported TRI release submissions to water and air
Release quantity:	lists reported TRI release quantities from 12 facilities to water and air

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 PET manufacture byproduct, 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	High	Statistical distribution of samples is fully characterized (discrete 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	Uncertainty is not addressed. Variability is addressed by multiple TRI submissions.

Overall Quality Determination High

Study Citation:	Huntsman, (2023). Comments of the Huntsman International, LLC on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11332422
Conditions of Use:	nan

EXTRACTION

Parameter	**Data**
Description of release source:	The source provides a block flow diagram that shows release sources from the process (page 4 and 5). A brief description of 1,4-dioxane releases states that a scrubber is used to prevent air emissions and wastewater is collected before disposal through underground injection well (page 2)
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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 PET manufacturing byproduct, 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 described qualitatively.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Medium	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:	Mahmoud, M., Ismail, S., Tawfik, A. (2018). Post-treatment of anaerobic effluent containing 1,4-dioxane and heavy metals via auto-aerated down-flow hanging luffa (ADHL) system. Process Safety and Environmental Protection 117:22-32.
HERO ID:	5078320
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Release quantity:	Approximately 55.0 m3/d wastewater are produced from the factory and discharged into sewerage network without treatment; 2.4+/-1.1 mg/L dioxane in wastewater, 2.2+/-0.9 mg/L in anaerobic effluent (page 2)
Waste treatment methods and pollution control:	Waste treatment methods and pollution control
Comments:	1,4-dioxane was measured using GC/MS, shimadzu-Qp2010 Ultra (page 3)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Medium	Report uses high quality data/techniques/methods that are not from frequently-used sources and there are no known quality issues.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	Low	Data are from Egypt, a non-OECD country.
Metric 3:	Applicability	Medium	Data are for an out-of-scope COU, but the waste treatment data may be applicable for other COU releases.
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 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	Variability addressed by discussing different retention times, but uncertainty is not addressed.

Overall Quality Determination Medium

Study Citation:	Stefl, B. A., George, K. F. (2014). Antifreezes and deicing fluids.
HERO ID:	10366190
Conditions of Use:	Industrial/Commercial Use: Automotive care products - Antifreeze

EXTRACTION

Parameter	**Data**
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report is from Kirk-Othmer, a frequently used source.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for antifreeze, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Report is less than 10 years old.
	Metric 5:	Sample Size	N/A	No quantitative data available.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	All sources, methods, results, and assumptions are documented.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Variability and uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2017). Technical fact sheet 1,4-dioxane.
HERO ID:	9959767
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Waste treatment methods and pollution control:	Waste treatment methods and pollution control

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 not for a specific COU
	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	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	All data sources, methods, results, and assumptions are clearly documented.
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, (2021). Use of additives in plastic compounding – Generic scenario for estimating occupational exposures and environmental releases (Revised draft).
HERO ID:	10366192
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Process description:	Section 2.0 provides an overview of different types of compounding processes, including: Tumble Blenders, Ball Blenders, Gravity Mixers, Paddle/Double Arm Mixer, Intensive Vortex Action Mixers, Banbury Internal Mixers, Two Roll Mills, and Extruders. The section also includes a detailed discussion of the generic compounding process and the typical exposure and release points.
Throughput:	Annual U.S. Demand for Plastics Additives (kg additives/year): 1,814,000,000Number of Sites: 420Default Qall_additives_site_yr (kg all additives/site-year): 4,319,048
Number of sites:	Data on the number of compounding sites obtained from the 2018 Census (2018): 420 sites, based on NAICS 325991
Chemical concentration:	The below sections describe methods for determining/estimating the concentration of various chemicals of interest in compounded plastics. The defaults provided in these sections are based on data compiled in Table 1-2. Table 1-2 "typical weight fractions of plastics additives in various plastic resins" uses data from OECD (2009)Section 3.4 Mass Fraction of the Chemical of Interest in the Plastics AdditiveSection 3.5 Mass Fraction of the Plastics Additive of Interest in the Compounded Plastic ResinSection 3.6 Mass Fraction of the Chemical of Interest in the Compounded Plastic Resin

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Model is peer-reviewed and free of mathematical errors, based on sound approaches/methods, and uses appropriate equations and parameters.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	Medium	Model can be applied to Polyethylene Terephthalate (PET) Byproduct, an in-scope occupational scenario. Not specific to 1,4 Dioxane.
	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	High	Uncertainty is addressed in Section 7.0 DATA GAPS/UNCERTAINTIES AND FUTURE WORK and by indicating that the modeling approach is conservative and estimates are likely to be higher, or at least higher than average, than amounts that might actually occur in real world practice. Variability addressed by ranges for many model inputs informed by industry and other data.

Overall Quality Determination High

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Study Citation:	U.S. EPA, (2021). Use of additives in plastic compounding – Generic scenario for estimating occupational exposures and environmental releases (Revised draft).
HERO ID:	10366192
Conditions of Use:	Other:

		EVALUATION	
Domain	Metric	Rating	Comments

Study Citation:	ATSDR, (2012). Toxicological profile for 1,4 dioxane.
HERO ID:	1787229
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	The total production of 1,4-dioxane for 1982 was estimated at 15 million pounds (6,800 metric tons), up from 12 million pounds (5,400 metric tons) reported in 1977. (174/295)
Number of sites:	There are 381 facilities that produce or process 1,4-dioxane in the United States. (174/295)
Chemical concentration:	During 1992–1997, the average concentration of 1,4-dioxane in some cosmetic products reportedly ranged from 14 to 79 mg/kg. In a more recent survey reported by the Campaign for Safe Cosmetics, the levels of 1,4-dioxane in cosmetic products were found to be lower (1.5–12 ppm in baby and children's products and 2–23 ppm in adult products) than in the survey done by the FDA in the 1990s. (22/295)
Comments:	Table 5-1. Facilities that Produce, Process, or Use 1,4-Dioxane

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 all conditions of use, including those relevant to this risk assessment.
	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 limited statistics (productions, ranges) 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	The assessment provides only limited discussion of the variability and uncertainty in the results. Variability is discussed by including various metrics of exposure and release sources.

Overall Quality Determination High

Study Citation:	Makino, R., Kawasaki, H., Kishimoto, A., Gamo, M., Nakanishi, J. (2006). Estimating health risk from exposure to 1,4-dioxane in Japan. Environmental Sciences 13(1):43-58.
HERO ID:	3660508
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Chemical concentration:	PRODUCT:CONCENTRATION (determination limits):Liquid Soap 1n.d. (<5mg/kg)Liquid Soap 2n.d. (<5mg/kg)Dishwashing Liquid 1n.d. (<10mg/L)Dishwashing Liquid 251 mg/LDishwashing Liquid 3n.d. (<5mg/kg)Dishwashing Liquid 4n.d. (<10mg/L)Laundry Detergent 1n.d. (<10mg/L)Laundry Detergent 2n.d. (<5mg/kg)Laundry Detergent 3n.d. (<5mg/kg)Laundry Detergent 4n.d. (<25mg/L)
Comments:	Example process description was only given for shampooing, not dish washing or laundry. Note, occupational exposure and environmental release were not assessed due to none of the details being related to the Use case of these CoUS (they are all MFG related).

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Assessment uses high quality techniques and methods from frequently-used sources.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	Medium	Data are from Japan, an OECD Country
Metric 3:	Applicability	Medium	Data are for consumer laundry and dish detergents, which is similar to the the in-scope occupational scenario of commercial/industrial laundry and dish detergents.
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 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	Uncertainty is addressed by discussing how the marketshare of each product could affect the actual results, but that the data was unknown. Gave examples how the results could skew one way or another. Variability is addressed by providing potential reasons for previous studies showing a 1,4-dioxane concentration in products that this study did not.

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:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
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 jobsAlso provides method for adjsuting the use rate based on the type of coating product used”
Number of sites:	32,296
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 Medium

Study Citation:	OECD, (2009). Emission scenario documents on coating industry (paints, lacquers and varnishes).
HERO ID:	3827298
Conditions of Use:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	3.2 million tonnes coating/yr
Life cycle description:	Formulation of Coatings and Use of Coatings
Process description:	”PROC: Dispersion, milling, finishing, fillingUSE: 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. Table 5.1, P.137/201
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 Medium

Study Citation:	OECD, (2017). Emission Scenario Document (ESD) on the use of textile dyes.
HERO ID:	3828838
Conditions of Use:	Industrial/Commercial Use: Arts, crafts, and hobby materials - Textile dye

EXTRACTION

Parameter	**Data**
Process description:	Dye formulation received, unloaded, dyeing of fiber, yarn, or fabric
Throughput:	31-295 days/yrProvides methodology for estimating throughput based on the amount of textile dyed and concentration of chemical in the dye
Number of sites:	Provides methodology to estimate number of sites based on chemical production volume, use rate, and operating days
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	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 from 2015 but is based on data greater than 20 years old.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	All data sources, methods, results, and assumptions are clearly documented.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Uncertainty not addressed. Variability addressed by considering multiple chemical functions

Overall Quality Determination Medium

Study Citation:	OECD, (2020). Emission scenario document on chemical additives used in automotive lubricants.
HERO ID:	6385735
Conditions of Use:	Industrial/Commercial Use: Automotive care products - Antifreeze

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	6.3 billion kg lubricants/yr
Process description:	”Processing: Unloading raw materials, blending, intermediate storageUse: Unloading lube oil, removing spend oil and replacing with new oil, disposing/recycling of used oil”
Throughput:	Provides methodology for estimating throughput based on the amount of lubricant produced, and the concentration of the chemical in the lube oil
Number of sites:	Provides methodology for estimating number of sites based on chemical PV, the use rate, and the concentration of the chemical in the lubricant
Chemical concentration:	Provides conc. estimates based on chemical function, not chemical specific.

EVALUATION

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

Overall Quality Determination — High

Study Citation:	OECD, (2011). Emission scenario document on the chemicals used in water-based washing operations at industrial and institutional laundries.
HERO ID:	6387321
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Laundry detergent

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	110,000-15,000,000 kg dry, clean laundry/site-yr450-95,000 kg cleaning product/site-yr
Process description:	Laundry received/sorted/weighed, cleaning product received, automatic or manual loading of chemicals into washing machine, washing, handling damp laundry, drying and steaming, hanging and folding
Throughput:	20-365 days/yrProvides methodology for estimating throughput based on the amount of adhesived used, and the concentration of the chemical in the formulation
Number of sites:	1,018-54,000 total sites
Chemical concentration:	Provides conc. estimates based on the cleaning product type and chemical function, not chemical specific.
Comments:	phys form: liquid or solid

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 limited statistics (min,max, mean, median, and 90th percentile) 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 laundry product types, chemical functions, and types of launderers.

Overall Quality Determination Medium

Study Citation:	OECD, (2012). Emission scenario document on chemicals used in oil well production.
HERO ID:	6387322
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	703-112,875 bbl/well-yr
Life cycle description:	Hydraulic Fracturing
Process description:	Container unloading, storage, pumped into oil well, extracted, temporary storage tank or separation process, natural gas processing/refinery/disposal
Throughput:	1.29-3.86 million bbl oil/day
Number of sites:	Provides methodology to estimate number of sites based on chemical production volume, oil production rate, and operating days
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 on- and off-shore wells and chemical functions.

Overall Quality Determination High

Study Citation:	OECD, (2015). Emission scenario document (ESD) on industrial use of industrial cleaners.
HERO ID:	6414932
Conditions of Use:	Industrial/Commercial Use: Cleaning and furniture care products - Surface cleaner

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 Medium

Study Citation:	P&G, (2023). Comments of The Procter & Gamble Company on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333406
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Process description:	The required and standard method for washing dishes is the 3-compartment sink of Wash-Rinse-Sanitize. The first sink is filled with hand dish detergent solution, the 2nd compartment is potablewater for rinsing, and the 3rd sink is filled with a sanitizing solution. The worker uses the diluted dish detergent solution to wash/clean an item, scrubs it with a tool such as a sponge, cloth, or soft brush, then dunks it in the rinse solution, and finally sanitizes it before allowing it to air dry. Most of this washing is done directly above the sink dish water where the hands are not constantly soaking in the dilute solution. As each item gets washed and hands are exposed, much of the time they will also get rinsed shortly after in the rinse water. P&G Professional supplies several ways for employees to dose the hand dish soap into sinks tominimize end-users' exposure to the finished product, both for safety and ease of use. 1. Auto dose in which the product is proportioned at the proper dose into the sink via a product tube in a proportioning system.2. A pump affixed to the top of the detergent bottle that is pumped directly into the sink.3. A flip-top squirt cap that is squirted directly into the sink.4. Some end-users will free-pour from a gallon bottle directly into the sink or pour from an open gallon into a measuring cup or similar.The 1 oz pumps are most frequently used, followed by the proportioned auto dose system(4/17)
Throughput:	The dish sink water by Food Code is kept at or above110° F (315° K). When it cools off, it is drained and re-filled with hot water. The most common 3-compartment sink size is 16" x 20", though they can be up to 30" x 24" x 14" deep, holding roughly 25 gallons max. (8/17)148 g soap/use (9/17)
Chemical concentration:	P&G recommends that EPA use concentrations of less than 1 ppm (or less than 15 ppm to conservatively account for industry waivers) as this is the de facto upper concentration of 1,4-dioxane in hand dish soap and auto dishwasher detergent products established by the New York State Department of Environmental Conservation. Note that of over 1,500 products that have received a waiver through the end of 2023, 95% have a 1,4-dioxane concentration less than 10 ppm and the median value is 4.7 ppm. (2/17)P&G recommends EPA to use 1 ppm (or 15 ppm to account for industry waivers) as the upper concentration limit for hand dish soap commercial use products and, in addition, apply a 0.156% dilution factor. (6/17)

EVALUATION

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source (Consumer Exposure Model, NY product waiver data) and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The assessment is for dish soap, an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	Assessment is less than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution is characterized by a range of concentrations, or single values for throughput information.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, andassumptions.

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Study Citation:	P&G, (2023). Comments of The Procter & Gamble Company on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333406
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

		EVALUATION	
Domain	Metric	Rating	Comments
Domain 4: Variability and Uncertainty			
	Metric 7: Metadata Completeness	Medium	Variability addressed by using different product concentrations and addressing different washing methods. Uncertainty isn't addressed.
Overall Quality Determination		**High**	

Study Citation:	P&G, (2023). Comments of The Procter & Gamble Company on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333406
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dishwasher detergent

EXTRACTION

Parameter	**Data**
Process description:	The employee loads dirty dishes into a dish rack (Figure 8), they open the door to the machine, slide in the rack and close thedoor. The products are not dispensed until the door is closed, and by the time the cycle is completed, the dishware in the rack have been rinsed with clean water (3 step – wash, rinse, sanitize). The employee pulls the rack out by hand on the “clean side” and pushes in another dirty rack on the “dirty side” (these steps are automatic in a continuous rack machine). (12/17)
Throughput:	Professional products are only sold in “closed loop” packages (1 and 5 gallon). (11/17)10 g detergent/use (15/17)
Chemical concentration:	P&G recommends that EPA use concentrations of less than 1 ppm (or less than 15 ppm to conservatively account for industry waivers) as this is the de facto upper concentration of 1,4-dioxane in hand dish soap and auto dishwasher detergent products established by the New York State Department of Environmental Conservation. Note that of over 1,500 products that have received a waiver through the end of 2023, 95% have a 1,4-dioxane concentration less than 10 ppm and the median value is 4.7 ppm. (2/17)P&G recommends EPA to use 1 ppm (or 15 ppm to account for industry waivers) as the upper concentration limit for hand dish soap commercial use products and, in addition, apply a 0.156% dilution factor. (6/17)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The assessment or report uses high quality data and/or techniques or sound methods that are from a frequently used source (Consumer Exposure Model, NY product waiver data) and are generally accepted by the scientific community, and associated information does not indicate flaws or quality issues.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	The data are from the United States and are representative of the industry being evaluated.
	Metric 3:	Applicability	High	The assessment is for dishwasher detergent, an occupational scenario within the scope of the risk evaluation.
	Metric 4:	Temporal Representativeness	High	Assessment is less than 10 years old.
	Metric 5:	Sample Size	Medium	Sample distribution is characterized by a range of concentrations, or single values for throughput information.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, andassumptions.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability addressed by using different product concentrations and addressing different washing methods. Uncertainty isn’t addressed.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2022). Emission scenario document on chemicals used in hydraulic fracturing (draft).
HERO ID:	10366193
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Process description:	Receiving chemicals, transfer to storage tank, formulation of fracturing fluids, well injection, wastewater management
Throughput:	11,000,000 gallon/well-yr (50th percentile), page 27
Number of sites:	982,000 total wells in the U.S., page 15
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 ESD 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 and data provided by multiple facilities.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2022). Chemicals used in furnishing cleaning products - Generic scenario for estimating occupational exposures and environmental releases (revised draft).
HERO ID:	10368811
Conditions of Use:	Industrial/Commercial Use: Cleaning and furniture care products - Surface cleaner

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	Total industry volume based on the default values in this GS are approximately 50,600,000 kg furnishing cleaning products/yr (average) and 203,000,00 kg cleaning products/yr (maximum) (page 21)
Process description:	Receive chemicals, application and use of cleaning product, solution extraction from fabric and/or surfaces
Throughput:	2.74 kg cleaning product /site-day (average); Table 3-2 (page 19) gives daily throughput based on chemical function
Number of sites:	Provides methodology to estimate number of sites based on chemical production volume, annual throughput
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). Commercial use of automotive detailing products - Generic scenario for estimating occupational exposures and environmental releases (Methodology review draft).
HERO ID:	10480464
Conditions of Use:	Industrial/Commercial Use: Automotive care products - Antifreeze

EXTRACTION

Parameter	**Data**
Process description:	Receive detailing products, dilute with water, application to vehicle through washing, polishing, and/or wiping (Page 12)
Throughput:	Provides methodology to estimate annual use rate based on number of cars, product used per car, and density of product (Page 18) 1 to 16 ounces of automotive detailing product per car (Page 18)
Number of sites:	Provides methodology to estimate number of sites based on chemical production volume, annual throughput - 147,152 total establishments (Page 21)
Chemical concentration:	'Provides conc. estimates based on the chemical function, not chemical specific (Page 17)

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). Use of laboratory chemicals - Generic scenario for estimating occupational exposures and environmental releases (Revised draft generic scenario).
HERO ID:	10480466
Conditions of Use:	Other:

EXTRACTION

Parameter	Data
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 (page 13)
Throughput:	Provides methodology to estimate annual use rate. Provides some use rate quantities for the first 10 chemicals in table 1-2 (page 11); 255 grams reagent/site-day (average); 2,000 mL reagent/site-day (average); Table 3-2 gives daily throughput for laboratory stock solutions (page 18)
Number of sites:	Provides methodology to estimate number of sites based on chemical production volume, annual throughput - 40,639 total establishments (page 20-21)
Chemical concentration:	Provides conc. estimates based on the chemical function, not chemical specific. Table 1-1 (page 10)

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, (2018). Application of spray polyurethane foam insulation - Generic scenario for estimating occupational exposures and environmental releases -Draft.
HERO ID:	5079085
Conditions of Use:	Other:

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 Medium

Study Citation:	Vallieres, M., Cockcroft, D. W., Taylor, D. M., Dolovich, J., Hargreave, F. E. (1977). Dimethyl ethanolamine-induced asthma. American Review of Respiratory Disease 115(5):867-871.
HERO ID:	6839929
Conditions of Use:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Chemical concentration:	The paint contained a water base emulsion of methyl methacrylate (98%), a cross-linking agent (2%), and occasionally a pigment. The cross-linking agent used was dimethyl ethanolamine (70%) with 1,4 dioxane (30%) as a thinner. (Page 1/5)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Report uses high quality techniques 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 Canada, an OECD country.
	Metric 3:	Applicability	High	Data are for industrial use of paint and floor lacquer, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Low	The report is based on data greater than 20 years old and industry conditions that are expected to be outdated.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by limited statistics (percentages) 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	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium

Study Citation:	Belanger, P. L. (1980). Health hazard evaluation report no. HHE-80-21-721, Colgate-Palmolive Co., Berkeley, California.
HERO ID:	3859368
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Process description:	Process includes transfer of bulk 3EO-sulfate from the storage area to the liquid mixing area using a closed transfer system. Dish soap is sampled then transferred to the bottling area (liquid finishing area). There are four bottling lines. The detergent is piped from the storage area to the bottle filler. The container is filled, capped, washed, dried, labeled and boxed.
Chemical concentration:	Report provides the concentration of 1,4-dioxane in multiple detergents and dish soap from analyzed samples

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Sampling/analytical methodology completed by NIOSH
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	Medium	Data are for manufacture of dish soap, which is similar to the in-scope occupational scenario for the use of dish soap.
Metric 4:	Temporal Representativeness	Low	Monitoring data are greater than 20 years old (1980)
Metric 5:	Sample Size	Low	Distribution of samples is qualitative or characterized by no statistics.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Medium	Assessment or report clearly documents results, methods, and assumptions. Data sources are generally described but not fully transparent
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	The monitoring study does not address variability or uncertainty.

Overall Quality Determination Medium

Study Citation:	Black, R. E., Hurley, F. J., Havery, D. C. (2001). Occurrence of 1,4-dioxane in cosmetic raw materials and finished cosmetic products. Journal of AOAC International 84(3):666-670.
HERO ID:	194351
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Process description:	Polyethoxylated raw materials are widely used in cosmetic products as emulsifiers, foaming agents, and dispersants. They are made by polymerizing ethylene oxide, usually with a fatty alcohol, to form polyethoxylated alcohols which may be used to synthesize other products such as sulfated surface-active agent. During the ethoxylation process, 1,4-dioxane can be formed as a byproduct by the dimerization of ethylene oxide. (1/5)
Chemical concentration:	Average 1,4-dioxane concentrations in ethoxylated cosmetic products range from 0-279 ppm. (4/5)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Report is from Kirk-Othmer, a frequently used source.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Report is for ethoxylation byproducts, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	Medium	The report is more than 10 years but no more than 20 years old.
Metric 5:	Sample Size	Medium	Select statistics are provided (ranges, averages), but no discrete data provided.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	Report clearly documents its sources, methods, results, and assumptions.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Medium	Variability is addressed by sampling products from different years. Uncertainty isn't addressed.

Overall Quality Determination — High

Study Citation:	Davarani, H., S.S., Masoomi, L., Banitaba, M. H., Zhad, L.,Z, H.R., Sadeghi, O., Samiei, A. (2012). A New Aluminium Hydroxide Coating on Fused Silica Fiber for the Determination of 1,4-Dioxane in Surfactants and Detergents Using HS-SPME-GC. Chromatographia 75(7-8):371-377.
HERO ID:	2044064
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dishwasher detergent

EXTRACTION

Parameter	**Data**
Chemical concentration:	1 Sample described as "Dish Washing", uncertain if this is dish soap or dishwasher detergent. Further, no indication of whether this is industrial, commercial, or consumer. Tested concentration is 3 ug/g (3 ppm).
Comments:	Table 2 Determination of 1,4-dioxane in detergents and surfactantsfrom manufacturers in Iran by the proposed SPME fiber coupled withGC-FIDa

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 Iran, an OECD country
	Metric 3:	Applicability	High	Data are for industrial/commercial use: laundry and dishwashing detergent, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Medium	Report is based on data greater than 10 years old but no more than 20 years old and industry conditions that are expected to be representative of current industry conditions. (2011)
	Metric 5:	Sample Size	Low	Sample distribution is characterized by no statistics. There is only one sample point for this use.
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:	Dow Chemical, (2023). Comments of Dow Chemical on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11334206
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Process description:	The source describes a surfactant manufacturing process and areas where 1,4-dioxane is present as a byproduct (page 9 and 10). In summary, 1,4-dioxane is created as a byproduct in the ethoxylation reactor and transferred to rail car for transportation. 1,4-dioxane is also present during sample collection, reactor washing, railcar washing, and process wastewater.
Chemical concentration:	The source states, "amounts of 1,4-dioxane are formed as a byproduct at 1-30ppm during the ethoxylation process inside the reactors." and wash water from the rail cars contain 1-2% surfactant (page 9 and 10). The source also states, "The concentration of 1,4-dioxane in Dow products varies, with most of the products containing <100 ppm". There is also a list of products and the associated 1,4-dioxane concentration where the maximum concentration is listed as not more than 3ppm on page 23.

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 [occupational scenario], 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	High	Statistical distribution of samples is fully characterized
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 including a range of concentration but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	Forkner, M. W., Robson, J. H., Snellings, W. M., Martin, A. E., Murphy, F. H., Parsons, T. E. (2004). Glycols. 12:644-682.
HERO ID:	4940397
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Process description:	PET is produced by the esterification of terephthalic acid to form bishydroxyethyl terephthalate (BHET). BHET polymerizes in a transesterification reaction catalyzed by antimony oxide to form PET. (Page 2/39)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report is from Kirk-Othmer, a frequently used source.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data is for PET byproducts, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	Medium	Report is between 10 and 20 years old.
	Metric 5:	Sample Size	N/A	Process description
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	Uncertainty and variability aren't addressed.

Overall Quality Determination — High

Study Citation:	Franklin Associates,, Ltd., (2020). Cradle-to-resin life cycle analysis of polyethylene terephthalate resin (final revised report).
HERO ID:	10893260
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Process description:	”The function of PET resin is its ability to be used in a variety of PET products, for example, bottles and automotive products.” - page 8”Examples of PET resin end-uses include consumer food product packaging, beverage containers, and personal care products.” - page 40
Throughput:	’Approximately 4.7 million tons of polyethylene terephthalate capacity was available in 2015 in North America (Plastics Insight, 2016)

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	Data are from the U.S.
	Metric 3: Applicability	Medium	Data are for PET manufacture, which is similar to the in-scope occupational scenario PET byproduct manufacture.
	Metric 4: Temporal Representativeness	High	Assessment from 2018 but is based on data no more than 10 years old (2015).
	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	Low	Variability and uncertainty are not addressed.

Overall Quality Determination High

Study Citation:	Franz, C., Bennett, S., DeLeo, P. C., Collatz, M., Kelly, K., Nekoomaram, J., Wieroniey, S. (2015). Comments of the Adhesive and Sealant Council, the American Coatings Association, the American Chemistry Council, the American Cleaning Institute, the Consumer Specialty Products Association, and Waste Management on the 1,4-dioxane problem formulation and initial assessment.
HERO ID:	3986506
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Chemical concentration:	Levels of 1,4-dioxane impurity in ethoxylated surfactants are limited to 100 ppm in the product formulation (page 17)In a study of household products (soaps, shampoos, cleaners and detergents) in Japan, 1,4-dioxane was detected in 40 out of 51 products at concentrations from 0.05 to 33 mg/kg with a mean of 2.7 mg/kg (page 18)

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 various in-scope cleaning products
	Metric 4:	Temporal Representativeness	Medium	Concentration data from 2008 and 2012.
	Metric 5:	Sample Size	Medium	Sample distribution characterized by a range with uncertain statistics (other than mean)
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 providing data for various cleaner types but uncertainty is not addressed.

Overall Quality Determination Medium

Study Citation:	HCPA, (2023). Comments of the Household and Commercial Products Association (HCPA) on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation; Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11332911
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Chemical concentration:	The NYS DEC waiver concentrations range from 2.01-15.0 ppm for reported dish soaps and detergents. (2/8)

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 (NY DEC) 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	Data are from the U.S.
	Metric 3:	Applicability	High	Data is for dish soap and detergent, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Data is less than 10 years old.
	Metric 5:	Sample Size	Medium	Concentration data is presented as a range with uncertain statistics.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Assessment or report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability in product concentrations is addressed. Uncertainty isn't addressed.

Overall Quality Determination — High

Study Citation:	Health,, D.O. (2023). Comments of the Defend Our Health on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11335568
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Number of sites:	12 sites report releases of 1,4-dioxane from PET plastic and related chemical plants to TRI (5/9).

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 PET manufacture byproduct, 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	High	Statistical distribution of samples is fully characterized (discrete 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	Uncertainty is not addressed. Variability is addressed by multiple TRI submissions.

Overall Quality Determination High

Study Citation:	HHS, (2016). 1,4-Dioxane: CAS No. 123-91-1.
HERO ID:	9960766
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	Estimated U.S. production of 1,4-dioxane was 12 million pounds in 1977 and 15 million pounds in 1982. U.S. production plus imports of 1,4-dioxane totaled 10 million to 50 million pounds in 1986 and 1990, decreasing to between 1 million and 10 million pounds between 1994 and 2006 (Page 1/3)
Number of sites:	In 2009, 1,4-dioxane was produced by one manufacturer each in the United States, Europe, and India and three manufacturers in East Asia and was available from 48 suppliers, including 26 U.S. suppliers. (Page 1/3)
Chemical concentration:	Dioxane is typically at a concentration of 3.5% (Page 1/3)

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	Uninformative	Data are for domestic manufacturing, which isn't in-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	Medium	Sample distribution characterized by limited statistics (percentages, production values, number of sites) 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	Low	Variability and uncertainty are not addressed.

Overall Quality Determination — Uninformative

Study Citation:	Huntsman, (2023). Comments of the Huntsman International, LLC on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11332422
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Process description:	A block flow diagram is provided to show the PET manufacturing process (page 4 and 5).The source describes how 1,4-dioxane is formed as a byproduct in the PET manufacturing process and how the production facility collects and disposes of it. "The formation of 1,4-Dioxane occurs in a closed system and is distilled from the polyol reactors and condensed along with water and/or glycol. This condensed take-off material contains approximately 3% 1,4-Dioxane. This material is transferred into bulk storage tanks and then eventually into a tanker through a series of closed pipelines. Any non-condensed gases pass through a scrubber which prevents air emissions of 1,4-Dioxane. The solution of water and 1,4-Dioxane is sent by tanker truck to a third-party facility for disposal via a permitted Class I Underground Injection Well...The solution of glycol and 1,4-Dioxane from trans-esterification is sold to glycol manufacturersfor recovery of the 90%+ glycol in the stream." (page 2)
Throughput:	The source includes some numbers to describe throughput of raw materials and provides percentages of process mass throughout the block flow diagram. Page 1 states, "Both pre-consumer and post-consumer sources of PET are used, equivalent to one billion 500 ml PET bottles per year."
Chemical concentration:	The source includes a percentage of 1,4-dioxane produced in the process. Page 2 states, "This condensed take-off material contains approximately 3% 1,4-Dioxane."

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 PET manufacturing byproduct, 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 described qualitatively.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Medium	Data is generally described but 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:	IOGCC,, G.a. (2022). FracFocus: Chemical disclosure registry.
HERO ID:	10291772
Conditions of Use:	Other:

EXTRACTION

Parameter	Data
Throughput:	The FracFocus data includes 1,000s of entries voluntarily submitted by companies completing hydraulic fracturing. Two submitted fields are combined to give a total throughput of hydraulic fracturing fluid. Total Base Water Volume and Total Base Non Water Volume add to give the use rate of hydraulic fracturing fluid from each well site.
Number of sites:	The FracFocus data includes 1,000s of entries voluntarily submitted by companies completing hydraulic fracturing. Each submission includes a well name and API number to denote individual wells. The count of individual wells from all submissions will indicate the total number of well sites using hydraulic fracturing. Data also indicates the ingredients in the fluid used, which could indicate the number of sites using 1,4-dioxane in hydraulic fracturing
Chemical concentration:	The FracFocus data includes 1,000s of entries voluntarily submitted by companies completing hydraulic fracturing. Companies submit values for 'Percent High Additive', which indicates the percent of the ingredient in the chemical additive, and 'Percent HF Job', which indicates the percent of the ingredient in the total hydraulic fracturing volume

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Low	Methodology is not specified and all entries are voluntarily submitted
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for hydraulic fracturing, 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	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:	Johnson, W. (2004). Final report on the safety assessment of octoxynol-1, octoxynol-3, octoxynol-5, octoxynol-6, octoxynol-7, octoxynol-8, octoxynol-9, octoxynol-10, octoxynol-11, octoxynol-12, octoxynol-13, octoxynol-16, octoxynol-20, octoxynol-25, octoxynol-30, octoxynol-33, octoxynol-40, octoxynol-70, octoxynol-9 carboxylic acid, octoxynol-20 carboxylic acid, potassium octoxynol-12 phosphate, sodium octoxynol-2 ethane sulfonate, sodium octoxynol-2 sulfate, sodium octoxynol-6 sulfate, and sodium octoxynol-9 sulfate. International Journal of Toxicology 23(Suppl 1):59-111.
HERO ID:	1419086
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Chemical concentration:	"However, Nonoxynol-4 (five samples) contained 4.5 to 20 ppm 1,4-dioxane and 7.9 to 67 ppm ethylene oxide. Triplicate samples of Nonoxynol-9 contained <4.5 to 5.9 ppm 1,4-dioxane."

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality methods from frequently-used sources.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	Uninformative	Data are for a condition of use which is not in-scope or similar to an in-scope condition of use.
	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	Medium	Sample distribution characterized by a range with uncertain 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 Uninformative

Study Citation:	Lin, W. T., Chen, W. L., Cheng, W. C., Chang, H. C., Tsai, S. W. (2017). Determining the residual characteristics of alkylphenols, arsenic, and lead as well as assessing the exposures of 1,4-dioxane from household food detergents. Journal of AOAC International 100(4):1086-1093.
HERO ID:	3828958
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Chemical concentration:	”Among the 80 detergent samples commercially purchased,9 had concentrations lower than the LODs, whereas 71 of the 80(i.e., 88.75%) were determined to have concentrations rangingfrom 0.03 to ~3.73 μg/g, with a mean of 1.22 μg/g and medianof 0.75 μg/g. (page 7/8)”

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Report uses high quality techniques that are not from frequently-used sources and there are no known quality issues.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Low	Data are from Taiwan, a non-OECD country.
	Metric 3:	Applicability	Low	Data are for consumer use of dishwasher detergent, which is similar to the in-scope occupational scenario commercial use of dishwasher detergent.
	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 limited statistics (range, mean, median) 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	Variability is addressed by performing an ANOVA test. Uncertainty isn’t addressed.

Overall Quality Determination Medium

Study Citation:	McDaniel, M. P., DesLauriers, P. J. (2015). Ethylene polymers, HDPE.
HERO ID:	9493557
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	In 2014, 20.6 million metric tons of PET were used worldwide, and 12.8 million metric tons of polyethylene were used in the United States. (Page 2/40)

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Data is from Kirk-Othmer, a frequently used source.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for PET byproducts, an in-scope occupational scenario.
	Metric 4:	Temporal Representativeness	High	Report is less than 10 years old.
	Metric 5:	Sample Size	Medium	Only certain statistics provided (production values), no discrete sampling.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	High	Report clearly documents its data sources, assessment methods, results, and assumptions.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Variability is addressed by including productions for different PE -based polymers in the U.S. and worldwide. Uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	Nagy, A., Theiner, E. (2020). Detergency and detergents.
HERO ID:	10366191
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	The United States holds the largest market share of soap and detergent products (33% of the world market). Value of products globally in 2016 was $133 × 10^9... Laundry detergents and hand washing liquids account for 95% of the consumption of surfactants in household detergents. (Page 49)
Process description:	dioxane only mentioned here: Ethoxylated surfactants do have low amounts of ethylene oxide and 1,4-dioxane (Page 50)Page 1 describes the mechanisms of how detergents workPage 2-5 describe types of substrates, soils, detergents, bath or liquor ratio, and mechanical actions for various applications (including laundering and dishwashing)Page 6 starts discussion of detergent formulation/different additive types and their functionsPage 33 starts discussion of "measurement of detergency", including sections for laundering and dishwashingPage 44 starts discussion of detergent MFG process (which I think is upstream/out of scope for this systematic review)Page 54 starts discussion of household cleaning product types which might have overlap with commercial use; Page 56 starts discussion of industrial and institutional use
Comments:	Solid and liquid detergents discussed (in general, not dioxane-specific and thus why no occ. exposure data evaluation was completed)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Kirk-Othmer source
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for various in-scope cleaning product/detergent types.
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	Process description data
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 industries and detergent types but uncertainty is not addressed.

Overall Quality Determination High

Study Citation:	NIH, (2021). PubChem: Dioxane.
HERO ID:	9959774
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	1,000,000 - 10,000,000 lb (Page 27/70)
Process description:	1,4-Dioxane is manufactured commercially by dehydration and ring closure of diethylene glycol. Concentrated sulfuric acid (ca. 5%) is used as a catalyst, although phosphoric acid, p-toluene sulfonic acid, and strongly acidic ion-exchange resins are recognized alternatives. The process is continuous, with dioxane vaporized from the reaction vessel. The vapors are passed through an acid trap and two distillation columns to remove water and to purify the product. (Page 27/70)

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	Uninformative	Data are for domestic manufacturing, which isn't in-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	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 Uninformative

Study Citation:	NYDEC, (2023). List of consumer products for which companies have submitted waivers to exceed 1 ppm 1,4-dioxane, including their concentrations.
HERO ID:	11337367
Conditions of Use:	Industrial/Commercial Use: Cleaning and furniture care products - Surface cleaner

EXTRACTION

Parameter	**Data**
Chemical concentration:	1,4-dioxane concentration reported for over 1,500 cleaning products

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality data from known sources.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for surface cleaners, 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	High	Statistical distribution of samples is fully characterized (discrete data provided).
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Data are clearly documented, but underlying data sources are not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Uncertainty is not addressed. Variability is addressed by listing concentrations for a wide range of products.

Overall Quality Determination — High

Study Citation:	NYDEC, (2023). List of consumer products for which companies have submitted waivers to exceed 1 ppm 1,4-dioxane, including their concentrations.
HERO ID:	11337367
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Chemical concentration:	1,4-dioxane concentration reported for over 1,500 cleaning products

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality data from known sources.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for dish soaps, 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	High	Statistical distribution of samples is fully characterized (discrete data provided).
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Data are clearly documented, but underlying data sources are not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Uncertainty is not addressed. Variability is addressed by listing concentrations for a wide range of products.

Overall Quality Determination — High

Study Citation:	NYDEC, (2023). List of consumer products for which companies have submitted waivers to exceed 1 ppm 1,4-dioxane, including their concentrations.
HERO ID:	11337367
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dishwasher detergent

EXTRACTION

Parameter	**Data**
Chemical concentration:	1,4-dioxane concentration reported for over 1,500 cleaning products

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality data from known sources.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for dishwashing detergents, 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	High	Statistical distribution of samples is fully characterized (discrete data provided).
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Data are clearly documented, but underlying data sources are not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Uncertainty is not addressed. Variability is addressed by listing concentrations for a wide range of products.

Overall Quality Determination — High

Study Citation:	NYDEC, (2023). List of consumer products for which companies have submitted waivers to exceed 1 ppm 1,4-dioxane, including their concentrations.
HERO ID:	11337367
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Laundry detergent

EXTRACTION

Parameter	**Data**
Chemical concentration:	1,4-dioxane concentration reported for over 1,500 cleaning products

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report uses high quality data from known sources.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	Data are from the U.S.
	Metric 3:	Applicability	High	Data are for laundry detergents, 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	High	Statistical distribution of samples is fully characterized (discrete data provided).
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Data are clearly documented, but underlying data sources are not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	Uncertainty is not addressed. Variability is addressed by listing concentrations for a wide range of products.

Overall Quality Determination — High

Study Citation:	OAG,, NYS (2023). Comments of the New York State Office of the Attorney General et al. on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333829
Conditions of Use:	Industrial/Commercial Use: Cleaning and furniture care products - Surface cleaner

EXTRACTION

Parameter	**Data**
Chemical concentration:	Cleaning products in New York are required to have a concentration of 1,4-dioxane no more than 2ppm (as of 12/32/2022) and will lower to 1 ppm (12/31/2023). Companies have submitted waivers for 1,471 products that contain 1,4-dioxane higher than the 2ppm limit.

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 surface cleaner (cleaning 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 concentration listed is a limit, but does not list any submitted concentrations that are over the limit.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.

Overall Quality Determination High

Study Citation:	OAG,, NYS (2023). Comments of the New York State Office of the Attorney General et al. on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333829
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dish soap

EXTRACTION

Parameter	**Data**
Chemical concentration:	Cleaning products in New York are required to have a concentration of 1,4-dioxane no more than 2ppm (as of 12/32/2022) and will lower to 1 ppm (12/31/2023). Companies have submitted waivers for 1,471 products that contain 1,4-dioxane higher than the 2ppm limit.

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 dish soap (cleaning 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 concentration listed is a limit, but does not list any submitted concentrations that are over the limit.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.

Overall Quality Determination High

Study Citation:	OAG,, NYS (2023). Comments of the New York State Office of the Attorney General et al. on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333829
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dishwasher detergent

EXTRACTION

Parameter	**Data**
Chemical concentration:	Cleaning products in New York are required to have a concentration of 1,4-dioxane no more than 2ppm (as of 12/32/2022) and will lower to 1 ppm (12/31/2023). Companies have submitted waivers for 1,471 products that contain 1,4-dioxane higher than the 2ppm limit.

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 dishwashing detergent (cleaning 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 concentration listed is a limit, but does not list any submitted concentrations that are over the limit.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.

Overall Quality Determination High

Study Citation:	OAG,, NYS (2023). Comments of the New York State Office of the Attorney General et al. on 1,4-Dioxane: Draft Supplement to the TSCA Risk Evaluation Science Advisory Committee on Chemicals (SACC) Meeting.
HERO ID:	11333829
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Laundry detergent

EXTRACTION

Parameter	**Data**
Chemical concentration:	Cleaning products in New York are required to have a concentration of 1,4-dioxane no more than 2ppm (as of 12/32/2022) and will lower to 1 ppm (12/31/2023). Companies have submitted waivers for 1,471 products that contain 1,4-dioxane higher than the 2ppm limit.

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 laundry detergents (cleaning 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 concentration listed is a limit, but does not list any submitted concentrations that are over the limit.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	Data sources are generally described but not fully transparent.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Medium	The report provides only limited discussion of the variability and uncertainty in the results.

Overall Quality Determination High

Study Citation:	Saraji, M., Shirvani, N. (2017). Determination of residual 1,4-dioxane in surfactants and cleaning agents using headspace single-drop microextraction followed by gas chromatography-flame ionization detection. International Journal of Cosmetic Science 39(1):36-41.
HERO ID:	3538324
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dishwasher detergent

EXTRACTION

Parameter	**Data**
Chemical concentration:	<0.4 ug/g of dioxane were detected in dishwashing liquid. (4/6)
Comments:	Table II: Analytical results of 1,4-dioxane in real samples

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Report uses high quality techniques that are not from frequently-used sources and there are no known quality issues.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	Low	Data are from Iran, a non-OECD country.
	Metric 3:	Applicability	High	Data are for commercial use of dishwasher detergent, 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 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 is addressed by stating the limit of detection. Variability isn't addressed.

Overall Quality Determination Medium

Study Citation:	Stefl, B. A., George, K. F. (2014). Antifreezes and deicing fluids.
HERO ID:	10366190
Conditions of Use:	Industrial/Commercial Use: Automotive care products - Antifreeze

EXTRACTION

Parameter	**Data**
Process description:	An antifreeze is defined as a chemical which, when added to a water-based fluid, reduces the freezing point of the mixture. Antifreezes are used in a wide variety of mechanical equipment during the winter months to prevent freezing of aqueousheat-transfer fluids. Most commonly, antifreeze refers to the freeze-protected fluid which cools automotive engines, although antifreeze liquids are also used in ice skating rinks, refrigeration systems (as a secondary coolant), heating and air conditioning systems, solar energy units, and many other applications. (Page 1/21)

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	High	Report is from Kirk-Othmer, a frequently used source.
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	Data are for antifreeze, an in-scope occupational scenario.
Metric 4:	Temporal Representativeness	High	Report is less than 10 years old.
Metric 5:	Sample Size	N/A	No quantitative data available.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	High	All sources, methods, results, and assumptions are documented.
Domain 4: Variability and Uncertainty			
Metric 7:	Metadata Completeness	Low	Variability and uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	U.S. BLS, (2016). May 2016 Occupational Employment and Wage Estimates: National Industry-Specific Estimates.
HERO ID:	5079087
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Number of sites:	Provided data used to develop a method to estimate number of sites and workers.

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	These economic data cover all industry and occupation typesin scope for all chemicals
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old.
	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
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	BLS documents results and methods, but underlying surveyresults 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:	Industrial/Commercial Use: Paints and coatings - Paint and floor lacquer

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	Production volume was CBI for all sites. Import volume was 74,611 and 152,740 lbs in 2019.
Life cycle description:	Dioxane is used as a stabilizing agent and additive in paints and coatings.
Number of sites:	8 sites reported consumer/commercial use of 1,4-dioxane in the 2020 CDR.
Chemical concentration:	The maximum concentration was 90+% for all reporting sites.

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 paints and floor lacquers, 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	High	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 is addressed by including data from different sites. Uncertainty isn't addressed.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2022). Discharge Monitoring Report (DMR) data for 1,4-dioxane, 2013-2019.
HERO ID:	10480472
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Throughput:	Submissions provide flow rates of 1,4-dioxane
Number of sites:	The submissions indicate number of sites using/disposing of 1,4-dioxane
Chemical concentration:	Submissions provide concentration of 1,4-dioxane

EVALUATION

Domain	Metric	Rating	Comments
Domain 1: Reliability			
Metric 1:	Methodology	Low	Methodology used by submitters to estimate release data is notknown
Domain 2: Representativeness			
Metric 2:	Geographic Scope	High	Data are from the U.S.
Metric 3:	Applicability	High	DMR includes industries included in the scopes of 1,4-dioxane
Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old (2013-2019)
Metric 5:	Sample Size	Medium	Universe is limited to NPDES permit holders; statistical representativeness is unclear.
Domain 3: Accessibility/ Clarity			
Metric 6:	Metadata Completeness	Low	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	DMR does not address variability or uncertainty in submitterprovided data.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (2022). Toxics Release Inventory (TRI) data for 1,4-dioxane, 2013-2019.
HERO ID:	10480474
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Number of sites:	Data provided can be used to determine the number of sites for certain uses and occupational scenarios

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	Data are from the U.S.
	Metric 3:	Applicability	High	TRI includes industries included in the scopes of 1,4-dioxane
	Metric 4:	Temporal Representativeness	High	Report is based on current industry conditions and data no more than 10 years old (2013-2019)
	Metric 5:	Sample Size	Medium	Due to reporting requirements, statistical representativeness isunclear.
Domain 3: Accessibility/ Clarity				
	Metric 6:	Metadata Completeness	Medium	TRI only includes release media but no other metadata.
Domain 4: Variability and Uncertainty				
	Metric 7:	Metadata Completeness	Low	TRI does not address variability or uncertainty in submitterprovided data.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (2016). Chemical Data Reporting (CDR): 1,4-Dioxane CAS Number 123-91-1.
HERO ID:	9960770
Conditions of Use:	Other:

EXTRACTION

Parameter	**Data**
Production, import, or use volume:	Two sites (one claimed CBI) indicated that 45,444 and 151,265 lbs of dioxane were manufactured, and that 100% of this production volume is used downstream for industrial/commercial use.
Number of sites:	3 sites
Chemical concentration:	Dioxane is reported in concentrations of at least 90% by weight

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The report uses high-quality data, Chemical Data Reporting by industry to the EPA.
Domain 2: Representativeness				
	Metric 2:	Geographic Scope	High	CDR is U.S. based data.
	Metric 3:	Applicability	High	CDR provides manufacturing information, but also includes downstream use percentages, and use concentrations, which are in-scope.
	Metric 4:	Temporal Representativeness	High	EPA used data from the 2016 CDR, which includes data reported for 2015.
	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:	Wala-Jerzykiewicz, A., Szymanowski, J. (1998). Headspace gas chromatography analysis of toxic contaminants in ethoxylated alcohols and alkylamines. Chromatographia 48(3-4):299-304.
HERO ID:	4421101
Conditions of Use:	Industrial/Commercial Use: Laundry and dishwashing products - Dishwasher detergent

EXTRACTION

Parameter	**Data**
Chemical concentration:	2-10 ug*g -1 in dish-washing liquids (Page 6)
Comments:	When commercial cosmetics and washing products, even of well known producers, are considered, a relatively high contents of toxic components are observed. The following ranges of 1,4-dioxane content were observed: 2-7 ug.g -1 in various shampoos (even in those proposed for babies), 2-8 ug.g-1 in body lotions and 2-10 ug.g -1 in dish-washing liquids.

EVALUATION

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Report uses high quality [data/techniques/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 Poland, an OECD country
	Metric 3:	Applicability	High	Data are for dishwashing liquids, and 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	Sample distribution characterized by a range 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	Low	Variability and uncertainty are not addressed.

Overall Quality Determination Medium