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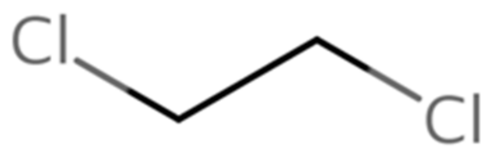
Office of Chemical Safety and
Pollution Prevention

United States
Environmental Protection Agency

Environmental Release Assessment for 1,2-Dichloroethane

Technical Support Document for the Risk Evaluation

CASRN 107-06-2



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KEY ABBREVIATIONS AND ACRONYMS

CAA	Clean Air Act
CASRN	Chemical Abstracts Service Registry Number
CBI	Confidential business information
CDR	Chemical Data Reporting
CEHD	Chemical Exposure Health Data
CFR	Code of Federal Regulations
CWA	Clean Water Act
COU	Conditions of use
DMR	Discharge Monitoring Report
DRE	Destruction and removal efficiency
EPA	Environmental Protection Agency (U.S.)
EPCRA	Emergency Planning and Community Right-to-Know Act
ESD	Emission scenario document
GS	Generic scenario
HAP	Hazardous air pollutant
HHE	Health Hazard Evaluations (NIOSH)
IQR	Interquartile range
LOD	Limit of detection
MWC	Municipal waste combustors
NAICS	North American Industry Classification System
NASA	National Aeronautics and Space Administration (U.S.)
ND	Non-detect
NEI	National Emissions Inventory
NESHAP	National Emission Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NPDWR	National Primary Drinking Water Regulation

OCSPP	Office of Chemical Safety and Pollution Prevention (EPA)
OECD	Organisation for Economic Co-operation and Development
OEL	Occupational exposure limit
OES	Occupational exposure scenario
ONU	Occupational non-user
OPPT	Office of Pollution Prevention and Toxics (EPA)
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limit
PERC	Perchloroethylene
POTW	Publicly owned treatment works
PV	Production volume
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RQ	Reportable quantity
SDS	Safety data sheet
SDWA	Safe Drinking Water Act
SpERC	Specific Environmental Release Categories
TRI	Toxics Release Inventory
TSD	Technical support document
TSCA	Toxic Substances Control Act
U.S.	United States
VCM	Vinyl chloride monomer
WWT	Wastewater treatment

SUMMARY

This technical support document (TSD) accompanies the *Risk Evaluation for 1,2-Dichloroethane* (also called the "1,2-dichloroethane risk evaluation" or "risk evaluation") (U.S. EPA, 2026o). 1,2-Dichloroethane is (1) a Toxics Release Inventory (TRI)-reportable substance; (2) included on the U.S. Environmental Protection Agency (EPA or the Agency) initial list of hazardous air pollutants (HAPs) under the Clean Air Act (CAA); (3) designated as a toxic pollutant under the Clean Water Act (CWA) and subject to National Primary Drinking Water Regulations (NPDWR) under the Safe Drinking Water Act (SDWA); and (5) included in the Toxic Substances Control Act (TSCA) Inventory and reported under the Chemical Data Reporting (CDR) rule. This TSD describes the use of reasonably available information to estimate environmental releases of 1,2-dichloroethane. See Appendix C of the risk evaluation (U.S. EPA, 2026o) for a complete list of all the TSDs and supporting documents and files.

Focus of This TSD on Environmental Release Assessment

During scoping, EPA considered all conditions of use (COUs) under TSCA for 1,2-dichloroethane. 1,2-Dichloroethane is a colorless oily liquid with a pleasant, chloroform-like odor and with a total production volume (PV) in the United States between 30 and 40 billion pounds (lb) from the 2020 CDR reporting period. It is used primarily in the synthesis of vinyl chloride monomer (VCM), which is then used to manufacture of wide range of plastic products (U.S. EPA, 2026o).

Industrial, commercial, and consumer uses of 1,2-dichloroethane-containing articles may result in releases to air, water, or land as well as exposures to workers, consumers, general populations, and ecological species. Exposure to the general population and ecological species can occur from industrial and commercial releases related to the manufacture, import, processing, distribution, and use of 1,2-dichloroethane. This TSD provides the details of the assessment of the environmental releases that can occur for each COU of 1,2-dichloroethane. It does not include releases resulting from consumer uses, which are assessed in the *Consumer Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026f).

Approach for Assessing Environmental Releases

EPA evaluated environmental releases of 1,2-dichloroethane to air, water, and land from COUs assessed in this risk evaluation. The Agency mapped 19 COUs with exposures to workers to 11 occupational exposure scenarios (OESs) based on data and information gathered during systematic review, industry outreach, and public comments. Each OES is developed based on a set of occupational activities and operational conditions such that similar environmental releases are expected from the use(s) covered under the OES. EPA used release data from the TRI, the National Emissions Inventory (NEI), and Discharge Monitoring Report (DMR) databases to assess environmental releases for a majority of OESs. For OESs with limited or no databases, data modeling approaches were used.

Results for Environmental Releases

For each OES, EPA provided environmental release to air, water, and/or land that are expected to be representative of the sites for the given OES across the United States. The Agency found data for 9 of the 11 OESs, covering more than 1,300 facilities. Modeling was used for four OESs (Repackaging; Industrial Application of Adhesives and Sealants; Industrial and Commercial Non-Aerosol Cleaning/Degreasing; and Commercial Laboratory Use) to supplement existing data and one OES (Industrial and Commercial Aerosol Products) where programmatic data were not available. Most releases of 1,2-dichloroethane were to air with land and water releases occuring in lesser volumes. The OESs with the highest expected releases were Manufacturing and some industrial uses such as Application of Adhesives and Sealants as well as Non-Aerosol Cleaning/Degreasing with releases to stack and fugitive air being the highest release media.

Uncertainties

Uncertainties exist with the monitoring and modeling approaches used to assess 1,2-dichloroethane environmental releases. For example, the lack of 1,2-dichloroethane facility production volume data and use of throughput estimates based on CDR reporting thresholds may not be representative of the actual volume of 1,2-dichloroethane used in the United States. The Agency also used EPA generic models and default input parameter values when site-specific data were not available. The Agency did not identify data on the prevalence of engineering controls or that correlate the use of controls to specific parameter values used to model releases. However, EPA's use of distributions for most parameters in the calculation of releases is likely to be inclusive of a variety of controls used at the point of release. EPA was not able to quantify end-of-pipe type controls in the modeling approaches but did qualitatively address this potential by indicating the potential for a release to be to multiple media. In such instances, the release may be entirely to one media or divided amongst the media due to the use of end-of-pipe controls.

Environmental and Exposure Pathways Considered

EPA used environmental releases to air, water, and land to estimate 1,2-dichloroethane concentrations in the environment and biota to assess exposures to the general population and ecological species for relevant COUs.

1 INTRODUCTION

1.1 Overview

This TSD provides details on the environmental release assessment and supports the risk evaluation for 1,2-dichloroethane under the Frank R. Lautenberg Chemical Safety for the 21st Century Act, amending TSCA. TSCA section 6(b)(4) requires EPA to establish a risk evaluation process. In performing risk evaluations for existing chemicals, the Agency is directed to "determine whether a chemical substance presents an unreasonable risk of injury to health or the environment, without consideration of costs or other non-risk factors, including an unreasonable risk to a potentially exposed or susceptible subpopulation identified as relevant to the risk evaluation by the Administrator under the conditions of use." In December 2019, EPA published a list of 20 chemical substances designated high priority substances for risk evaluations (84 FR 71924, December 30, 2019), as required by TSCA section 6(b)(2)(B), which initiated the risk evaluation process for those chemical substances. 1,2-Dichloroethane is one of the chemicals designated as a high-priority substance for risk evaluation.

1,2-Dichloroethane (also known as ethylene dichloride), is a colorless, oily liquid with a chloroform-like odor. It is soluble in water and is miscible in most organic solvents. 1,2-Dichloroethane is a volatile, synthetic hydrocarbon that is used primarily in the synthesis of vinyl chloride monomer (VCM). It is also used as an intermediate in the production of other chlorinated organics, ethylene amines, and other chemicals. It is included on the TSCA Inventory reported under the CDR rule and has a total production volume in the United States between 30 to 40 billion pounds (lb) based on the 2020 CDR reporting period (U.S. EPA, 2026o). Review of 2024 CDR data shows that total production volume for the years 2020 to 2023 are similar to the previously reported range from 2020 CDR.

1,2-Dichloroethane is a TRI-reportable substance. It is also on EPA's initial list of hazardous air pollutant (HAPs) under the CAA, is a designated toxic pollutant under the CWA, and subject to NPDWR under the SDWA.

The life cycle diagram (LCD) shown in Figure 1-1 is a graphical representation of the various life stages of the industrial, commercial, and consumer use categories included within the *Final Scope of the Risk Evaluation for 1,2-Dichloroethane; CASRN 107-06-2* (also referred to as the "final scope") (U.S. EPA, 2020b). The information in the LCD is grouped according to the CDR processing codes and use categories (including functional use codes for industrial uses and product categories for industrial, commercial, and consumer uses). The CDR Rule under TSCA requires U.S. manufacturers (including importers) to provide the Agency with information on the chemicals they manufacture or import into the United States. EPA collects CDR data approximately every 4 years with the latest collections occurring in 2024. This TSD contains additional descriptions (*e.g.,* process descriptions, worker activities, process flow diagrams) for each manufacturing, processing, use, and disposal category. The production volume reported in the final scope document was between 20 and 30 billion lb, based on total production volume of 1,2-dichloroethane in 2015 from the 2016 CDR reporting period. The range increased in the 2020 CDR data (the reported total production volume in 2019 was between 30 and 40 billion lb (U.S. EPA, 2026o)). Review of 2024 CDR data shows that total production volume for the years 2020 to 2023 are similar to the previously reported range from 2020 CDR.

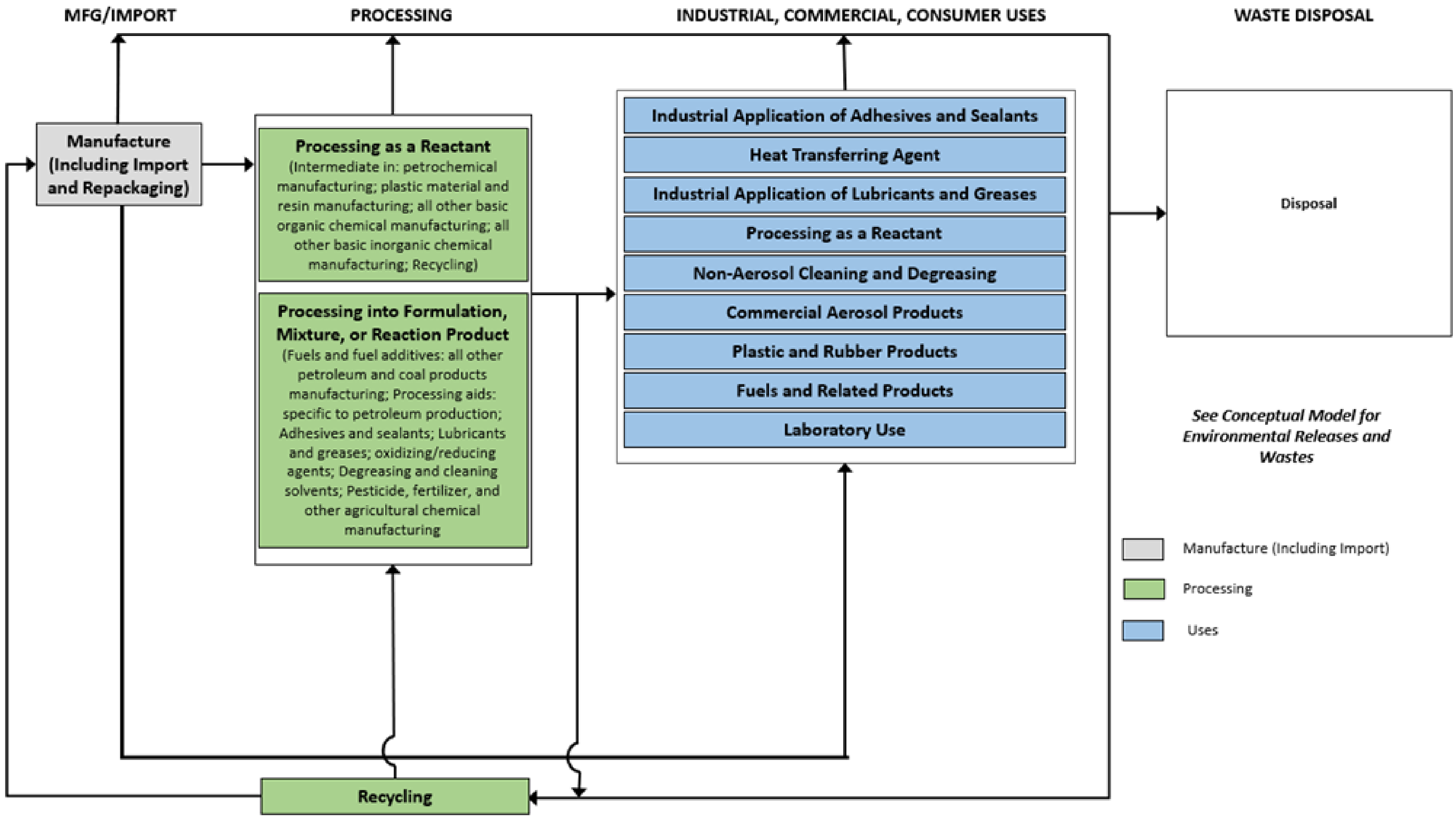


Figure 1-1. 1,2-Dichloroethane Life Cycle Diagram

This assessment addresses environmental releases of 1,2-dichloroethane in industrial and commercial settings. Releases of 1,2-dichloroethane in consumer settings and the discussion of downstream environmental fate and transport factors used to estimate exposures to the general population and ecological species are not addressed in this assessment but can be found in the other TSDs. In the sections that follow the scope, methods used, and the results are described in detail.

For more information on the reviewed sources used to build this assessment, as well as the evaluation strategies for these sources, refer to the *Systematic Review Protocol for 1,2-Dichloroethane* (U.S. EPA, 2026p) and the *Draft Systematic Review Protocol Supporting TSCA Risk Evaluations for Chemical Substances: Version 1.0: A Generic TSCA Systematic Review Protocol with Chemical-Specific Methodologies* (also referred to as the "Draft Systematic Review Protocol") (U.S. EPA, 2021a), respectively.

1.2 Scope of the Risk Evaluation

EPA assessed environmental releases for COUs as described in Table 2-1 of the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026o). These COUs are also listed in Table 1-1. TSCA section 3(4) defines COUs as "the circumstances, as determined by the Administrator, under which a chemical substance is intended, known, or reasonably foreseen to be manufactured, processed, distributed in commerce, used, or disposed of." EPA identifies COUs for chemicals during the scoping phase and presents them in the *Final Scope of the Risk Evaluation for 1,2-Dichloroethane CASRN 107-06-2* (U.S. EPA, 2020b) ("final scope")—though the COUs presented may change between the scope document and the risk evaluation as the assessment is conducted and more information about the chemical is gathered. Each COU has a unique combination of life cycle stage, category(ies), and subcategory(ies) that describes the chemical's use. As shown in Table 1-1, EPA has identified 19 COUs for 1,2-dichloroethane with exposures to workers.

Each COU for 1,2-dichloroethane was assigned one or more OESs that characterizes its release and exposure potential. Although named for their utility when assessing occupational exposure, these scenarios are also used when assessing environmental releases from industrial and commercial facilities. For more about the occupational exposure assessment for 1,2-dichloroethane, see the *Occupational Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026m). OES is a term that is intended to describe the grouping or segmenting of COUs for assessment of releases and exposures. For example, EPA may assess a group of multiple COUs together as one OES due to similarities in release and exposure sources, worker activities, and use patterns. Alternatively, EPA may assess multiple OESs for one COU because there are different release and exposure potentials within a given COU. OES determinations are largely driven by the availability of data and modeling approaches to assess releases. For example, even if there are similarities between multiple COUs and sufficient data to separately assess releases for each COU, EPA would not group them into the same OES. For each OES, environmental release results are provided and are expected to be representative of the sites involved for the given OES in the United States. Figure 1-2 depicts the ways that COUs may be mapped to OESs.

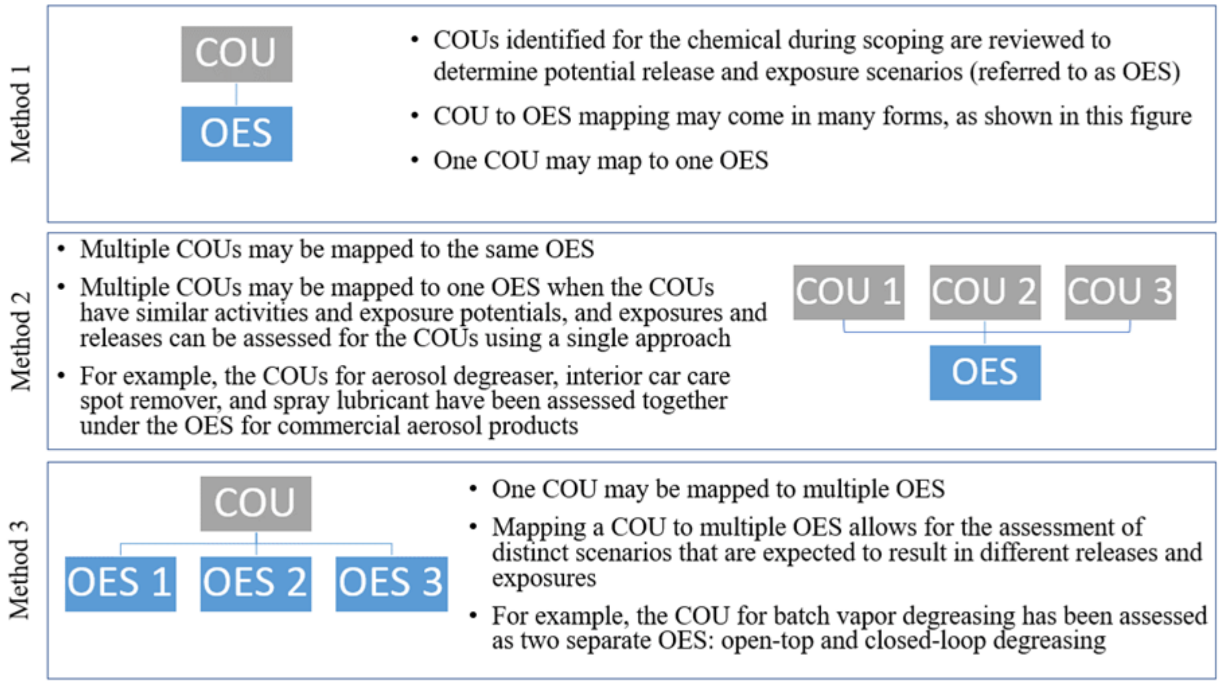


Figure 1-2. Condition of Use to Occupational Exposure Scenario Mapping

Table 1-1 shows mapping between the COUs in the risk evaluation (U.S. EPA, 2026o) to the OESs assessed in this TSD. For 1,2-dichloroethane, EPA mapped OESs to COUs based on data and information gathered during systematic review, industry outreach, and public comments. Some COU categories and subcategories were grouped and assessed together in a single OES due to similarities in the processes or lack of data to differentiate between them. For example, Recycling and Processing – As a Reactant categories were both assessed under the Processing as a Reactant OES. This grouping minimized repetitive assessments. In one case, the COU subcategory was further delineated into multiple OESs based on expected differences in process and associated releases or exposure potentials between facilities. Specifically, the subcategory Degreasing and cleaning solvents was delineated into Commercial Aerosol Products and Non-Aerosol Cleaning and Degreasing OESs. A total of 11 unique OESs were identified and mapped across 19 COUs for 1,2-dichloroethane. Table 1-1 lists each COU (defined by its unique combination of a life cycle stage, category[ies], and subcategory[ies]) and its corresponding OES.

Table 1-1. Crosswalk of Conditions of Use (COUs) to Occupational Exposure Scenarios (OESs)

Life Cycle Stage[a]	Category[b]	Subcategory[c]	OES
Manufacturing	Domestic manufacture	Domestic manufacture	Manufacturing[d]
			Manufacturing as an Unintended Byproduct
	Import	Import	Repackaging
Processing	Processing – As a reactant	Intermediate in: Petrochemical manufacturing; Plastic material and resin manufacturing; All other basic organic chemical manufacturing; All other basic inorganic chemical manufacturing	Processing as a Reactant
	Processing – Incorporated into formulation, mixture, or reaction product	Fuels and fuel additives: All other petroleum and coal products manufacturing	Processing into Formulation, Mixture, or Reaction Product
		Processing aids: Specific to petroleum production	Processing into Formulation, Mixture, or Reaction Product
		Adhesives and sealants; Lubricants and greases; Process regulators; Degreasing and cleaning solvents; Pesticide, fertilizer, and other agricultural chemical manufacturing	Processing into Formulation, Mixture, or Reaction Product
	Repackaging	Repackaging	Repackaging
	Recycling	Recycling	Processing as a Reactant
Distribution in commerce	Distribution in commerce	Distribution in commerce	Distribution in Commerce[e]
Industrial use	Adhesives and sealants	Adhesives and sealants	Industrial Application of Adhesives and Sealants
	Functional fluids (closed systems)	Heat transferring agent	Heat Transferring Agent[f]
	Lubricants and greases	Solid film lubricants and greases	Industrial Application of Lubricants and Greases
	Process regulator	*e.g.,* Catalyst moderator; oxidation inhibitor	Processing as a Reactant
	Solvents (for cleaning and degreasing)	A component of degreasing and cleaning solvents	Commercial Aerosol Products
			Non-Aerosol Cleaning and Degreasing
	Other use	Process solvent	Processing into Formulation, Mixture, or Reaction Product
Commercial use	Plastic and rubber products	Products such as: Plastic and rubber products	Plastic and Rubber Products[f]
	Fuels and related products	Fuels and related products	Fuels and Related Products[f]

Life Cycle Stage[a]	Category[b]	Subcategory[c]	OES
	Other use	Laboratory chemical	Laboratory Use
Consumer use	Plastic and rubber products	Plastic and rubber products	N/A[g]
Disposal	Disposal	Disposal	Waste Handling, Treatment, and Disposal (Landfill)
			Waste Handling, Treatment, and Disposal (POTW)
			Waste Handling, Treatment, and Disposal (Remediation)
			Waste Handling, Treatment, and Disposal (Non-POTW WWT)
			Waste Handling, Treatment, and Disposal (Incinerator)

POTW = publicly owned treatment works; WWT = wastewater treatment

[a] Life cycle stage use definitions (40 CFR 711.3)

- "Industrial use" means use at a site at which 1 or more chemicals or mixtures are manufactured (including imported) or processed.
- "Commercial use" means the use of a chemical or a mixture containing a chemical (including as part of an article) in a commercial enterprise providing saleable goods or services.
- "Consumer use" means the use of a chemical or a mixture containing a chemical (including as part of an article, such as furniture or clothing) when sold to or made available to consumers for their use.
- Although EPA has identified both industrial and commercial uses here for purposes of distinguishing scenarios in this document, the Agency interprets the authority over "any manner or method of commercial use" under TSCA section 6(a)(5) to reach both.

[b] These categories of COUs reflect CDR codes and broadly represent conditions of use for 1,2-dichloroethane in industrial and/or commercial settings.

[c] These subcategories reflect more specific uses of 1,2-dichloroethane.

[d] During the manufacture of 1,2-dichloroethane, the byproducts 1,1-dichloroethane (CASRN 75-34-3), 1,1,2-trichloroethane (CASRN 79-00-5), *trans*-1,2-dichloroethylene (CASRN 156-60-5), trichloroethylene (CASRN 79-01-6), perchloroethylene (CASRN 127-18-4), methylene chloride (CASRN 75-09-2), and carbon tetrachloride (CASRN 56-23-5) are formed, and are assessed in this risk evaluation. See *Byproducts Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026d).

[e] EPA considers the activities of loading and unloading of chemical product part of distribution in commerce, however these activities were assessed as part of each use's OES. EPA's current approach for quantitively assessing releases and exposures for the remaining aspects of distribution in commerce consists of searching Department of Transportation (DOT) and National Response Center (NRC) data for incident reports pertaining to 1,2-dichloroethane distribution.

[f] Although these uses were identified during scoping, upon further investigation EPA made the decision to not quantitatively assess the releases due to these uses of 1,2-dichloroethane. The rationale for not performing a quantitative assessment is described later in this section.

[g] Consumer uses are not assigned to OESs but are assessed elsewhere in this risk evaluation. See the *Consumer Exposure Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026f).

As stated in table footnote "d" above, during the manufacture of 1,2-dichloroethane, the byproducts 1,1-dichloroethane, 1,1,2-trichloroethane, *trans*-1,2-dichloroethylene, trichloroethylene, perchloroethylene, methylene chloride, and carbon tetrachloride are unintentionally formed. Releases and associated exposures from byproducts are discussed in the *Byproducts Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026d).

As stated in table footnote "f" above, there are several COUs that did not receive a quantitative assessment. The Industrial use life cycle stage, Functional fluids (closed systems) category, Heat transferring agent subcategory was identified due to several safety data sheets (SDSs) for a supplemental coolant additive that lists regulatory information about 1,2-dichloroethane but provides no data on the concentration of 1,2-dichloroethane in the product (Baldwin Filters, 2015). EPA confirmed with the manufacturer of the product that 1,2-dichloroethane's presence is not intentional but present only in trace amounts as an impurity in a raw material, Versa TL-3 (EPA-HQ-OPPT-2018-0427-0066).

The second COU that did not receive a quantitative assessment in this risk evaluation is the Commercial use life cycle stage, Plastic and rubber products category, Products such as: Plastic and rubber products subcategory. The sources for this COU were the 2012 and 2016 CDR databases. Upon further review of the 2012 and 2016 non-confidential business information (CBI) databases, it appears that this COU was based on submissions by Formosa Plastics in Point Comfort, Texas. That company reported themselves as domestic manufacturers of 1,2-dichloroethane. In 2012 and 2016, they also reported that there was potential industrial processing and use of 1,2-dichloroethane as a chemical intermediate in plastic material and resin manufacturing at less than 10 downstream sites (Industrial Sector: Plastic Material and Resin Manufacturing; Industrial Function Category: Intermediates). This presumably reflects the use of 1,2-dichloroethane as a reactant to produce vinyl chloride. However, Formosa Plastics also reported potential downstream commercial/consumer use in the Plastic and rubber products not covered elsewhere, the source of the COU in the scope document.

EPA contacted Formosa about this use, and it was confirmed that their reported commercial and consumer use of 1,2-dichloroethane was an inadvertent over-classification. Formosa also stated that there is residual 1,2-dichloroethane in vinyl chloride at low parts per million (ppm) concentrations, and residual vinyl chloride in finished polyvinyl chloride (PVC) at ppm concentrations, leading to an expected amount of residual 1,2-dichloroethane in post-polymerization PVC in the low parts per billion levels. Any remaining 1,2-dichloroethane would be removed further during the stream stripping and drying steps that all PVC resins go through. As a result, the amount of 1,2-dichloroethane in the finished resin product is not expected to be detectable under normal conditions (EPA-HQ-OPPT-2018-0427-0025).

The next COU that did not receive a quantitative assessment is Commercial use life cycle stage, Fuels and related products category, Fuels and related products subcategory. 1,2-Dichloroethane was used as a lead scavenger, preventing the buildup of lead deposits within internal combustion engines, in antiknock formulations for automobiles (UNEP, 1988). While the CAA banned the sale of leaded fuel for on-road use beginning January 1, 1996, it was still permitted in specialty uses such as in high performance racing cars. However, this use was discontinued as of 2016, with the industry shifting to use ethylene dibromide (EPA-HQ-OPPT-2018-0427-0043; EPA-HQ-OPPT-2018-0427-0006).

Also relevant to the Fuels and related products COU, EPA received a comment from the National Aeronautics and Space Administration (NASA) informing of their use of 1,2-dichloroethane in fuels for combustion research (EPA-HQ-OPPT-2018-0427-0041). The Agency has determined that this specific use of 1,2-dichloroethane in fuels that NASA has reported would fall under the Commercial use life cycle stage, Other category, Laboratory chemicals (*e.g.,* reagent) subcategory.

After identifying those OESs that will be quantitatively assessed, the next step was to describe the function of 1,2-dichloroethane within each OES. This would be utilized in mapping release data to an OES as well as applying release modeling approaches. Table 1-2 below provides a summary; for more information on each OES, see the corresponding process description in Section 1.

Table 1-2. Description of the Function of 1,2-Dichloroethane for Each OES

OES	Role/Function of 1,2-Dichloroethane
Manufacturing	This OES captures the Domestic manufacture COU category. 1,2-Dichloroethane may be produced by various methods, including by the vapor- or liquid-phase chlorination of ethylene. Additionally, 1,2-dichloroethane is manufactured as a byproduct or impurity during the intentional manufacturing of other chemical products such as dichloroethyl ether.
Repackaging	This OES captures the Import and Repackaging COU categories. 1,2-Dichloroethane may be transported in liquid cargo barges, railcars, tank trucks, tank containers, intermediate bulk containers (IBCs)/totes, and drums. A portion of the 1,2-dichloroethane manufactured is also expected to be repackaged into smaller containers for commercial laboratory use.
Processing as a Reactant	This OES captures the Processing as a reactant, Recycling, and Industrial use of oxidizing/reducing agents COU categories. 1,2-Dichloroethane is primarily used to produce vinyl chloride via thermal cracking, but can also be used to produce ethyleneamines, polyethyleneamines, and it can be used as an oxidation inhibitor. Additionally, EPA assumes that waste streams containing 1,2-dichloroethane may be recycled on-site and then re-introduced into the facility's process waste stream or recycled as a feedstock to be used in the manufacture of other chemicals.
Processing into Formulation, Mixture, or Reaction Product	This OES captures the Processing – Incorporated into formulation, mixture, or reaction product COU category. Incorporation into a formulation, mixture or reaction product refers to the process of mixing or blending of several raw materials to obtain a product or mixture. 1,2-Dichloroethane is expected to be mixed or blended into adhesives and sealants, lubricants and greases, oxidizing/reducing agents, cleaning and degreasing solvents, and pesticides.
Distribution in Commerce	This OES captures the Distribution in commerce COU category. 1,2-Dichloroethane is expected to be distributed in commerce for the purposes of each processing, industrial, and commercial use of 1,2-dichloroethane. EPA expects 1,2-dichloroethane to be transported from manufacturing sites to downstream processing and repackaging sites.
Industrial Application of Adhesives and Sealants	This OES captures the Industrial use of adhesives and sealants COU category. 1,2-Dichloroethane has been identified in some industrial adhesives as residual, and it is present in heat resistant adhesives used in the aerospace industry, and in adhesives for plastics. It may also be used in waterproofing membranes that support adhesion used in extrusion coating laminating and printing, and it may be a component of sealants that protect plastics and coatings from ultraviolet (UV) light degradation.

OES	Role/Function of 1,2-Dichloroethane
Industrial Application of Lubricants and Greases	This OES captures the Industrial use of lubricants and greases COU category. 1,2-Dichloroethane may be present in solid film lubricants used to prevent metal to metal contact when used in the presence of conventional lubricants. It is also used in the aerospace industry in low friction and anti-knock coatings. EPA has conservatively assumed that lubricants and greases are spray applied, and so for the occupational exposure assessment this OES is assumed the same as the commercial aerosol products OES described below.
Non-Aerosol Cleaning and Degreasing	This OES captures part of the Industrial use of solvents (for cleaning and degreasing) COU category. 1,2-Dichloroethane was reported to be a component of cleaning and degreasing solvents in the aerospace industry. EPA also identified 1,2-dichloroethane present in a process cleaner. EPA did not identify the primary methods used in the application of industrial solvents for cleaning and degreasing, and so for this OES vapor degreasing was assumed. Vapor degreasing is a popular cleaning method in the electronic and metal processing industries because it is effective in removing organics such as oils, greases, lubricants, coolants, and resins from crevices and hard to clean parts.
Commercial Aerosol Products	This OES captures part of the Industrial use of solvents (for cleaning and degreasing) COU category. 1,2-Dichloroethane was reported to be a component of cleaning and degreasing solvents in the aerospace industry. EPA also identified 1,2-dichloroethane present in a process cleaner. EPA did not identify the primary methods used in the application of industrial solvents for cleaning/degreasing, and so for this OES aerosol degreasing was assumed. Aerosol degreasing is a process that uses an aerosolized solvent spray, typically applied from a pressurized can, to remove residual contaminants for fabricated parts. A propellant is used to aerosolize the formulation, allowing it to be sprayed onto substrates. The aerosol droplets bead up on the fabricated part and then drip off, carrying away any contaminants and leaving behind a clean surface. Similarly, aerosol lubricant products use an aerosolized spray to help free frozen parts by dissolving rust and leave behind a residue to protect surfaces against rust and corrosion. In the occupational exposure assessment, this OES is used to represent exposure to lubricants and greases.
Laboratory Use	This OES captures the Commercial use of laboratory chemical COU subcategory. This OES refers to the use of 1,2-dichloroethane as a laboratory chemical, such as a chemical standard for research, equipment calibration and sample preparation, including as a reference material during analysis. The agency notes that industrial and commercial use of 1,2-dichloroethane as a laboratory chemical applies to research, government, and academic institutions, as well as to industrial and commercial laboratories. At 1,2-dichloroethane manufacturing/processing facilities, samples for quality control are taken from the process and analyzed at on-site laboratories. This activity was assessed under the Manufacturing/Processing OES.
Waste Handling, Treatment, and	This OES captures part of the Disposal COU category.

OES	Role/Function of 1,2-Dichloroethane
Disposal (Incineration)	Each of the OES may generate waste streams of 1,2-dichloroethane that are collected and transported to third-party sites for incineration and these cases are assessed under this OES. Waste containing 1,2-dichloroethane may be shipped in containers or piped directly to incineration sites. Incineration can result in releases of 1,2-dichloroethane to air or water through volatilization at loading and unloading points, incomplete combustion, or container cleaning.
Waste Handling, Treatment, and Disposal (Landfill)	This OES captures part of the Disposal COU category. Each of the OES may generate waste streams of 1,2-dichloroethane that are collected and transported to third-party landfill sites for disposal and these cases are assessed under this OES. Waste containing 1,2-dichloroethane may be shipped in containers to landfill sites at various concentrations. 1,2-dichloroethane is a U-listed hazardous waste under code U0777 under RCRA; therefore, discarded, unused pure and commercial grades of 1,2-dichloroethane are regulated as a hazardous waste under RCRA (40 CFR § 261.33(f)). Hazardous waste landfills are excavated or engineered sites specifically designed for the final disposal of non-liquid hazardous wastes. Releases of 1,2-dichloroethane may occur through volatilization to air and leachate release to groundwater.
Waste Handling, Treatment, and Disposal (POTW)	This OES captures part of the Disposal COU category. Each of the OES may generate waste streams of 1,2-dichloroethane that are collected and transported to third-party POTW sites for disposal and these cases are assessed under this OES. Disposal to POTW refers to the collection and routing of 1,2-dichloroethane-containing wastes to third-party publicly owned treatment works which treat the wastes utilizing water treatment units. Releases of 1,2-dichloroethane to air or water may occur through volatilization during loading/unloading and wastewater treatment, fugitive leaks, or container cleaning.
Waste Handling, Treatment, and Disposal (Non-POTW WWT)	This OES captures part of the Disposal COU category. Each of the OES may generate waste streams of 1,2-dichloroethane that are collected and transported to third-party non-POTW WWT sites for disposal and these cases are assessed under this OES. Disposal to WWT refers to the collection and routing of 1,2-dichloroethane-containing wastes to third-party water treatment systems which treat the wastes utilizing water treatment units. Releases of 1,2-dichloroethane to air or water may occur through volatilization during loading/unloading and wastewater treatment, fugitive leaks, or container cleaning.
Waste Handling, Treatment, and Disposal (Remediation)	This OES captures part of the Disposal COU category. Remediation refers to the removal of 1,2-dichloroethane from contaminated soil, water, or air. Thermal, biological, physical, and chemical treatment methods can be applied to contaminated media at the release site.
COU = condition of use; OES = occupational exposure scenario; POTW = publicly owned treatment works; WWT = wastewater treatment	

EPA reviewed release data from the TRI (data from 2015–2024), Discharge Monitoring Report (DMR; data from 2015–2024), and the National Emissions Inventory (NEI; data from 2014, 2017, and 2020) to identify relevant releases of 1,2-dichloroethane to the environment. While these databases sufficiently informed industrial and processing COUs, the databases are limited in data on environmental releases for commercial COUs; therefore, EPA used modeling to estimate releases to the environment. These databases may not identify all 1,2-dichloroethane releases as some facilities may not be required to report.

EPA's assessment of releases includes quantifying annual and daily releases of 1,2-dichloroethane to air, water, and land. Releases to air include both fugitive and stack air emissions and emissions resulting from on-site waste treatment equipment, such as incinerators. For purposes of this report, releases to water include both direct discharges to surface water and indirect discharges to publicly owned treatment works (POTWs) or non-POTW wastewater treatment (WWT). Releases to land include any disposal of liquid or solids wastes containing 1,2-dichloroethane into landfills, land treatment, surface impoundments, or other land applications.

In response to public comments, EPA compiled and reviewed more recent facility release data from TRI (2021–2024), DMR (2021–2025), and NEI (2020). TRI releases are generally consistent with 2015–2020 levels, except for land releases, which are higher primarily due to one facility (TRIFID 77536DSPSL2525B) that began reporting land releases of 1,2-dichloroethane in the later period. DMR (2021–2025) and NEI (2020) indicate releases of the same order of magnitude as those reported for 2015–2020. EPA developed OES level facility estimates for these release data. Annual and daily release estimates are presented as 50th and 95th percentiles.

The purpose of this TSD is to quantify releases; therefore, downstream environmental fate and transport factors used to estimate exposures to the general population and ecological species are not discussed. Environmental fate and transport of 1,2-dichloroethane is discussed in the *Chemistry, and Fate, and Transport Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026e). The details on how these factors were considered when determining risk are described in the *Risk Evaluation for 1,2-Dichloroethane* (U.S. EPA, 2026o).

2 APPROACH AND METHODOLOGY

An environmental release assessment was conducted for each OES specified in Table 1-1. For each OES, the following components are presented:

- **Process description:** A description of the OES, including the function of the chemical in the OES; physical forms and weight fractions of the chemical throughout the process; the total production volume associated with the OES; per site throughputs/use rates of the chemical; operating schedules; and process vessels, equipment, and tools used during the COU.
- **Estimates of number of facilities:** An estimate of the number of sites that use 1,2-dichloroethane for the given OES.
- **Environmental release sources:** A description of each of the potential sources of environmental releases in the process and their expected media of release for the given OES.
- **Environmental release assessment results:** Estimates of chemical released into each environmental media (surface water, POTW, non-POTW WWT, fugitive air, stack air, and land disposal).

For the remainder of this section, the approach and methodology for completing each of the above components are described in more detail.

2.1 Process Descriptions

EPA performed a literature search to find descriptions of processes involved in each OES. Where data were available to do so, EPA included the following information in each process description:

- total PV associated with the OES;
- name and location of sites the OES occurs;
- facility operating schedules (*e.g.,* year-round, 5 days/week, batch process, continuous process, multiple shifts);
- key process steps;
- physical form and weight fraction of the chemical throughout the process steps;
- information on receiving and shipping containers; and
- ultimate destination of chemical leaving the facility.

Where 1,2-dichloroethane-specific process descriptions were unclear or not available, EPA referenced generic process descriptions from literature, including relevant emission scenario documents (ESD) or generic scenarios (GS). Process descriptions for each OES can be found in Section 1.

2.2 Number of Facilities

To estimate the number of facilities within each OES, EPA used a combination of bottom-up analyses of EPA reporting programs as well as top-down analyses of U.S. economic data and industry-specific data. Generally, EPA used the following steps to develop facility estimates:

1. Identify or "map" each facility reporting for 1,2-dichloroethane in the 2016 and 2020 CDR (U.S. EPA, 2020a, 2019a), 2015 to 2024 TRI (U.S. EPA, 2021b), 2015 to 2024 DMR (U.S. EPA, 2022c); and 2014 and 2017 NEI (U.S. EPA, 2019c) to an OES. The full details of the methodology for mapping facilities from EPA reporting programs is described in Appendix A In brief, mapping consists of using facility reported industry sectors (typically reported as either North American Industry Classification System [NAICS] or Standard Industrial Classification [SIC] codes), and chemical activity, processing, and use information to assign the most likely OES to each facility.

2. Based on the reporting thresholds and requirements of each dataset, evaluate whether the data in the reporting programs is expected to cover most or all the facilities within the OES. If so, no further action was required, and EPA assessed the total number of facilities in the OES as equal to the count of facilities mapped to the OES from each dataset. See the *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of this count. If not, EPA proceeded to Step 3.
3. Supplement the available reporting data with U.S. economic and market data using the following method:
    a. Identify the NAICS codes for the industry sectors associated with the OES.
    b. Estimate total number of facilities using the U.S. Census' Statistics of US Businesses (SUSB) data on total establishments by 6-digit NAICS.
    c. Use market penetration data to estimate the percentage of establishments likely to be using 1,2-dichloroethane instead of other chemicals.
    d. Combine the data generated in Steps 3.a through 3.c to produce an estimate of the number of facilities using 1,2-dichloroethane in each 6-digit NAICS code and sum across all applicable NAICS codes for the OES to arrive at a total estimate of the number of facilities within the OES. Typically, EPA assumed this estimate encompasses the facilities identified in Step 1; therefore, the Agency assessed the total number of facilities for the OES as the total generated from this analysis.
4. If market penetration data required for Step 3.c. are not available, use generic industry data from GSs, ESDs, and other literature sources on typical throughputs/use rates, operating schedules, and the 1,2-dichloroethane production volume used within the OES to estimate the number of facilities. In cases where EPA identified a range of operating data in the literature for an OES, the Agency used stochastic modeling to provide a range of estimates for the number of facilities within an OES. EPA provided the details of the approaches, equations, and input parameters used in stochastic modeling in the relevant OES sections throughout this TSD.

See the *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) to observe the number of sites from facility mapping of standard sources (such as TRI, DMR, or NEI) and an OES' corresponding Release Model Spreadsheet Supplement to observe the number of sites estimates in cases when Steps 3 and 4 were utilized.

2.3 Environmental Releases Approach and Methodology

Releases to the environment are a component of potential exposure and may be derived from reported data that are obtained through direct measurement via monitoring, calculations based on empirical data, and/or assumptions and models. For each OES, EPA, where possible, provided annual releases, high-end and central tendency daily releases, as well as the number of release days per year for each media of release (air, water, and land).

EPA used the following hierarchy in selecting data and approaches for assessing environmental releases:

1. Monitoring and measured data:
    a. Releases calculated from site-specific concentration in medium and flow rate data
    b. Releases calculated from mass balances or emission factor methods using site-specific measured data
2. Modeling approaches:
    a. Surrogate release data
    b. Fundamental modeling approaches

   c. Statistical regression modeling approaches
3. Release limits:
   a. Company-specific limits
   b. Regulatory limits (*e.g.,* National Emission Standards for Hazardous Air Pollutants [NESHAPs] or effluent limitations/requirements)

EPA's preference was to rely on facility-specific release data reported in TRI (U.S. EPA, 2021b), DMR (U.S. EPA, 2022c), and NEI (U.S. EPA, 2019c), where available. There were cases where releases are expected for an OES but TRI, DMR, and NEI data were not available or where EPA determined TRI, DMR, and/or NEI data did not capture the entirety of environmental releases for an OES (*e.g.,* if there were very few data points reported to TRI, DMR, and/or NEI). In such cases, releases were estimated using data from literature, relevant ESDs or GSs, and/or existing EPA models. The Agency's general approach to estimating releases from these sources is described in Sections 2.3.1 through 2.3.4. Specific details related to the use of release data or models for each OES can be found in Section 1. With release estimates identified for all OESs using monitoring data and modeling, the third option listed above; that is, the use of release limits was not used in this assessment).

The final release results may be described as a point estimate (*i.e.,* a single descriptor or statistic such as central tendency or high-end) or a full distribution. EPA considered three general approaches for estimating the final release result:

- **Deterministic calculations:** EPA used combinations of point estimates of each input parameter to estimate a central tendency and high-end for each final release result. The Agency documented the method and rationale for selecting parametric combinations to be representative of central tendency and high-end in the relevant OES subsections in Section 1. In general, central tendency is calculated as the 50th percentile of the releases reported to the OES whereas high-end is the 95th percentile. Calculations for these results can be found in the Supplemental Release Files.
- **Probabilistic (stochastic) calculations:** EPA used Monte Carlo simulations using the full distribution of each input parameter to calculate a full distribution of the final release results and selecting the 50th and 95th percentiles of this resulting distribution as the central tendency and high-end, respectively.
- **Combination of deterministic and probabilistic calculations:** EPA had full distributions for some parameters but point estimates of the remaining parameters. For example, the Agency used Monte Carlo modeling to estimate annual throughputs and emission factors but only had point estimates of release frequency and PV. In this case, EPA documented the approach and rationale for combining point estimates with distribution results for estimating central tendency and high-end results in the relevant OES subsections listed in Section 1.

2.3.1 Identifying Release Sources

EPA performed a literature search to identify process operations that could potentially result in releases of 1,2-dichloroethane to air, water, or land from each OES. EPA identified the release sources and the associated media of release for each OES. Where 1,2-dichloroethane-specific release sources were unclear or not available, EPA referenced relevant ESDs or GSs. Descriptions of release sources for each OES can be found in Section 1.

2.3.2 Estimating Release Days per Year

EPA typically assumed the number of release days per year from any release source will be equal to the number of operating days at the facility unless information is available to indicate otherwise. To estimate the number of operating days, the Agency used the following hierarchy:

1. **Facility-specific data:** EPA used facility-specific operating days per year data if available. If facility-specific data were not available for one facility of interest but was available for other facilities within the same OES, the Agency estimated the operating days per year using one of the following approaches:
    a. If other facilities have known or estimated average daily use rates, EPA calculated the days per year as: Days/year = estimated annual use rate for the facility (kg/year) / average daily use rate from facilities with available data (kg/day).
    b. If facilities with days per year data do not have known or estimate average daily use rates, EPA used the average number of days per year from the facilities with such data available.
2. **Industry-specific data:** EPA used industry-specific data available from GSs, ESDs, trade publications, or other relevant literature.
3. **Manufacture of large-PV commodity chemicals:** Commodity chemicals are basic and relatively inexpensive compounds that are often produced in large quantities at plants built specifically to make one chemical. These plants are often run continuously, typically only shutting down for a few weeks a year for maintenance. Because of this, for the manufacture of the large-PV commodity chemicals, EPA used a value of 350 days per year. This assumes the plant runs 7 days per week and 50 weeks per year (with 2 weeks down for turnaround) and assumes that the plant is always producing the chemical.
4. **Manufacture of lower-PV specialty chemicals:** Specialty chemicals are often more expensive and are produced less frequently, at smaller quantities, and on an "as needed" basis. Because of this, for the manufacture of lower-PV specialty chemicals, it is unlikely the chemical is being manufactured continuously throughout the year. Therefore, EPA used a value of 250 days per year. This assumes the plant manufactures the chemical 5 days per week and 50 weeks per year (with 2 weeks down for turnaround).
5. **Processing as reactant (intermediate use) in the manufacture of commodity chemicals:** Similar to #3 above, EPA assumed the manufacture of commodity chemicals occurs 350 days per year such that the use of a chemicals as a reactant to manufacture a commodity chemical would also occur 350 days per year.
6. **Processing as reactant (intermediate use) in the manufacture of specialty chemicals:** Similar to #4 above, the manufacture of specialty chemicals is not likely to occur continuously throughout the year; therefore, EPA used a value of 250 days per year.
7. **Other chemical plant OESs (*e.g.,* Processing into Formulation and Use of Industrial Processing Aids):** For these OESs, EPA assumed that the chemical of interest is not always in use at the facility, even if the facility operates 24/7. Therefore and in general, EPA used a value of 300 days/year based on the "SpERC fact sheet – Formulation & (re)packing of substances and mixtures – Industrial (Solvent-borne)" which uses a default of 300 days/year for the chemical industry (ESIG, 2012). However, in instances where the OES uses a low volume of the chemical of interest, EPA used 250 days per year as a lower estimate.
8. **POTWs:** Although EPA expects POTWs to operate continuously over 365 days per year, the discharge frequency of the chemical of interest from a POTW will be dependent on the discharge patterns of the chemical from the upstream facilities discharging to the POTW. However, there can be multiple upstream facilities (possibly with different OESs) discharging to the same POTW; furthermore, information to determine when the discharges from each facility occur on the same day or separate days is typically not available. Therefore, EPA could not determine an

exact number of days per year the chemical of interest is discharged from the POTW. In such situation, the Agency typically assumes that the number of release days for the chemical at a facility equals the number of operating days.

9. **All other OESs:** Regardless of what the facility operating schedule is, other OESs are unlikely to use the chemical of interest every day. Therefore, EPA used a value of 250 days per year for these OESs.

2.3.3 Estimating Releases from Data Reported to EPA

Generally, EPA used the facility-specific release data reported in TRI, DMR, and NEI as annual releases in each dataset for each site and estimated the daily release by averaging the annual release over the expected release days per year. The Agency's approach to estimating release days per year is described in Section 2.3.2. The relevant supplemental files contain the calculations of the central tendency and high-end annual and daily releases for each OES that used EPA databases to estimate releases. Land release calculations are in *Land Releases for 1,2-Dichloroethane* (U.S. EPA, 2026j); water release calculations are in *Water Releases for 1,2-Dichloroethane* (U.S. EPA, 2026q); and air release calculations are in *Air Releases for 1,2-Dichloroethane* (U.S. EPA, 2026b).

Toxics Release Inventory

Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) established the TRI, which tracks the waste management of designated toxic chemicals from facilities within certain industry sectors. Facilities are required to report to TRI if the facility has 10 or more full-time employees; is included in an applicable NAICS code; and manufactures, processes, or uses the chemical in quantities greater than a certain threshold (25,000 lb for manufacturers and processors of 1,2-dichloroethane and 10,000 lb for users). Facilities provide on-site release information using readily available data (including monitoring data) collected pursuant to other provisions of law, or, where such data are not readily available, "reasonable estimates" of the amounts released. EPA makes the reported information publicly available through TRI.

Each facility subject to the rule must report either using a Form R or a Form A. Facilities reporting using a Form R must report annually the volume of chemical released to the environment (*i.e.,* surface water, air, or land) and/or managed through recycling, energy recovery, and treatment (*e.g.,* incineration) from the facility. Facilities may submit a Form A if the volume of chemical manufactured, processed, or otherwise used does not exceed 1,000,000 lb per year (lb/year) and the total annual reportable releases do not exceed 500 lb per year. Facilities reporting using Form A are not required to submit annual release and waste management volumes or use/sub-use information for the chemical. Due to reporting limitations, some sites that manufacture, process, or use 1,2-dichloroethane may not report to TRI and are therefore not included in this assessment.

For each release quantity reported, TRI filers select a "basis of estimate" code to indicate the principal method used to determine the release quantity. TRI provides six basis of estimate codes, which in no particular order, are continuous monitoring, periodic monitoring, mass balance calculations, published emission factors, site-specific emission factors, and engineering calculations/best engineering judgment. For facilities that use a TRI chemical in multiple operations, the filer may use a combination of methods to calculate the overall release quantity. In such cases, TRI instructs the facility to enter the basis of estimate code for the method that corresponds to the largest portion of the reported release quantity. Additional details on the basis for the reported release estimate (*e.g.,* calculations, underlying assumptions) are not reported in TRI.

EPA included both TRI Form R and Form A submissions in the analysis of environmental releases. For Form R's, the Agency assessed releases using the reported annual release volumes from each media. For Form A's, EPA attempted to estimate releases to each media using other approaches, where possible. Where no other approaches were available to estimate releases from facilities reporting using Form A's, EPA assessed releases using the 500 lb per year threshold for each release media; however, because this threshold is for total site releases, the 500 lb per year is attributed one release media—not all (to avoid over-counting the releases and exceeding the total release threshold for Form A). For this risk evaluation, the Agency used TRI data from reporting years 2015 to 2024 to provide a basis for estimating releases (U.S. EPA, 2021b). Further details on EPA's approach to using TRI data for estimating releases are provided in Section 2.3.3 and Appendix D.

The Agency obtained 2015 to 2024 TRI data for 1,2-dichloroethane from EPA's Basic Plus Data Files and followed a similar approach to estimate air, water, and land releases. The Agency used the reported annual releases directly as reported in TRI and then divided the annual releases over the number of estimated operating days to obtain daily average release estimates. EPA presents the release data as high-end and central tendency estimates by calculating the 50th and 95th percentiles, respectively, of the releases from all facilities mapped to a given OES. Release estimates are separated where relevant by stack and fugitive air emissions, surface water discharges, POTWs, non-POTW WWT, and land releases.

- Air emissions in TRI are reported separately for stack air and fugitive air and occur on-site at the facility. A total of 81 facilities reported air releases of 1,2-dichloroethane with a total of 545 reports over the 10 years that were assessed.
- Water releases in TRI include both reports of annual direct discharges to surface water and annual indirect discharges to off-site POTWs and WWT facilities. A total of 41 facilities reported water releases of 1,2-dichloroethane with a total of 247 reports over the 10 years that were assessed.
- Land releases in TRI provide the type of release media for a particular facility, as well as how the chemical is managed through recycling, energy recovery, or treatment. A total of 36 facilities reported land releases of 1,2-dichloroethane with a total of 131 reports over the 10 years assessed.

TRI emission data also include releases from start up, shutdown, and malfunction events, since the TRI release definition broadly covers any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed receptacles) of any toxic chemical (40 CFR 372.3). Specifically, in Part II, Section 8.8 of the EPA's TRI Reporting Form R, a facility must report the quantity of any release of a toxic chemical into the environment or transferred off-site as a result of a remedial action, catastrophic event, or one-time event not associated with production processes. The Agency EPA generally does not include releases associated with extreme weather events within the scope of the risk evaluation.

Discharge Monitoring Reports

Under the CWA, EPA regulates the discharge of pollutants into receiving waters through NPDES permits, which authorize discharging facilities to discharge pollutants to specified effluent limits. There are two types of effluent limits: (1) technology-based, and (2) water quality-based. Although the technology-based effluent limits are uniform across the nation, the water quality-based effluent limits vary and are more stringent in certain areas. NPDES permits may also specifiy requirements for sewage sludge management.

NPDES permits apply pollutant discharge limits to each outfall at a facility. For TSCA existing chemical risk evaluation purposes, EPA was interested only in the outfalls to surface water bodies. NPDES permits also include internal outfalls but are not included in this analysis because these outfalls are internal monitoring points within the facility wastewater collection or treatment system and do not represent discharges from the facility. NPDES permits require facilities to monitor their discharges and report the results to EPA and the state regulatory agency. Facilities report these results in DMRs. EPA makes these reported data publicly available via the Agency's Enforcement and Compliance History Online (ECHO) system and Water Pollutant Loading Tool (also referred to as "Loading Tool"). The latter is a web-based tool that obtains DMR data through ECHO, presents data summaries, and calculates pollutant loading (mass of pollutant discharged). For this risk evaluation, EPA queried DMRs for all 1,2-dichloroethane point source water discharges available for 2015 to 2024 (U.S. EPA, 2022c). A total of 490 facilities reported, with a total of 2,419 annual release reports over the 10 years.

Across the 10 years of facility-reported specific DMR release data, EPA selected the highest 1,2-dichloroethane release per facility for the surface water analysis and subsequent assessments. For each facility (represented by the highest release across the 10 years), EPA used NHDPlus to download the corresponding receiving waterbody flow data and calculated 1,2-dichloroethane surface water concentrations for each flow metric. If the receiving waterbody flow as found in NHDPlus was lower than the effluent plant flow as reported in ECHO, EPA used the plant flow to calculate the resultant surface water concentrations (see *Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026g)).

Further details on EPA's approach to using DMR data for estimating releases are provided in Sections 2.3.3.1 and Appendix C.

National Emissions Inventory
The NEI was established to track emissions of Criteria Air Pollutants (CAPs) and CAP precursors and assist with National Ambient Air Quality Standard (NAAQS) compliance under the CAA. Air emissions data for the NEI are collected at the state, local, and tribal (SLT) level. SLT air agencies then submit these data to EPA through the Emissions Inventory System (EIS). In addition to CAP data, many SLT air agencies voluntarily submit data for pollutants on EPA's list of HAPs. The Agency uses the data collected from SLT air agencies, in conjunction with supplemental HAP data, to build the NEI. EPA makes an updated NEI publicly available every 3 years. For this risk evaluation, the Agency used NEI data for reporting years 2014, 2017, and 2020 data to provide a basis for estimating releases (U.S. EPA, 2019c).

NEI emissions data is categorized into (1) point source data, (2) area or nonpoint source data, (3) on-road mobile source data, and (4) non-road mobile source data. EPA included only point source data categories in the assessment of environmental releases in this risk evaluation (see Appendix D.2.1 for more information on area or nonpoint and on-road mobile sources). Point sources are stationary sources of air emissions from facilities with operating permits under Title V of the CAA, also called "major sources," which are defined as having actual or potential emissions at or above the major source thresholds. While thresholds can vary for certain chemicals in NAAQS non-attainment areas, the default threshold is 100 tons/year for non-HAPs, 10 tons per year for a single HAP, or 25 tons per year for any combination of HAPs. Point source facilities include large energy and industrial sites and are reported at the emission unit- and release point-level. Further details on EPA's approach to using NEI data for estimating releases are described in Section 2.3.3.2 and Appendix D.

Where available, EPA used NEI data to estimate annual and average daily fugitive and stack air emissions. Facility-level annual emissions are available for major sources in NEI. The Agency then divided the annual stack and fugitive emissions over the number of estimated operating days to develop daily release estimates. In some cases, the same facility reported air releases to both TRI and NEI for a given reporting year. EPA presented data from both sources for the air release assessment. A total of 4,528 facilities reported 18,948 individual point source reports.

In the draft risk evaluation, EPA modeled all available data for 2014 and 2017 using AERMOD (U.S. EPA, 2025a). In the general population inhalation exposure assessment (U.S. EPA, 2026h) for the final risk evaluation, EPA used the Human Exposure Model Version 5 (HEM5.0) to model (1) all facilities in the draft risk evaluation that showed risk greater than 1×10^{-6} based on the 95th percentile concentration at 10 m from the release location, and (2) any new 2020 NEI releases exceeding the 2014 and 2017 NEI releases that previously resulted in a risk greater than 1×10^{-6} based on the 95th percentile concentration at 10 m from the release location. EPA acknowledges that using 10 m as a screening criterion is conservative as that distance from a release location is generally still on the facility property and would not be representative of exposures to the general population; however, this is not necessarily always true—especially for fugitive emissions and 10 m represents a health-protective screening scenario. EPA did not model releases that were assigned to the OES of Use in Fuels and Related Products or with SCC level one code "internal combustion engine" or "external combustion engine," even if they met criteria stated above, because this OES was not quantitively evaluated in this risk evaluation. See Section 1.2 for more information.

2.3.3.1 Estimating Wastewater Discharges from TRI and DMR

Where available, EPA used TRI and DMR data to estimate annual wastewater discharges. Water releases in TRI include both reports of annual direct discharges to surface water and annual indirect discharges to off-site POTWs and WWT facilities. Direct discharges to surface water and indirect discharges to off-site POTWs and WWT facilities from TRI were assessed.[1] Although surface water discharges are released to the environment, discharges to POTWs and WWT facilities are not directly released into the environment but to treatment facilities. The estimates of high-end daily and 1-day maximums are based on data availability in DMR as described in this section.

Annual Wastewater Discharges

For TRI, annual discharges are reported directly by facilities. For DMR, annual discharges are automatically calculated by the Loading Tool based on the sum of the discharges associated with each monitoring period in DMR. Monitoring periods in DMR are set by each facility's NPDES permit and can vary between facilities. Typical monitoring periods in DMR include monthly, bimonthly, quarterly, biannual, and annual reporting. In instances where a facility reports a period's monitoring results as below the limit of detection (LOD) (also referred to as a "non-detect" or ND) for a pollutant, the Loading Tool applies a hybrid method to estimate the wastewater discharge for the period. The hybrid method sets the values to half of the LOD if there was at least one detected value in the facility's DMRs in a calendar year. If all values were less than the LOD in a calendar year, the annual load is set to zero.

[1] Eighty-one percent of TRI-reporting facilities report annual direct discharges to surface water, while 44% reported annual indirect discharges to off-site POTWs and WWT facilities. There is some overlap with nine facilities reporting both direct and indirect discharges of 1,2-dichloroethane. For more details, refer to the "Facility Summary" tab in the *Water Releases for 1,2-Dichloroethane* supplemental file (U.S. EPA, 2025b), which includes columns indicating whether a site was direct or indirect and the program to which the facility reported. Direct discharges occur following treatment at the discharging facility.

Average Daily Wastewater Discharges

To estimate average daily discharges, EPA used the following steps:

1. Obtained total annual loads calculated from the Loading Tool and reported annual direct surface water discharges and indirect discharges to POTW and non-POTW WWT in TRI.
2. Because releases are not provided for TRI reporters using Form A, EPA estimated annual releases using an alternative approach (see Section 2.3.4) or at the threshold of 500 lb per year.
3. Determined if any of the facilities receiving indirect discharges reported in TRI have reported DMRs for the corresponding TRI reporting year, if so, these indirect discharges were excluded from further analysis because it is assumed those discharges will be covered in facility discharge data for POTWs and other non-POTW WWTs. The associated surface water release (after any treatment at the receiving facility) was incorporated as part of the receiving facility's DMR.
4. Divided the annual discharges over the number of estimated operating days (estimated as described in Section 2.3.2).

High-End Daily Wastewater Discharges

High-end daily wastewater discharges are an estimate of the high-end daily discharge rate that may take place for a single monitoring period during the year for the facility. As a first step, EPA only analyzed high-end daily discharges for the facilities with DMRs accounting for the top 90% of non-POTW WWT annual discharges and the top 90% of POTW discharges. The Agency analyzed high-end discharges from the bottom 10% only in the case where risk was found for facilities in the top 90% with the smallest annual discharges. For 1,2-dichloroethane, facilities accounting for the top 95% discharges were analyzed for high-end daily discharges.

EPA used the following steps to estimate high-end discharges for facilities *with DMR data*:

1. Identify the facilities that represent the top 90% of annual discharges for non-POTW WWTs in the DMRs and the top 90% of annual discharges for POTWs. Note that if EPA found unreasonable risks for facilities in the top 90%, a second tier of facilities was evaluated. EPA continued to evaluate additional tiers as needed.
2. Use the Loading Tool to obtain the reporting periods (*e.g.,* monthly, bimonthly, quarterly, biannually, annually) and required reporting statistics (*e.g.,* average monthly concentration, maximum daily concentration) for each external outfall at each facility identified in Step 1. When one outfall was reported in the Loading Tool, EPA assumed it was an external outfall. If multiple outfalls are reported in the Loading Tool, the Agency determined the external outfall by reviewing the facility's permits.
3. For each external outfall at each facility, calculate the average daily load for each reporting period by multiplying the period average concentration by the period average wastewater flowrate.
4. Sum the average daily loads from each external outfall for each period.
5. Select the period with the highest average daily load across all external outfalls as an estimate of the high-end daily discharge assessed over the number of days in the period. Note that the number of days in the reporting period does not necessarily equate to the number of operating days in the reporting period. For example, for a plant that operates 200 days/year, EPA used 200 rather than 365 days per year for average daily discharge. Therefore, discharges will not occur every day of the reporting period, but only for a fraction estimated as (*e.g.,* 200 ÷ 365 = 68%). EPA multiplied the number of days of the reporting period by this factor to maintain consistency between operating days per year and operating days per reporting period.

EPA used the following steps to estimate high-end discharges for facilities *without DMR data* (*e.g.,* facilities with TRI data but no DMR data):

1. Identify facilities that report under the NPDES program for the same chemical, same year, and same OES as the TRI facility and report DMRs monthly. Note that if no monthly reporters exist, reporters with less frequent reporting can be substituted provided the number of release days per year are adjusted in subsequent steps. In such cases, the period data need to be normalized to monthly averages by dividing the period load by the number of months in the period. EPA used 30.4167 days per month to normalize the period discharges (*i.e.,* 365 days/12 months).
2. For each facility identified in #1, calculate the percentage of the total annual discharge that occurred in the highest 1-month period.
3. Calculate a generic factor for the OES as the average of the percentages calculated in step #2.
4. Estimate the high-end daily discharge for each facility without DMRs by multiplying the annual discharge by the generic factor from #3. For example, a facility reports 227 kg released per year and has a generic factor of 15% for the OES from #3. The estimated high-end chronic daily discharge for the facility would be 227 kg times 15% equals 34 kg/month.
5. Use the value calculated in #4 as an estimate of the high-end daily discharge assessed over 30.4167 days per year (consistent with the normalization from step #1 above). For example, the high-end daily discharge assessed over 30.4167 days per year for the facility with the estimated high-end chronic daily discharge of 34 kg/month (from #4 above) is 34 kg/month divided by 30.4167 days equals 1.12 kg/day for 30.4167 days.

1-Day Maximum Wastewater Discharges

One-day maximum discharge rates estimate a discharge rate that may represent a 1-day maximum rate for the facility. Facilities required to report DMRs under the NPDES may sometimes be required to report a daily maximum discharge concentration for the period. EPA used these values to estimate 1-day maximum discharges by multiplying the maximum daily concentration by the corresponding month's maximum daily wastewater flow rate. Where no such data existed for a facility (*i.e.,* facilities without DMRs or facilities with DMRs whose permits do not require reporting of 1-day maximums), EPA did not have data to estimate a 1-day maximum discharge rate.

2.3.3.2 Estimating Air Emissions from TRI and NEI

Where available, EPA used TRI and NEI data to estimate annual and average daily fugitive and stack air emissions. For air emissions, the Agency estimated both release patterns (*i.e.,* days per year of release) and release durations (*i.e.,* hours per day the release occurs).

Annual Emissions

Facility-level annual emissions are available for TRI reporters and major sources in NEI. EPA used the reported annual emissions directly as reported in TRI and NEI for major sources.

Average Daily Emissions

To estimate average daily emissions for TRI reporters and major sources in NEI, EPA used the following steps:

1. Obtain total annual fugitive and stack emissions for each TRI reporter and major sources in NEI.
2. For TRI reporters using a Form A, estimate annual releases using the threshold of 500 lb per year.

3. Divide the annual stack and fugitive emissions over the number of estimated operating days (note that NEI data includes operating schedules for many facilities that can be used to estimate facility-specific days per year).
4. Estimate a release duration using facility-specific data available in NEI, models, and/or literature sources. If no data is available, list as "unknown."

2.3.3.3 Estimating Land Disposals from TRI

Where available, EPA used TRI data to estimate annual and average daily land disposal volumes. TRI includes reporting of disposal volumes for a variety of land disposal methods, including underground injection, Resource Conservation and Recovery Act (RCRA) Subtitle C landfills, land treatment, RCRA Subtitle C surface impoundments, other surface impoundments, and other land disposal. TRI also provides the type of release media for a particular facility, as well as how the chemical is managed through recycling, energy recovery, or treatment. EPA provided estimates for both a total aggregated land disposal volume and disposal volumes for each disposal method reported in TRI.

Annual Land Disposal

Facility-level annual disposal volumes are available directly for TRI reporters. EPA used the reported annual land disposal volumes directly as reported in TRI for each land disposal method. The Agency combined totals from all land disposal methods from each facility to estimate a total annual aggregate disposal volume to land.

Average Daily Land Disposal

To estimate average daily disposal volumes, EPA used the following steps:

1. Obtain total annual disposal volumes for each land disposal method for each TRI reporter.
2. For TRI reporters using a Form A, estimate annual releases using the threshold of 500 lb per year.
3. Divide the annual disposal volumes for each land disposal method over the number of estimated operating days.
4. Combine totals from all land disposal methods from each facility to estimate a total aggregate disposal volume to land.

2.3.3.4 Trends in Release Data

EPA analyzed data for the following years for the three main data sources: 2015 to 2020 for DMR and TRI, and 2014 and 2017 for NEI. EPA also conducted a review of additional available years (2021–2025 for DMR, 2021–2024 for TRI, and 2020 for NEI). Tables showing release data since 2015 are provided below.

Table 2-1. 1,2-Dichloroethane TRI Release Trends for Reporting Years 2015–2024

Reporting Year	Air (kg/yr)			Water (kg/yr)			Land (kg/yr)
	Fugitive	Stack	Fugitive and Stack	On-Site Discharge	Transfer to POTW	Transfer to WWT (Non-POTW)	
2024	8.6E04	5.4E04	1.4E05	1,105	162	896	4.7E04
2023	1.1E05	6.3E04	1.7E05	503	84	1,290	5.4E04
2022	1.5E05	5.8E04	2.1E05	702	28	877	3.4E04
2021	1.3E05	5.2E04	1.9E05	1,824	63	1,767	2.0E04
2020	1.0E05	5.1E04	1.5E05	3,533	503	1,992	46

Reporting Year	Air (kg/yr)			Water (kg/yr)			Land (kg/yr)
	Fugitive	Stack	Fugitive and Stack	On-Site Discharge	Transfer to POTW	Transfer to WWT (Non-POTW)	
2019	9.3E04	5.6E04	1.5E05	829	1,281	2,668	17
2018	1.4E05	6.3E04	2.1E05	2,432	929	1,540	416
2017	1.4E05	6.0E04	2.0E05	1,501	572	1,571	4,419
2016	1.1E05	5.6E04	1.7E05	1,550	571	796	98
2015	1.1E05	7.8E04	1.9E05	2,066	1,026	1.1E04	92
POTW = publicly owned treatment works; TRI = Toxics Release Inventory; WWT = wastewater treatment plant							

A review of the 2021 to 2024 TRI release data showed that releases are generally consistent with those from 2015 to 2020—except for land releases, which were significantly higher. This increase is primarily due to one TRI-reporting facility (TRIFID 77536DSPSL2525B) that did not report land releases of 1,2-dichloroethane in previous years.

Table 2-2. 1,2-Dichloroethane NEI Release Trends for Reporting Years 2014, 2017, and 2020

Reporting Year	Stack Air (kg/yr)	Fugitive Air (kg/yr)	Fugitive and Stack Air (kg/yr)
2020	7.6E04	1.3E05	2.1E05
2017	7.0E04	1.5E05	1.0E05
2014	7.7E04	1.0E05	1.8E05
NEI = National Emissions Inventory			

Table 2-3. 1,2-Dichloroethane DMR Release Trends for Reporting Years 2015–2025

Reporting Year	Annual Releases to Surface Water (kg/yr)
2025	1,767
2024	2,007
2023	1,538
2022	4,478
2021	1.2E04
2020	6.6E04
2019	1,626
2018	2,222
2017	1.0E04
2016	6,275
2015	3,210
DMR = Discharge Monitoring Report	

A review of the 2021 to 2025 DMR and 2020 NEI release data indicates that releases are generally on the same order of magnitude as the 2015 to 2020 releases.

2.3.4 Estimating Releases from Models

Where releases were expected for an OES—but TRI, DMR, and/or NEI data were not available or where EPA determined they did not capture the entirety of environmental releases for an OES—the Agency utilized models to estimate environmental releases. Outputs from models may be the result of deterministic calculations, stochastic calculations, or a combination of both deterministic and stochastic calculations. For each OES with modeled releases, EPA followed these steps to estimate releases:

1. Identify release sources from process and associated release media.
2. Identify or develop model equations for estimating releases from each release source.
3. Identify model input parameter values from relevant literature sources.
4. If a range of input values is available for an input parameter, determine the associated distribution of input values.
5. Calculate annual and daily release volumes for each release source using input values and model equations.
6. Aggregate release volumes by release media and report total releases to each media from each facility.

For release models that utilized stochastic calculations, EPA performed a Monte Carlo simulation using the Palisade @Risk Industrial Edition, Version 7.0.0 software[2] with 100,000 iterations and the Latin Hypercube sampling method. Detailed descriptions of the model approaches used for each OES, model equations, input parameter values and associated distributions are provided per OES in Section 1 and Appendix A.

Modeling was used to assess the releases for the following OESs: Repackaging, Industrial Application of Adhesives and Sealants, Industrial and Commercial Non-Aerosol Cleaning/Degreasing, Industrial and Commercial Aerosol Products, and Commercial Laboratory Use. See the corresponding text in Section 1 for an overview of the methods in these cases. See Appendix A and the corresponding supplemental release model files for more detail on the method and equations used in each case.

2.4 Evidence Integration for Environmental Releases

Evidence integration for the environmental release assessment includes analysis, synthesis, and integration of information and data to produce estimates of environmental releases. During evidence integration, EPA considered the likely location, duration, intensity, frequency, and quantity of releases while also considering factors that increase or decrease the strength of evidence when analyzing and integrating the data. Key factors the Agency considered when integrating evidence include the following:

1. **Data quality:** EPA only integrated data or information rated as high, medium, or low obtained during the data evaluation phase. Data and information rated as uninformative are not used in exposure evidence integration. In general, higher rankings are given preference over lower ratings; however, lower ranked data may be used over higher ranked data when specific aspects of the data are carefully examined and compared. For example, a lower ranked dataset that precisely matches the OES of interest may be used over a higher ranked study that does not as closely match the OES of interest.

[2] This software is available from @*Risk*; Palisade; https://www.palisade.com/risk/ (accessed August 11, 2025).

2. **Data hierarchy:** EPA used both measured and modeled data to obtain accurate and representative estimates (*e.g.,* central tendency, high-end) of the environmental releases resulting directly from a specific source, medium, or product. If available, measured release data are given preference over modeled data, with the highest preference given to data that are chemical-specific and directly representative of the OES.

EPA considered both data quality and data hierarchy when determining evidence integration strategies. For example, the Agency may have given preference to high quality modeled data directly applicable to the OES being assessed over low quality measured data that is not specific to the OES. The final integration of the environmental release evidence combined decisions regarding the strength of the available information, including information on plausibility and coherence across each evidence stream.

3 ENVIRONMENTAL RELEASE ASSESSMENTS BY OES

The following sections contain process descriptions and the specific details (release sources, media of release, and release assessment approach and results) for the assessment for each OES.

Refer to Table 1-1 to see which COUs are relevant to each of the OESs described below.

For all OES that have reported release data, the annual and daily central tendencies (50th percentile) and high-ends (95th percentile) for releases can be found in the following locations:

- For surface water releases from TRI and DMR, see the "OES Summary" tab of *Water Releases for 1,2-Dichloroethane* (U.S. EPA, 2026q). One DMR on-site water release was 33 times greater than the corresponding TRI value. Based on the facility-specific data received, including documentation of storm events, EPA determined that this release was associated with these storm events. For more information on this release, refer to the *Environmental Media Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026g).
- For stack and fugitive air releases from TRI and NEI, see the "OES Summary" tab of *Air Releases for 1,2-Dichloroethane* (U.S. EPA, 2026b).
- For land releases, see the "OES Summary" tab of *Land Releases for 1,2-Dichloroethane* (U.S. EPA, 2026j).

For the OESs that use release modeling, see the following supplemental files, as applicable:

- *Application of Adhesives Release Model for 1,2-Dichloroethane* (U.S. EPA, 2026c)
- *Aerosol Products Release Model for 1,2-Dichloroethane* (U.S. EPA, 2026a)
- *Non-Aerosol Cleaning and Degreasing Release Model for 1,2-Dichloroethane* (U.S. EPA, 2026k)
- *Repackaging Release Model for 1,2-Dichloroethane* (U.S. EPA, 2026n)
- *Laboratory Use Release Model for 1,2-Dichloroethane* (U.S. EPA, 2026i)

3.1 Manufacturing

Based on CDR data, EPA identified Manufacture as a COU and OES for 1,2-dichloroethane (U.S. EPA, 2020a, 2016), as listed in Table 1-1.

3.1.1 Process Description

CDR data indicates that 1,2-dichloroethane is manufactured as a liquid with a purity of exceeding 90% (U.S. EPA, 2020a). Various methods for manufacture of 1,2-dichloroethane are discussed in literature. 1,2-Dichloroethane may be produced by the vapor phase chlorination of ethylene (oxychlorination) or by the liquid-phase chlorination of ethylene (direct chlorination) (Reed, 2000; Carroll et al., 1998; NTP, 1991; UNEP, 1988; NIOSH, 1976). In practice, both methods are often applied in tandem as part of an integrated balanced process (Stantec ChemRisk, 2024). Most liquid-phase processes use small amounts of ferric chloride as the catalyst. Other catalysts claimed in the patent literature include aluminum chloride, antimony pentachloride, and cupric chloride and an ammonium, alkali, or alkaline-earth tetrachloroferrate. The chlorination is carried out at 40 to 50 °C with 5% air or other free-radical inhibitors added to prevent substitution chlorination of the product. The exothermic heat of reaction vaporizes the 1,2-dichloroethane product, which is purified by distillation (Snedecor et al., 2004).

1,2-Dichloroethane can also be manufactured as a byproduct in the manufacture of other chemical products, such as during the production of dichloroethylether (Stantec ChemRisk, 2024), or as a minor byproduct of the hydrochlorination of organics in the manufacture of pesticides (EPA-HQ-OPPT-2018-0427-0016).

EPA received comments from the Vinyl Institute describing the unintentional formation of seven byproducts during the manufacture of 1,2-dichloroethane: 1,1-dichloroethane, 1,1,2-trichloroethane, *trans*-1,2-dichloroethylene, trichloroethylene, perchloroethylene, methylene chloride, and carbon tetrachloride. Releases and exposures due to these byproducts are discussed and assessed in the *Byproduct Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026d).

A process diagram depicting a 1,2-dichloroethane manufacturing process is available in comments from the Vinyl Institute (EPA-HQ-OPPT-2018-0427-0024).

3.1.2 Number of Facilities and Release Days

In the 2020 CDR, 17 sites (Table 3-1) reported the manufacture of 1,2-dichloroethane. Facilities reported production volumes ranging from approximately 24,040 to 2.72 billion kg with an aggregate production volume of 13.6 to 18.1 billion kg (U.S. EPA, 2020a).

Table 3-1. Sites Reported Manufacturing 1,2-Dichloroethane in 2020 CDR

Site Name	Location
Westlake Vinyls, Inc.	Calvert City, KY
Axiall, LLC	Westlake, LA
Axiall, LLC	Plaquemine, LA
Blue Cube Operations, LLC	Plaquemine, LA
Buckman Laboratories, Inc.	Cadet, MO
Eagle US 2, LLC	Westlake, LA
Formosa Plastics Corporation	Baton Rouge, LA
Formosa Plastics Corporation	Point Comfort, TX
Geon Oxy Vinyl	Laporte, TX
Lanxess Corporation	North Charleston, SC
Occidental Chemical Corporation	Convent, LA
Occidental Chemical Corporation	Geismar, LA
Olin Blue Cube	Freeport, TX
Oxy Vinyls LP	Deer Park, TX
OxyChem Ingleside Plant	Gregory, TX
Shintech	Plaquemine, LA
Westlake Vinyls Company, LP	Geismar, LA

CDR = Chemical Data Reporting
Source: (U.S. EPA, 2020a)

EPA identified all 17 sites reporting to CDR in TRI, DMR, and NEI release data and additional 28 manufacturing sites from these databases. In total, the Agency identified 45 manufacturing sites. The Agency reviewed the 2024 CDR and did not identify any additional manufacturing facilities. See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to manufacturing that reported to CDR, TRI, DMR, and/or NEI.

EPA did not identify data on facility operating schedules; therefore, because 1,2-dichloroethane is a large-PV commodity chemical, EPA assumed 350 days/year of operation as discussed in Section 2.3.2.

3.1.3 Release Assessment

3.1.3.1 Environmental Release Points

Potential releases to air, wastewater, and land include equipment cleaning, transport container cleaning and sampling waste. In general, potential sources of water releases in the chemical industry may include equipment cleaning operations, transport container cleaning, aqueous wastes from scrubbers/decanters, reaction water, process water from washing intermediate products, and trace water settled in storage tanks. Sources specific to 1,2-dichloroethane may include during the direct chlorination process crude 1,2-dichloroethane from the reactor is washed with water and "caustic [soda]" (NaOH) to remove dissolved hydrochloric acid (HCl) and chlorine gas (Cl_2) before being transferred to in-process storage. This waste wash water can be sent then to a wastewater stripper. Water is both produced during the oxychlorination process for manufacturing 1,2-dichloroethane and removed from the product stream during distillation. Additionally, stack air releases are expected from vented losses to air during process operations as well as fugitive air releases from leakage of pipes (including equipment such as valves, pumps, and connectors), flanges, loading racks, and container filling from equipment leaks and displaced vapor as containers are filled. Releases may also occur during sampling of the process.

3.1.3.2 Environmental Release Assessment Results

As described in Section 2.3, EPA used 2015 to 2024 DMR, 2015 to 2024 TRI, and 2014, 2017, and 2020 NEI data to estimate environmental releases during the manufacture of 1,2-dichloroethane, as presented in Table 3-2. The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively. According to reported data, 1,2-dichloroethane is released through the following environmental media: surface water, fugitive air, stack air, and land disposal. The release estimates are separated by these release media. Annual release estimates were reported directly by facilities in TRI, DMR, and NEI. Annual fugitive and stack air release data was provided by TRI and NEI, surface water discharge release data was provided by TRI and DMR, and land release data was provided by TRI.

Table 3-2. Summary of Environmental Releases During the Manufacture of 1,2-Dichloroethane

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	1.4	190	350	3.9E−03	0.54	70	2015–2024 TRI/DMR
Fugitive air	3,174	1.7E04		9.1	48	22	2015–2024 TRI
Stack air	1,102	1.2E04		3.1	35	23	2015–2024 TRI
Fugitive air	2,665	1.0E04		7.6	29	21	2014, 2017, and 2020 NEI[a]
Stack air	833	6,192		2.4	18	23	2014, 2017, and 2020 NEI[a]
Land	6.8	621		1.9E−02	1.8	18	2015–2024 TRI

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; TRI = Toxics Release Inventory [a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.							

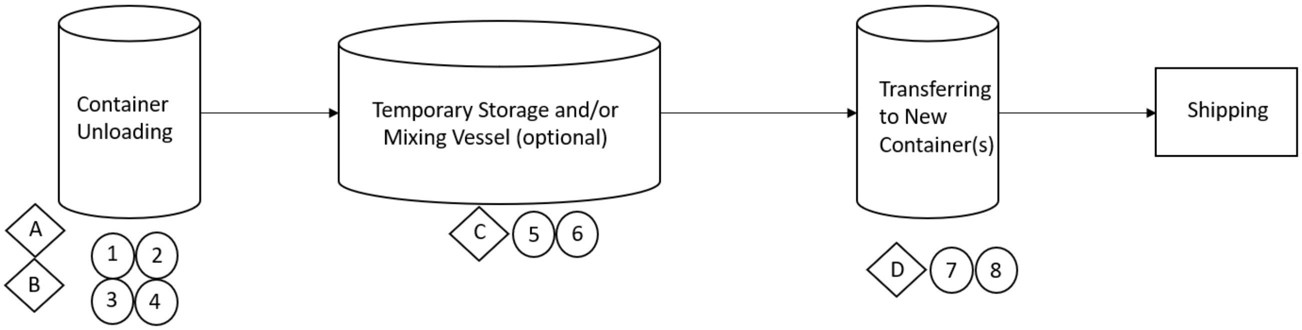
3.2 Repackaging

Based on the 2016 CDR data, EPA identified Repackaging as an OES (U.S. EPA, 2019a). As listed in Table 1-1 this OES includes the following COUs: Import, and Repackaging.

3.2.1 Process Description

Chemicals such as 1,2-dichloroethane may be imported into the United States in bulk via water, air, land, and intermodal shipments (Tomer and Kane, 2015). These shipments take the form of oceangoing chemical tankers, railcars, tank trucks, and tank containers. Chemicals shipped in bulk containers may be repackaged into smaller containers for resale, such as drums or bottles. Domestically manufactured commodity chemicals may be shipped within the United States in liquid cargo barges, railcars, tank trucks, tank containers, intermediate bulk containers (IBCs)/totes, and drums. Both imported and domestically manufactured commodity chemicals may be repackaged by wholesalers for resale; for example, repackaging bulk packaging into drums or bottles. Repackaging into bottles or smaller containers for laboratory use is expected to occur. The type and size of container will vary depending on customer requirement. In some cases, quality control (QC) samples may be taken at import and repackaging sites for analyses. Some import facilities may only serve as storage and distribution locations, and repackaging/sampling may not occur at all import facilities.

1,2-Dichloroethane may be imported neat or as a component in a formulation. EPA assumes that no mixing takes place during the repackaging of 1,2-dichloroethane. Figure 3-1 provides typical release and exposure points during the repackaging of 1,2-dichloroethane.



Environmental Releases:

1. Releases to air from unloading volatile chemicals from transport containers.
2. Releases to air, water, incineration, or landfill from unloading solids from transport containers.
3. Releases to water, incineration or land from transport container residue (via container cleaning or direct disposal of empty containers).
4. Releases to air from cleaning transport containers containing volatile chemicals
5. Releases to water, incineration or land from cleaning of storage/mixing vessels and other equipment.
6. Releases to air from cleaning equipment used to process volatile chemicals.
7. Releases to air from loading volatile chemicals into transport containers.
8. Releases to air, water, incineration, or landfill from loading solids into transport containers.

Figure 3-1. Typical Release Points During the Repackaging of 1,2-Dichloroethane (U.S. EPA, 2022a).

3.2.2 Number of Facilities and Release Days

In the 2016 CDR, 11 companies reported importing 1,2-dichloroethane at concentrations mainly exceeding 90%. Six additional facilities reported manufacturing/import information (U.S. EPA, 2019a). No companies reported importing 1,2-dichloroethane in the 2020 CDR. An analysis of 2024 CDR data showed that no sites reported import for 1,2-dichloroethane for the 2024 CDR reporting cycle. Using CDR, TRI, DMR, and NEI, EPA identified 59 total repackaging sites potentially repackaging 1,2-dichloroethane. Sites indicating the storage of chemicals, such as tank farms or terminals, were classified under repackaging for this assessment, and comprise roughly 51 of the 59 identified sites. These sites included the following NAICS codes: 424710 – Petroleum Bulk Stations and Terminals; and 493110 – General Warehousing and Storage. See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to 1,2-dichloroethane repackaging that reported to CDR, TRI, DMR, and/or NEI.

Because EPA did not identify data on facility operating schedules, the Agency assumes 250 days/year of operation as discussed in Section 2.3.2.

3.2.3 Release Assessment

3.2.3.1 Environmental Release Points

EPA expects releases to occur to air, water, and/or land during the emptying and cleaning of drums and transport containers and during the filling and loading of transport containers. Releases may also occur from the cleaning of storage vessels and other equipment and cleaning equipment used to process the chemical.

3.2.3.2 Environmental Release Assessment Results

EPA used 2015 to 2024 TRI and DMR and 2014,2017, and 2020 NEI to estimate environmental releases during the repackaging of 1,2-dichloroethane, as presented in Table 3-3. The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively. According to reported data, 1,2-dichloroethane is released through the following environmental media: surface water, fugitive air, stack air, incineration, and land disposal. The differences between the TRI and NEI fugitive air releases could be attributed to the TRI reporting thresholds. Therefore, only facilities exceeding those thresholds report to TRI, which can skew the dataset toward larger releasers. For details on reporting thresholds for both TRI and NEI, see Section 2.3.3.

Table 3-3. Summary of Environmental Releases of 1,2-Dichloroethane During Repackaging

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	4.1E−02	227	250	1.6E−04	0.91	27	2015–2024 TRI/DMR
Fugitive air	113	227	250	0.45	0.91	4	2015–2024 TRI
Stack air	38	227		0.15	0.91	4	2015–2024 TRI
Fugitive air	1.4E−02	105		5.7E−05	0.42	28	2014, 2017, and 2020 NEI[a]
Stack air	2.0	545		7.8E−03	2.2	11	2014, 2017, and 2020 NEI[a]

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; TRI = Toxics Release Inventory
[a] Between the draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in this table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

The Agency also modeled releases because the facility release data does not capture the entirety of environmental releases, in particular releases from repackaging into smaller containers may not be captured in the release data from larger repackaging sites. To supplement the database data, EPA estimated releases for repackaging using the models and approaches described in the July 2022 Chemical Repackaging – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2022a). The Agency used the following approach to obtain both high-end and central tendency release estimates:

1. Identify release sources and media of release for the OES.
2. Identify model input parameters from relevant literature sources, GSs, or ESDs. Model input parameters include the estimated number of sites, container size, mass fractions, and 1,2-dichloroethane's physical properties. If a range of input values is available for an input parameter, determine the associated distribution of input values.
3. Identify model equations based on standard models from relevant GSs or ESDs.
4. Conduct a Monte Carlo simulation to calculate the total 1,2-dichloroethane release (by environmental media) across all release sources during each iteration of the simulation.
5. Select the 50th and 95th percentile values to estimate the central tendency and high-end releases, respectively.

EPA performed a Monte Carlo simulation to estimate variability in the model input parameters. The simulation used the Latin hypercube sampling method in @Risk Industrial Edition, Version 7.0.0, which generates a sample of possible values. The Agency performed the model at 100,000 iterations to capture a broad range of possible values. EPA selected the 50th and 95th percentile to estimate releases.

In this model, EPA assumed one generic repackaging site with a PV of 11,340 kg/year. This PV assumption was based on the CDR reporting threshold of 25,000 lb/yr (11,340 kg/yr) per site. See Appendix A.2 for more detailed information. Table 3-4 summarizes the estimated release results for repackaging based on the scenario applied. The high-end values are the 95th percentile of the respective simulation output and the central tendencies are the 50th percentile. The number of release days are also a result of the simulation output and are dependent on the facility throughput and number of import containers received. Appendix A.2 includes the model equations and input parameters used in the Monte Carlo simulation for this COU.

Table 3-4. Summary of Modeled Environmental Releases for the Repackaging of 1,2-Dichloroethane

Modeled Scenario	Environmental Media	Annual Release (kg/site-yr)		Number of Release Days[a]		Daily Release (kg/site-day)	
		Central Tendency	High-End	Central Tendency	High-End	Central Tendency	High-End
11,340 kg/yr	Fugitive or stack air	3.6	5.8	119	24	8.4E−02	0.15
	Hazardous landfill or incineration	275	320	119	24	6.5	10

[a] EPA assumed that the number of operating days is equivalent to the number of drums imported per year (*i.e.,* 1 drum repackaged per day) but not to exceed 250 operating days per year. The number of release days presented in this table is based on simulation outputs for the annual release divided by the daily release (grouped by high-end or central tendency estimate), rounded to the closest integer. Thus, annual totals may not add up exactly due to rounding.

3.3 Processing as a Reactant

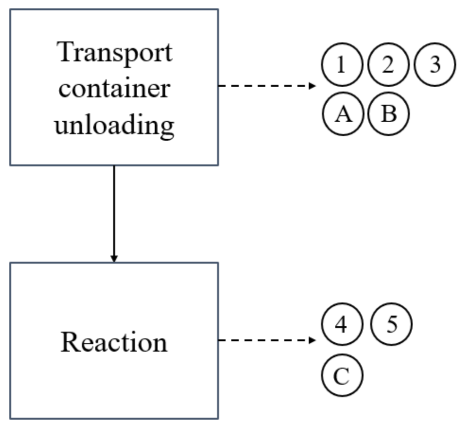
Based on 2016 and 2020 CDR data, EPA identified Processing as a Reactant as COU and OES to assess (U.S. EPA, 2020a, 2016). Over 90% of the 1,2-dichloroethane manufactured goes to the production of vinyl chloride. Other uses include the production of ethylene amines, 1,1,1-trichloroethane, vinylidene chloride, trichloroethylene perchloroethylene, and ethylene oxide (Snedecor et al., 2004; UNEP, 1988) (EPA-HQ-OPPT-2018-0427-0162).

As listed in Table 1-1, this OES includes the following COUs: Intermediate in: Petrochemical manufacturing; Plastic material and resin manufacturing; All other basic organic chemical manufacturing; Recycling; and Oxidation inhibitor in controlled oxidative chemical reactions. EPA combined these COUs into one OES due to similarities in expected exposure scenarios.

3.3.1 Process Description

Processing as a reactant or intermediate is the use of 1,2-dichloroethane as a feedstock in the production of another chemical via a chemical reaction in which it is consumed to form the product. The concentration of 1,2-dichloroethane used in these processes is unknown; though EPA assumes that it is used at a concentration exceeding 90% from the manufacturing process (U.S. EPA, 2020a). EPA did not find specific container information for 1,2-dichloroethane used as a reactant; however, the ESD on the Storage and Transfer of Chemicals describes that typically chemicals may arrive in tank trucks, rail cars, or pipelines received directly from the manufacturing sites (OECD, 2009b).

1,2-dichloroethane can be used for the production of VCM via thermal cracking (EPA-HQ-OPPT-2018-0427-0024). 1,2-dichloroethane production units are typically collocated with VCM thermal cracking units and feed directly into VCM units (EPA-HQ-OPPT-2018-0427-0165). 1,2-Dichloroethane can also be used to produce ethyleneamines and polyethyleneamines by the reaction of 1,2-dichloroethane with ammonia, followed by neutralization with sodium hydroxide to produce a mixture of ethyleneamines and sodium chloride, which is then separated via fractional distillation (Huntsman, 2007). Use of 1,2-dichloroethane as an oxidation inhibitor (reactant) in some large scale controlled oxidative chemical reactions is also possible (EPA-HQ-OPPT-2018-0427-0006). 1,2-Dichloroethane is used in the production of glycols to control the ethylene glycol reactor conversion efficiency. In this process, a small inhibitor stream of ethylene with a low concentration of 1,2-dichloroethane is introduced into the reactor feed stream, which is then converted to ethylene oxide, carbon dioxide, and water in the presence of a catalyst (EPA-HQ-OPPT-2018-0427-0045). 1,2-dichloroethane is also used as a catalyst moderator in the production of ethylene oxide from ethylene and oxygen (EPA-HQ-OPPT-2018-0427-0162, EPA-HQ-OPPT-2018-0427-0165). Figure 3-2 below highlights the typical release and exposure points during the processing of 1,2-dichloroethane as a reactant or intermediate.



Environmental Releases:

1. Releases to air from transferring volatile chemicals from transport containers.
2. Releases to air, water, incineration, or landfill from unloading solids from transport containers.
3. Releases to air, water, incineration, or land from cleaning of transport containers.
4. Releases to water, incineration, or land from cleaning of reaction vessels and other equipment.
5. Releases to air from reaction of volatile chemicals.

Figure 3-2. Typical Release Points During the Processing of 1,2-Dichloroethane as a Reactant or Intermediate

3.3.2 Number of Facilities and Release Days

In the 2020 CDR, 15 sites reported the processing of 1,2-dichloroethane as an intermediate in the manufacture of petrochemicals, plastics material and resin, and other basic organic chemicals. Using TRI, NEI, and DMR release data, EPA identified 28 additional facilities that potentially process 1,2-dichloroethane as a reactant for a total of 43 facilities.

EPA estimated the total non-CBI production volume for this OES as 6.9 billion lbs (3.1 billion kg) based on 15 facilities (listed in Table 3-5) reporting downstream use of 1,2-dichloroethane for processing as a reactant. In CDR, facilities also report the percentage of their manufactured or imported production volume that goes to this use. EPA calculated the total by summing each facility's reported production volume multiplied by the percentage allocated to this use. The Agency did not further use CDR production volume data to estimate releases for this OES because facility-specific release data was available from TRI, DMR and NEI (U.S. EPA, 2020a). Table 3-5 presents the sites that reported processing of 1,2-dichloroethane as a reactant or intermediate to the 2020 CDR.

Table 3-5. Sites Reported Processing 1,2-Dichloroethane as a Reactant in 2020 CDR

Site Name	Location
Westlake Vinyls, Inc.	Calvert City, KY
Axiall, LLC	Westlake, LA
Axiall, LLC	Plaquemine, LA
Blue Cube Operations, LLC	Plaquemine, LA
Eagle US 2, LLC	Westlake, LA
Formosa Plastics Corporation	Baton Rouge, LA
Formosa Plastics Corporation	Point Comfort, TX
Geon Oxy Vinyl	Laporte, TX
Lanxess Corporation	North Charleston, SC
Occidental Chemical Corporation	Convent, LA
Occidental Chemical Corporation	Geismar, LA
Olin Blue Cube	Freeport, TX
Oxy Vinyls LP	Deer Park, TX
OxyChem Ingleside Plant	Gregory, TX
Westlake Vinyls Company, LP	Geismar, LA
CDR = Chemical Data Reporting Source: (U.S. EPA, 2020a)	

See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to processing as a reactant that reported to CDR, TRI, DMR, and/or NEI.

EPA did not identify data on facility operating schedules; therefore, as this is the processing of a large-PV commodity chemical, the Agency assumes 350 days/year of operation, as discussed in Section 2.3.2.

3.3.3 Release Assessment

3.3.3.1 Environmental Release Points

As presented in Figure 3-2, EPA expects releases to occur during container and equipment cleaning and sampling waste. Environmental releases may also occur during the unloading of 1,2-dichloroethane from transport containers into intermediate storage tanks and process vessels. Equipment leaks may occur while connecting and disconnecting hoses and transfer lines; releases to air may occur due to the reaction of 1,2-dichloroethane that is a volatile chemical.

3.3.3.2 Environmental Release Assessment Results

As described in Section 2.3, EPA used 2015 to 2024 DMR, 2015 to 2024 TRI, and 2014, 2017, and 2020 NEI to estimate environmental releases during the processing of 1,2-dichloroethane as a reactant, as presented in Table 3-6. The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively. According to reported data, 1,2-dichloroethane is released through the following environmental media: surface water, fugitive air, and stack air. Annual release estimates were reported directly by facilities in TRI, DMR, and NEI. Annual fugitive and stack air release data was provided by TRI and NEI, surface water discharge release data was provided by TRI and DMR, and land release data was provided by TRI.

Table 3-6. Summary of Environmental Releases During the Processing of 1,2-Dichloroethane as a Reactant

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	0.26	227	350	7.4E−04	0.65	38	2015–2024 TRI/ DMR
Fugitive air	37	3,012		0.10	1.1	11	2015–2024 TRI
Stack air	5.4	445		1.6E−02	1.3	10	2015–2024 TRI
Fugitive air	63	4,216		0.18	12	17	2014, 2017, and 2020 NEI[a]
Stack air	14	1,622		3.9E−02	4.6	14	2014, 2017, and 2020 NEI[a]
Land	6.8	621		1.9E−02	1.8	4	2015–2024 TRI

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; TRI = Toxics Release Inventory
[a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

3.4 Processing into Formulation, Mixture, or Reaction Product

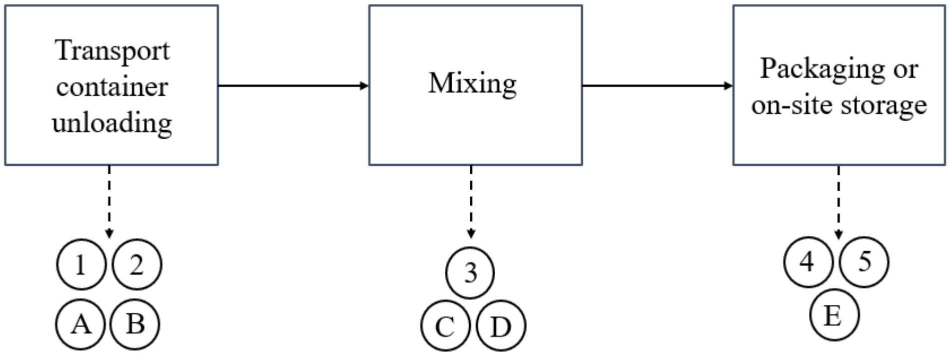
CDR data indicates that incorporating 1,2-dichloroethane into a formulation, mixture, or reaction product is an occupational exposure scenario that is performed in the United States (U.S. EPA, 2020a, 2016). This COU also includes activities identified by the U.S. Department of Energy (DOE) (DOE, 2025). As listed in Table 1-1, this OES includes the COU category Processing – Incorporated into formulation, mixture, or reaction product that includes the following COU subcategories: (1) Fuels and fuel additives: All other petroleum and coal products manufacturing; (2) Processing aids: Specific to petroleum production; and (3) Adhesives and sealants; Lubricants and greases; Oxidizing/reducing agents; Degreasing and cleaning solvents; Pesticide, fertilizer, and other agricultural chemical manufacturing. EPA combined these COUs into one OES due to similarities in expected exposure scenarios.

3.4.1 Process Description

Incorporation into a formulation, mixture or reaction product refers to the process of mixing or blending of several raw materials to obtain a product or mixture.

EPA did not identify chemical-specific process information. However, based on the OECD Emission Scenario Document on Adhesive Formulation, As described in the OECD ESD, EPA expects 1,2-dichloroethane to arrive as a neat liquid in tank trucks, rail cars, totes, or drums (OECD, 2009a) and unloaded from transport containers directly into mixing equipment or intermediate storage tanks (OECD, 2009a). Formulation processes specific to 1,2-dichloroethane were not identified; however, lubricant formulation typically involves the blending of two or more components, including liquid and solid additives, together in a blending vessel (OECD, 2004). The final formulation may be packaged and shipped to the end user, or transferred to on-site storage (OECD, 2009a).

Figure 3-3 below highlights the typical release and exposure points during the incorporation of 1,2-dichloroethane into a formulation, mixture, or reaction product.



Environmental Releases:

1. Releases to air from transferring volatile chemicals from transport containers.
2. Releases to air, water, incineration, or land from cleaning of transport containers.
3. Fugitive losses of volatile chemicals to air during mixing operations.
4. Releases to water, air, incineration, or landfill during equipment cleaning.
5. Transfer operation losses of volatile chemicals to air from loading formulation into transport or storage containers.

Figure 3-3. Typical Release Points During the Incorporation of 1,2-Dichloroethane into Formulation, Mixture, or Reaction Product

3.4.2 Number of Facilities and Release Days

In the 2020 CDR, two sites reported use of 1,2-dichloroethane in petrochemical manufacturing and pesticide, fertilizer, and other agricultural chemical manufacturing with a total non-CBI production volume of approximately 6.2 billion lbs (2.8 billion kg) (U.S. EPA, 2020a). Using TRI, DMR, and NEI, EPA identified 22 additional facilities that potentially process 1,2-dichloroethane by incorporation into formulation, mixture or reaction product, for a total of 24 sites. Procedures for mapping facilities to OES are described in Appendix A.

The volume of 1,2-dichloroethane used for adhesives and sealants is unknown; therefore, facility throughputs are also unknown.

See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to processing into formulation, mixture, or reaction product that reported to CDR, TRI, DMR, and/or NEI.

EPA did not identify data on facility operating schedules; therefore, as this is the processing of a large-PV commodity chemical, EPA assumes 350 days/year of operation, as discussed in Section 2.3.2.

3.4.3 Release Assessment

3.4.3.1 Environmental Release Points

As presented in Figure 3-3, EPA expects releases to occur to water, incineration, or landfill due to container residue in transport containers, product sample wastes, and equipment cleaning. Due to the chemical's volatility, the Agency also expects losses to air during container and equipment cleaning, transfer operations such as loading and unloading, product sampling, and mixing operations.

3.4.3.2 Environmental Release Assessment Results

As described in Section 2.3, EPA used 2015 to 2024 TRI and DMR and 2014, 2017, and 2020 NEI data to estimate environmental releases during the processing into formulation, mixture, or reactant product of 1,2-dichloroethane, as presented in Table 3-7. The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively. According to reported data, 1,2-dichloroethane is released through the following environmental media: surface water, fugitive air, stack air, and land disposal. Annual release estimates were reported directly by facilities in TRI, DMR, and NEI. Annual fugitive and stack air release data was provided by TRI and NEI, surface water discharge release data was provided by TRI and DMR, and land release data was provided by TRI. Note that the number of facilities listed in Table 3-7 are not unique because a single facility may report releases to multiple media.

Table 3-7. Summary of Environmental Releases During the Processing into Formulation, Mixture, or Reactant Product of 1,2-Dichloroethane

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	0.50	18	300	1.7E−03	6.1E−02	40	2015–2024 TRI/DMR
Fugitive air	72	3,012		0.24	10	11	2015–2024 TRI
Stack air	31	2,167		0.10	4.4	9	2015–2024 TRI
Fugitive air	113	438		0.38	1.5	10	2014, 2017, and 2020 NEI[a]
Stack air	8.6	1,595		2.9E−02	5.3	9	2014, 2017, and 2020 NEI[a]
Land	227	1.3E04		0.76	42	3	2015–2024 TRI

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; TRI = Toxics Release Inventory
[a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

3.5 Distribution in Commerce

As listed in Table 1-1, this OES includes the following COU: Distribution in commerce.

3.5.1 Process Description

EPA expects that 1,2-dichloroethane and 1,2-dichloroethane-containing products are distributed throughout commerce from manufacturing sites to repackaging sites. Repackaging sites are expected to distribute 1,2-dichloroethane and 1,2-dichloroethane-containing products for laboratory use or other downstream uses. Based on the information from the other COUs, 1,2-dichloroethane may be transported in pure liquid form and in various liquid formulations with a range of potential 1,2-dichloroethane concentrations.

Distribution of 1,2-dichloroethane in commerce may include loading and unloading activities that occur during other life cycle stages (*e.g.,* Manufacturing, Processing, Repackaging, Laboratory use, Disposal), transit activities that involve the movement of the chemical (*e.g.,* via motor vehicles, railcars, water vessels), and temporary storage and warehousing of the chemical during distribution (excluding repackaging and other processing activities, which are included in other COUs). Therefore, EPA assessed the distribution in commerce activities resulting in releases and exposures (*e.g.,* loading, unloading) throughout the various life cycle stages and COUs rather than a single distribution scenario. EPA considers activities conducted by third-party distributors that operate outside of the various life cycle stages to be part of Distribution in commerce; however, any transfer to smaller containers is assessed under the Repackaging OES.

Figure 3-4 shows an illustration of the distribution in commerce. The illustration shows red shading indicating loading and unloading activities related to distribution in commerce included in the assessment of the COUs within other life cycle stages. The red arrows indicate transport activities of distribution in commerce, which include the transit via motor vehicles, railcars, water vessels, as examples, and any temporary storage or warehousing, relabeling, and redistribution. The transport activities are what connect the life cycle stages (manufacture, processing, use, and disposal) together.

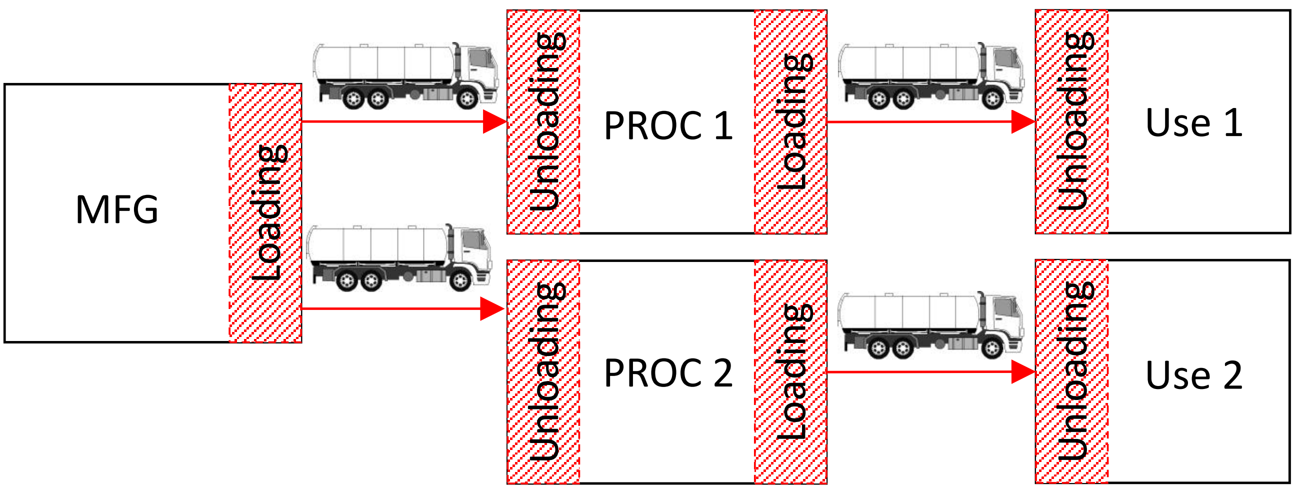


Figure 3-4. Illustration of Distribution in Commerce and its Relation to Other Life Cycle Stages

EPA did not identify data on the total volume of 1,2-dichloroethane distributed in commerce or volumes typically transported by a transportation company over any time. As discussed above, because the Agency is not separately assessing releases and exposures in a single Distribution in commerce scenario, EPA did not estimate 1,2-dichloroethane volumes or operating days for this COU.

Also in this section, EPA includes reported accidental spills and releases because these are releases that may occur during the distribution in commerce. However, these releases are not predictable or regular occurrences so information such as estimated release range, release days, and number of facilities are indeterminable.

Table 3-8 outlines how EPA expects each OES to receive the chemical and how it will be distributed for further processing or use.

Table 3-8. Receipt and Distribution in Commerce of 1,2-Dichloroethane Per OES

OES	How the OES Receives the Chemical	How the OES Distributes the Chemical
Manufacturing	Not applicable	Bulk transport from chemical manufacturing facilities via railcars, bulk marine vessels, and barges to chemical manufacturing and processing facilities.
Repackaging	Bulk transport from chemical manufacturing facilities	Transport to industrial or commercial uses
Processing as a Reactant	Bulk transport from chemical manufacturing facilities	Not applicable. 1,2-dichloroethane is reacted away and not part of products distributed from these sites.
Processing into Formulation, Mixture, or Reaction Product	Bulk transport from chemical manufacturing facilities	Transport to industrial or commercial uses
Industrial Application of Adhesives and Sealants	Transport from processing facilities	Not applicable. No further distribution expected after use.
Industrial Application of Lubricants and Greases	Transport from processing facilities	Not applicable. No further distribution expected after use.
Industrial and Commercial Non-Aerosol Cleaning and Degreasing	Transport from processing facilities	Not applicable. No further distribution expected after use.
Industrial and Commercial Aerosol Products	Transport from processing facilities	Not applicable. No further distribution expected after use.
Commercial Laboratory Use	Transport from processing facilities	Not applicable. No further distribution expected after use.
Waste Handling, Treatment, and Disposal	Transport from processing or use facilities	Not applicable.
OES = occupational exposure scenario		

3.5.2 Number of Facilities and Release Days

Distribution in commerce involves transportation of 1,2-dichloroethane between facilities that manage 1,2-dichloroethane at the various life cycle stages. Other OESs address the facility information relevant to handling 1,2-dichloroethane in each of these life cycle stages. EPA did not quantify the number of transportation/warehousing companies or facilities, volume of 1,2-dichloroethane transported, or number of transport vehicles. The amount of 1,2-dichloroethane distributed in commerce will scale with the demand for 1,2-dichloroethane and 1,2-dichloroethane-containing products.

3.5.3 Release Assessment

3.5.3.1 Environmental Release Points

During transportation, releases may occur from accidental releases of the compound during spill events. This section provides further information on these release sources. Additional information associated with accidental spill cleanup can be found in the following sources.[3,4]

[3] 40 CFR 300.415 Hazardous Substance Response; eCFR: 40 CFR 300.415 – Removal action (accessed October 20, 2025)
[4] Traffic Incident Management in Hazardous Materials Spills in Incident Clearance. Chapter 4.0 Hazard Materials Incident Clearance Compliance Requirements; https://ops.fhwa.dot.gov/publications/fhwahop08058/40.htm (accessed October 20, 2025)

3.5.3.2 Environmental Release Assessment

When evaluating releases related to distribution in commerce of 1,2-dichloroethane, EPA considered two sources including TRI data and NRC data. EPA examined data corresponding to the 2015 to 2020 calendar years for both data sources.

When evaluating the TRI data, EPA found that storage would not meet an activity threshold under EPCRA section 313.[5] Therefore, if a wholesale or warehouse facility reports to TRI, it is likely because they have exceeded the manufacturing, processing, or other use thresholds, and they may be reporting releases from the storage of a chemical. In such a case, EPA maps that facility to another OES (such as Repackaging). If a wholesale or warehouse facility stores, relabels, or redistributes a chemical product without opening the containers or performing any processing or otherwise use activity, the facility likely is not required to report that chemical to TRI.

Because EPCRA does not apply to transit activities (transportation in tank trucks, railcars, etc.), wholesale and warehouse operations are not likely to submit Form Rs under TRI, and wholesale and warehouse operations are less likely to have federally permitted releases subject to reporting (*e.g.,* NPDES permits, Clean Air Act permits). National Response Center (NRC) data of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-reportable accidental releases is a source of data to quantify environmental releases during transport activities.

Section 103 of CERCLA requires the person in charge of a vessel or an onshore or offshore facility immediately notify the NRC when a CERCLA hazardous substance is released at or above the reportable quantity (RQ)[6] in any 24-hour period, unless the release is federally permitted.[7] The NRC is an emergency call center maintained and operated by the U.S. Coast Guard that fields initial reports for pollution and railroad incidents. Information reported to the NRC is available on the NRC website.[8]

EPA downloaded NRC data for the 2015 to 2020 calendar years and reviewed it for reports pertaining to distribution of 1,2-dichloroethane. Upon review, the Agency found that one of the reported releases of 1,2-dichloroethane appeared to occur during distribution of the chemical. In 2015, a spill of 200 lb (91 kg) of 1,2-dichloroethane occurred from a vacuum truck at the Westlake Facility in Louisiana.

EPA downloaded DOT data from the Hazmat Incident Report Search Tool for the 2015 to 2021 calendar year and reviewed it for reports related to distribution of 1,2-dichloroethane. Upon review, the Agency found six reported releases of 1,2-dichloroethane that appeared to occur during distribution of the chemical. Note that loading and unloading activities are covered in other COUs and incident reports during those activities are not included in the below totals. Information on these incidents is summarized in Table 3-9, noting the amount is the estimate from initial reports. Since these releases are not predictable or regular occurrences, the information such as estimated release range, release days, and number of facilities are indeterminable. As a result, further analysis was not performed on these incidental releases occuring due to distribution of 1,2-dichloroethane in commerce.

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[5] *Question # 134*; TRI Program GuideMe Questions and Answers; EPA; https://ordspub.epa.gov/ords/guideme_ext/f?p=guideme:qa::::qa:19-134 (accessed August 11, 2025).
[6] The RQ for 1,2-dichloroethane is 100 lb. 40 CFR 302.4.
[7] CERCLA 103 – Release Notification; EPA; https://www.epa.gov/epcra/cercla-section-103-release-notification (accessed August 11, 2025).
[8] U.S. Coast Guard National Response Center; https://nrc.uscg.mil/ (accessed August 11, 2025).

Table 3-9. Releases of 1,2-Dichloroethane Reported to DOT Between 2015–2020 Using the Hazmat Incident Report Search Tool

Year of Incident	Amount Released (kg[a])	Type of Incident	State
2019	4.7	Highway	IL
2019	4.7	Highway	TX
2019	0.30	Highway	LA
2019	4.7	Highway	TX
2015	3.1	Air	TN
2018	0.15	Highway	CA

DOT = Department of Transportation
[a] Amount released is reported in gallons in the Hazmat Incident Report Search Tool. The reported values were converted to kg for better alignment with other reported releases in this TSD and evaluation. The density of 1.24529 g/mL was used for this conversion.

3.6 Industrial Application of Adhesives and Sealants

EPA has identified that some industrial adhesives and sealants contain 1,2-dichloroethane (EPA-HQ-OPPT-2018-0427-0018). The Aerospace Industries Association reported that a potential use for 1,2-dichloroethane includes heat resistant adhesives for primary and secondary structural and external metallic airframe parts (EPA-HQ-OPPT-2018-0427-0005). Through this process, 1,2-dichloroethane is found in industrial adhesives in amounts less than 0.1% (EPA-HQ-OPPT-2018-0427-0018). EPA also identified a SDS from Shinko for their Acryldine B product, which is used as an adhesive for plastics, that contains 1,2-dichloroethane (reported by the SDS at 91.8%; note that this SDS introduces uncertainty regarding the prior presumption that 1,2-dichloroethane is found in industrial adhesives in amounts <0.1%) (Shinko Plastics Co, 2010). 1,2-Dichloroethane may also be used in waterproofing membranes, water soluble polymers that support adhesion used in extrusion coating laminating and printing (EPA-HQ-OPPT-2018-0427-0030). Lycus Ltd in El Dorado, Arkansas, processes 1,2-dichloroethane as a solvent in the manufacturing of three chemicals and their derivatives: substituted benzophenones, anth[r]anilamide, and *o*-anisoyl chloride. These chemicals are marketed for use in protecting plastics and coatings from UV (ultraviolet light) degradation (Earthjustice, 2019). According to the Emission Scenario Document on the Use of Adhesives, organic solvent adhesive components may range from 60 to 75% (OECD, 2015).

As listed in Table 1-1, this OES includes the following COU: Adhesives and sealants.

3.6.1 Process Description

EPA did not identify 1,2-dichloroethane-specific information about the application of adhesives and sealants; however, it is assumed the following general description applies.

Both batch processing and dedicated-line facilities employ basically the same process flow. Incoming coating formulation raw materials are blended in mix tanks or drums with high- or variable-speed dispersers. The dedicated-line facilities typically formulate a coating from resins (*e.g.,* natural, or synthetic rubbers), solvents, and additives. Batch processors often mix purchased blends with performance enhancing additives or use and apply coatings premixed by a supplier. Only a small percentage of the coatings used by a batch processor is mixed from scratch. After the coatings have been mixed, they are pumped via a manifold system to the appropriate coating application system. Both industry segments use the same types of application equipment, including direct and reverse roll coaters and gravure cylinders. While a dedicated-line facility may have a cylinder library consisting of 10 gravure cylinders (one for each coating thickness), the batch processor might have a library consisting of several hundred gravure cylinders, each one dedicated to a certain coating thickness for a specific customer. Similarly, a dedicated-line facility limits itself to a single type of substrate (*e.g.,* film) with varying thicknesses, weights, and/or widths. A batch processor uses a variety of substrates, often including films, papers, foils, and foams. The substrate webs are loaded onto an unwinder. The substrate is guided by idling rolls to a coating application station where the appropriate coating is applied. Once the coating has been applied, it enters an oven (typically zoned) for drying. The dried substrate is then ready for the second coating, laminating, or winding. Following its final rewind, the coated, and possibly laminated, web is slit according to customer specifications (if necessary), packaged, and shipped (Nunez et al., 1995).

3.6.2 Number of Facilities and Release Days

No facilities using 1,2-dichloroethane in adhesives or sealants were identified in the 2016 CDR (U.S. EPA, 2016). EPA identified 83 facilities in the 2017 and 2020 NEI that potentially use 1,2-dichloroethane during the application of adhesives and sealants. No facilities were found in TRI or CDR. To expand upon the air release data available from NEI, EPA also modeled releases to evaluate potential releases from other media such as water, landfill and incineration from the application of adhesives and sealants. Releases to water were not expected, as hazardous waste is generally managed via incineration, surface impoundments, underground injection, or disposal in designated hazardous waste landfills under Subtitle C of RCRA (40 CFR Parts 264 and 265). See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to application of adhesives and sealants that reported to CDR, TRI, DMR, and/or NEI.

The volume of 1,2-dichloroethane used for adhesives and sealants is unknown; therefore, facility throughputs are also unknown. Because EPA did not identify data on facility operating schedules, the Agency used the April 2015 ESD on Use of Adhesives that recommended assuming 260 days/year for the default case (Motor and Non-Motor Vehicle, Vehicle Parts, and Tire Manufacturing (Except Retreading) (OECD, 2015). In the Monte Carlo modeling of releases for this OES, EPA varied the number of operating days as described in Appendix A.5 and calculated the 50th percentile as 74 and the 95th percentile as 217.

3.6.3 Release Assessment

3.6.3.1 Environmental Release Points

Environmental releases may occur during the processes of unloading, material sampling, transport, container cleaning, air that is vented or captured during the spray operation, and during the cleaning and disposal of equipment.

3.6.3.2 Environmental Release Assessment Results

EPA used 2014, 2017, and 2020 NEI to estimate environmental releases during the use of 1,2-dichloroethane in the industrial application of adhesives and sealants. The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively. According to reported data, 1,2-dichloroethane is released through air.

Because the NEI data only provided releases to air, EPA also chose to model releases for application of adhesives and sealants to obtain estimates for releases to landfill/incineration. The Agency modeled releases for this OES using the models and approaches described in the ESD on Use of Adhesives

(OECD, 2015). EPA used the following approach to obtain high-end and central tendency release estimates:

1. Identify release sources and media of release for the OES.
2. Identify model input parameters from relevant literature sources, GSs, or ESDs. Model input parameters include the estimated number of sites, container size, mass fractions, and 1,2-dichloroethane's physical properties. If a range of input values is available for an input parameter, determine the associated distribution of input values.
3. Identify model equations based on standard models from relevant GSs or ESDs.
4. Conduct a Monte Carlo simulation to calculate the total 1,2-dichloroethane release (by environmental media) across all release sources during each iteration of the simulation.
5. Select the 50th and 95th percentile values to estimate the central tendency and high-end releases, respectively.

EPA performed a Monte Carlo simulation to estimate variability in the model input parameters. The simulation used the Latin hypercube sampling method in @Risk Industrial Edition, Version 7.0.0, which generates a sample of possible values. The Agency performed the model at 100,000 iterations to capture a broad range of possible values. EPA selected the 50th and 95th percentile to estimate releases. See Appendix A.5 for more detailed information.

Table 3-10 summarizes the estimated release results for 1,2-dichloroethane use in adhesives and sealants based on both NEI data and from modeling. The modeled releases do not account for release reductions that may result from the use of on-site controls. The high-end releases are the 95th percentile of the respective simulation output and the central tendencies are the 50th percentile. Differences between facility reported release data and modeled release estimates can be attributed to the modeled release estimates not accounting for release controls and also uncertainty in the facility throughput parameter (kg/site-yr) in the release modeling.

Table 3-10. Summary of Environmental Releases in the Industrial Application of Adhesives and Sealants Use of 1,2-Dichloroethane

Environmental Media	Estimated Annual Release Range (kg-site/yr)		Number of Release Days	Estimated Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Fugitive air	1.8	261	260	6.9E−03	1.0	39	2014, 2017, and 2020 NEI[b]
Stack air	4.6	274		1.8E−02	1.1	69	2014, 2017, and 2020 NEI[b]
Fugitive or stack air	4,400	4,400	74 to 217	59	162	Generic site	Monte Carlo Modeling
Hazardous[a] landfill or incineration	155	174		2.1	5.8	Generic site	Monte Carlo Modeling

NEI = National Emissions Inventory; OES = occupational exposure scenario; RCRA = Resource Conservation and Recovery Act
[a] 1,2-Dichloroethane is classified as hazardous by RCRA and so it is assumed that hazardous wastes are likely sent to hazardous landfill or incineration.
[b] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

3.7 Industrial Application of Lubricants and Greases

EPA identified a safety data sheet for a low friction coating, also known as a solid film lubricant, containing 5 to 10% 1,2-dichloroethane (Everlube Products, 2019). According to the associated product technical data sheet, this product is a spray-applied, thermally-cured lubricant used to prevent metal to metal contact when used in the presence of conventional lubricants such as fuels, oils, greases, or other fluid environments (Everlube Products, 2003). According to comments from the Aerospace Industries Association (AIA), 1,2-dichloroethane is also used in low friction and anti-knock coatings for the aerospace industry (EPA-HQ-OPPT-2018-0427-0005). As listed in Table 1-1, this OES includes the following COU: Solid film lubricants and greases.

3.7.1 Process Description

EPA did not find specific container information for 1,2-dichloroethane used as a lubricant or grease; however, the Agency expects 1,2-dichloroethane to potentially arrive as a neat liquid in drums or smaller containers received from the formulator. 1,2-Dichloroethane is applied on substrate as lubricants and greases (either spray or manually applied) and subsequently disposed.

3.7.2 Number of Facilities and Release Days

No facilities using 1,2-dichloroethane as a lubricant or grease were identified in the 2016 CDR. (U.S. EPA, 2016). Using TRI, DMR, and NEI, EPA identified four sites that potentially use 1,2-dichloroethane during the application of lubricants and greases. Procedures for mapping facilities to OES are described in Appendix A. See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to application of lubricants and greases that reported to CDR, TRI, DMR, and/or NEI.

The volume of 1,2-dichloroethane used for lubricants and greases is unknown; therefore, facility throughputs are also unknown. The Agency did not identify data on facility operating schedules; therefore, EPA assumed 250 days/year of operation as discussed in Section 2.3.2.

3.7.3 Release Assessment

3.7.3.1 Environmental Release Points

Environmental releases may occur during the processes of unloading, material sampling, transport, container cleaning, air that is vented or captured during the spray operation, and during the equipment cleaning and waste disposal.

3.7.3.2 Environmental Release Assessment Results

EPA used 2014, 2017, and 2020 NEI to estimate environmental releases during the use of 1,2-dichloroethane in lubricants and greases, as presented in Table 3-11. The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively. According to reported data, 1,2-dichloroethane is released through the following environmental media: fugitive air and stack air.

Table 3-11. Summary of Environmental Releases in the Industrial Application of Lubricants and Greases Use of 1,2-Dichloroethane

Environmental Media	Estimated Annual Release Range (kg-site/yr)		Number of Release Days	Estimated Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Fugitive air	7.3E−02	82	250	2.9E−04	0.33	2	2014, 2017, and 2020 NEI[a]
Stack air	8.8E−03			3.5E−05		1	2014, 2017, and 2020 NEI[a]

NEI = National Emissions Inventory; OES = occupational exposure scenario
[a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

The results in this section summarize the air releases found in NEI. However, application of lubricants and greases may occur using an aerosol spray. Releases assessed in Section 3.9.3 are also relevant, as it estimates releases of 1,2-dichloroethane during the use of aerosol product using modeling. EPA endeavors to use specific information in the assessment of each OES; however, due to the low number of sites mapped to this use and the similarities between application of lubricants and greases and aerosol products, the model result presented in Section 3.9.3 may also be an applicable estimate of releases from the use of lubricants and greases.

3.8 Industrial and Commercial Non-Aerosol Cleaning/Degreasing

1,2-Dichloroethane is used as a component of cleaning and degreasing solvents in the aerospace industry (EPA-HQ-OPPT-2018-0427-0005). EPA also identified an SDS for 1,2-dichloroethane (99–100%) that identified use as a process cleaner (Occidental Chemical Corp, 2015). As listed in Table 1-1, these OESs include the COU subcategory, A component of degreasing and cleaning solvents.

3.8.1 Process Description

EPA could not determine the primary method industry may use when using 1,2-dichloroethane as a cleaning/degreasing product. The Agency's practice when a COU is broad and data is limited to refine the COU into a more specific OES, is to use a modeling approach that is applicable for the COU and conservatively assess exposures and release as the OES. Based on this practice, EPA selected Vapor Degreasing as the OES for this COU. Vapor degreasing is a popular cleaning method in the electronic and metal processing industries because it is effective in removing organics such as oils, greases, lubricants, coolants, and resins from crevices and hard to clean parts. It can be a critical cleaning step at some facilities, or it can be performed on an occasional, as-needed basis in others (OECD, 2017).

A typical vapor degreaser is a sump containing a heater that boils the solvent to generate vapors. The height of these pure vapors is controlled by condenser coils and/or a water jacket encircling the device. Solvent and moisture condensed on the coils are directed to a water separator, where the heavier solvent is drawn off the bottom and is returned to the vapor degreaser. A "freeboard" extends above the top of the vapor zone to minimize vapor escape. Parts to be cleaned are immersed in the vapor zone, and condensation continues until they are heated to the vapor temperature. Residual liquid solvent on the parts rapidly evaporates as they are slowly removed from the vapor zone (U.S. EPA, 1981).

EPA did not find specific container information for 1,2-dichloroethane used as a solvent for cleaning and degreasing; however, the Agency expects 1,2-dichloroethane to arrive as a neat liquid in drums or smaller containers received from the formulator. 1,2-Dichloroethane is used in solvents for cleaning and degreasing and then disposed of.

3.8.2 Number of Facilities and Release Days

No facilities using 1,2-dichloroethane in non-aerosol cleaning/degreasing were identified in the 2016 or 2020 CDR (U.S. EPA, 2020a, 2019a). Using TRI, DMR, and NEI, EPA identified 25 sites that potentially use 1,2-dichloroethane for cleaning/degreasing. This identification was based on facility-specific information provided in these data sources, such as TRI use and sub-use codes, NAICS codes, and source classification codes. Due to the difficulty of determining the exact activities that occur at each site and the method of use (aerosol vs non-aerosol), EPA assumes that the 25 sites may potentially use non-aerosol cleaning/degreasing. As additional evidence for this OES, EPA also modeled releases for non-aerosol cleaning and degreasing given that there can be limited metadata in these data. The Agency used NAICS codes and Monte Carlo modeling in estimating the number of facilities. See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to commercial non-aerosol cleaning and degreasing that reported to CDR, TRI, DMR, and/or NEI.

EPA estimated the total production volume of 1,2-dichloroethane used for cleaning and degreasing using the CDR reporting thresholds. Sites are required to report a use if it exceeds either 25,000 lb (11,340 kg) or 5% of the site's reported production volume—whichever value is smaller. Based on this approach, the total production volume for this OES was estimated at 182,640 kg/yr, assuming that 5% of the production volume reported by each unique site in CDR is used for cleaning and degreasing (U.S. EPA, 2020a). The ESD on the Use of Vapour Degreasers (OECD, 2021) provides a method for determining the number of sites based on the total annual production volume and annual throughput per site of the solvent, a method described in Appendix A.4.8. This results in an estimate of between 8 and 61 sites.

EPA did not identify data on facility operating schedules; therefore, as discussed in Section 2.3.2, the Agency assumed operation 5 days/week for 50 weeks/year, which is 250 days/year of operation, for database data. For modeling the operating days are determined based on the ESD on Use of Vapour Degreasers, which recommends the use of 296 days per year as the mode (OECD, 2017).

3.8.3 Release Assessment

3.8.3.1 Environmental Release Points

Environmental releases may occur due to losses to air due to transfer operations and unloading of transport containers, releases from container residue, from the vapor degreasing operations themselves, from equipment cleaning and waste solvent disposal, and any wastewater generated due to vapor degreasing.

3.8.3.2 Environmental Release Assessment Results

EPA used 2015 to 2024 DMR, 2015 to 2024 TRI, and 2014, 2017, and 2020 NEI to estimate environmental releases during the use of 1,2-dichloroethane in degreasing and cleaning solvents, as presented in Table 3-12. The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively. According to reported data, 1,2-dichloroethane is released through the following environmental media: surface water, fugitive air, and stack air.

Due to the limited data found on this use, EPA also estimated releases for this OES using the models and approaches described in the ESD on the Use of Vapour Degreasers (OECD, 2021). Non-aerosol cleaning and degreasing may occur due to different methods such as wipes or immersion, but the method of vapor degreasing would be the most conservative assumption, and so it is the scenario that EPA chose to model. The Agency used the following approach to obtain central tendency and high-end release estimates:

1. Identify release sources and media of release for the OES.
2. Identify model input parameters from relevant literature sources, GSs, or ESDs. Model input parameters include the estimated number of sites, container size, mass fractions, and 1,2-dichloroethane's physical properties. If a range of input values is available for an input parameter, determine the associated distribution of input values.
3. Identify model equations based on standard models from relevant GS or ESDs.
4. Conduct a Monte Carlo simulation to calculate the total 1,2-dichloroethane release (by environmental media) across all release sources during each iteration of the simulation.
5. Select the 50th and 95th percentile values to estimate the central tendency and high-end releases, respectively.

EPA performed a Monte Carlo simulation to estimate variability in the model input parameters. The simulation used the Latin hypercube sampling method in @Risk Industrial Edition, Version 7.0.0, which generates a sample of possible values. The Agency performed the model at 100,000 iterations to capture a broad range of possible values. EPA selected the 50th and 95th percentile to estimate releases. See Appendix A.1 for more detailed information.

Table 3-12 summarizes the estimated release results for 1,2-dichloroethane use in non-aerosol cleaning and degreasing for both facility-reported data and modeled releases. The high-end releases are the 95th percentile of the respective simulation output and the central tendencies are the 50th percentile. A key parameter in the modeling approach is the throughput in kg/site-yr of 1,2-dichloroethane at a facility for this OES. EPA has uncertainty in the value used for the modeling approach including whether it is unrealistically high. For the final risk evaluation, the Agency refined the release modeling for this OES to cap the throughput at the TRI reporting threshold of 10,000 lb for use based on assumption that TRI data would have been available for facilities at this throughput. The results of this refined release modeling are also presented in Table 3-12. In the case of This impacts the comparability of the modeled results with the reported release data. Differences between facility reported release data and modeled release estimates can be attributed to the modeled release estimates not accounting for release controls and also uncertainty in the facility throughput parameter (kg/site-yr) in the release modeling.

Table 3-12. Summary of Environmental Releases in the Industrial and Commercial Non-Aerosol Cleaning and Degreasing

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	0.43	13	250	1.7E−03	5.0E−02	4	2015–2024 TRI/ DMR
Fugitive air	4.1	1,738		1.6E−02	7.0	1	2015–2024 TRI
Stack air	11	995		4.5E−02	4.0	1	2015–2024 TRI
Fugitive air	2.2	42		8.9E−03	0.17	13	2014, 2017, and 2020 NEI[c]
Stack air	3.0	402		1.2E−02	1.6	15	2014, 2017, and 2020 NEI[c]

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Land	0.5	9	250	1.8E−03	3.8E−02	1	2015–2024 TRI
Fugitive or stack air	1.3E04	4.2E04		52	168	N/A	Environmental release modeling
Fugitive or stack air	2,800	4,100		9.3	14	N/A	Revised modeling based on TRI threshold
Wastewater treatment [a]	662	2,606		24	103	N/A	Environmental release modeling
Wastewater treatment	149	269		0.56	1.1	N/A	Revised modeling based on TRI threshold
Hazardous waste incineration [b]	7,152	3.1E04		24	103	N/A	Environmental release modeling
Hazardous waste incineration	1,425	3,429		4.8	12	N/A	Revised modeling based on TRI threshold
Hazardous waste landfill	64	255		0.24	0.86	N/A	Environmental release modeling
Hazardous waste landfill	14	23		0.11	0.28	N/A	Revised modeling based on TRI threshold

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; OES = occupational exposure scenario; TRI = Toxics Release Inventory

[a] Modeled releases to wastewater are further assessed by applying a removal efficiency to estimate the resulting surface water discharge. A value of 39.6% was used for WWT removal efficiency. See Section 3.6.2 of the *Chemistry and Fate and Transport Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026e) for more details on the efficiency used.

[b] Modeled releases to incineration are further assessed by applying a removal efficiency to estimate the resulting stack air release. A value of 99.99% was used. See Section 3.6.1 of the *Chemistry and Fate and Transport Assessment for 1,2-Dichloroethane* (U.S. EPA, 2026e) for more details on the efficiency used.

[c] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

3.9 Industrial and Commercial Aerosol Products

EPA has identified that 1,2-dichloroethane is used as a component of cleaning and degreasing solvents within the aerospace industry (EPA-HQ-OPPT-2018-0427-0005). Additionally, EPA identified a safety data sheet for 1,2-dichloroethane (99–100%) that identified use as a process cleaner (Occidental Chemical Corp, 2015), and another safety data sheet for 1,2-dichloroethane (90–100%) that identified use as a general solvent (Pharmco Products, 2013). As listed in Table 1-1, this OES includes the COU subcategory, A component of degreasing and cleaning solvents.

3.9.1 Process Description

Because EPA could not determine the primary method industry may use when using 1,2-dichloroethane as a cleaning/degreasing product, the Agency assumed that it may be used in aerosol cleaning/degreasing. Aerosol degreasing is a process that uses an aerosolized solvent spray, typically applied from a pressurized can, to remove residual contaminants for fabricated parts. A propellant is used to aerosolize the formulation, allowing it to be sprayed onto substrates. The aerosol droplets bead up on the fabricated part and then drip off, carrying away any contaminants and leaving behind a clean surface. Similarly, aerosol lubricant products use an aerosolized spray to help free frozen parts by dissolving rust and leave behind a residue to protect surfaces against rust and corrosion.

Figure 3-5 illustrates the typical process of using aerosol degreasing to clean components in commercial settings.

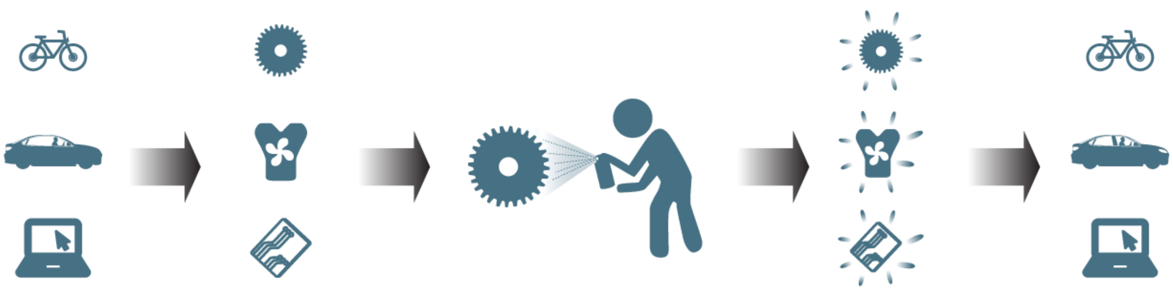


Figure 3-5. Overview of Aerosol Degreasing

Aerosol degreasing may occur at either industrial facilities or at commercial repair shops to remove contaminants on items being serviced. Appendix A.6 presents the modeling approach and model equations used in the Aerosol Degreasing Release Model. The release model uses data from CARB including number of jobs/site-yr, use rate/job and operating days/yr. The concentration of 1,2-dichloroethane in the aerosol degreasers ranges from 90 to 100%. The modeling estimates 1,2-dichloroethane use rates which are then combined with assumption of the sprayed 1,2-dichloroethane eventually released to fugitive air.

3.9.2 Number of Facilities and Release Days

No facilities using 1,2-dichloroethane as an aerosol product were identified in the 2016 CDR. (U.S. EPA, 2016). No facilities were identified from TRI, DMR, or NEI. However, EPA identified 25 sites using TRI, DMR, and NEI, that potentially use 1,2-dichloroethane during as general cleaner/degreaser. An additional four sites were mapped to application of lubricants and greases, with most data points being air releases from NEI. Due to the difficulty of determining the exact activities that occur at each site and the method of use (aerosol vs. non-aerosol), EPA assumed that all 29 sites could potentially use aerosols. Procedures for mapping facilities to OESs are described in detail in the *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l), including a list of all facilities mapped to use of aerosol product that reported to CDR, TRI, DMR, and/or NEI.

The volume of 1,2-dichloroethane used for aerosol products are unknown; therefore, facility throughputs are unknown. For the release model used to estimate releases for this OES, one representative generic site is assumed.

EPA did not identify data on facility operating schedules; therefore, the Agency assumed 250 days/year of operation as discussed in Section 2.3.2.

3.9.3 Release Assessment

3.9.3.1 Environmental Release Points

Environmental releases may occur due to losses to air due to transfer operations and unloading of transport containers, releases from container residue, from evaporation of the aerosol spray during application, evaporation after application, equipment cleaning and waste solvent disposal, and any air that is vented or captured during the spray operation.

3.9.3.2 Environmental Release Assessment Results

Because EPA had no release data to use for the assessment of environmental releases due to commercial aerosol products, the Agency estimated these releases using a Monte Carlo simulation with 100,000 iterations and the Latin Hypercube sampling method using the models and approaches described in Appendix A.6 for this OES. EPA applied a methodology based on assuming that spray application causes a large fraction of the aerosolized 1,2-dichloroethane-containing product to volatilize and be released as fugitive air emissions. EPA conservatively assumed 100% of the facility throughput released to air. EPA calculated the release amounts using the amount of 1,2-dichloroethane used per application, number of applications per job, and number of jobs per site-year. Table 3-13 summarizes the estimated release results for 1,2-dichloroethane use in commercial aerosol products. The high-ends are the 95th percentile of the respective simulation output and the central tendencies are the 50th percentile. Note that the central tendency and high-end daily releases appear equivalent in the table due to rounding.

Table 3-13. Summary of Environmental Releases of 1,2-Dichloroethane During Use of Commercial Aerosol Products

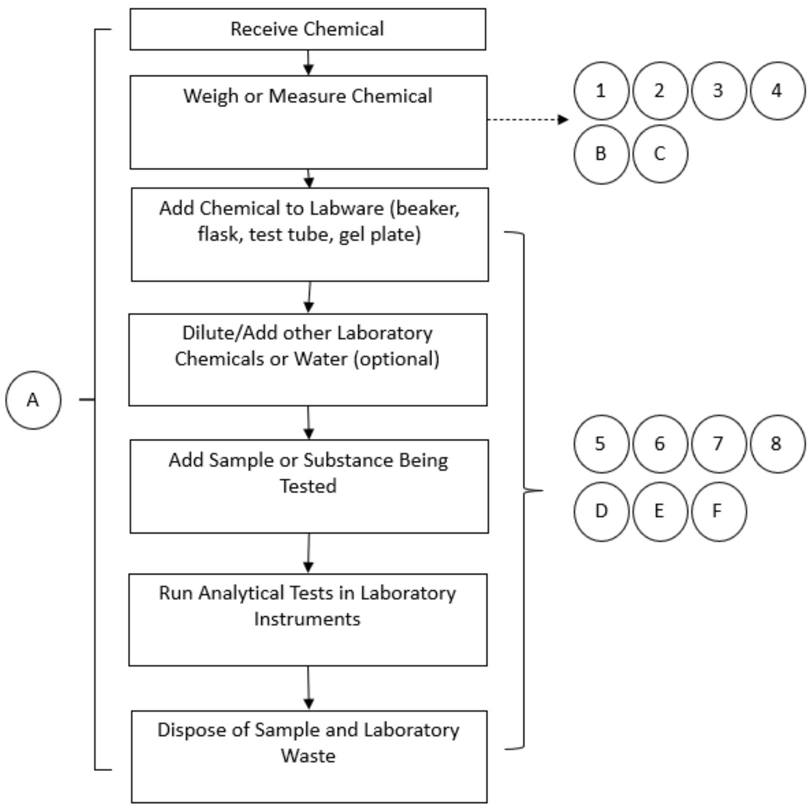
Environmental Media	Estimated Annual Release Range Across Sites (kg/yr)		Number of Release Days	Estimated Daily Release (kg/day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Fugitive air	379	382	250	1.5	1.5	29	Monte Carlo modeling

3.10 Commercial Laboratory Use

1,2-Dichloroethane is used as a laboratory reference standard for instrument calibration and sample preparation (EPA-HQ-OPPT-2018-0426-0026). EPA identified an SDS for 1,2-dichloroethane (>95% purity) that indicates recommended use as a laboratory chemical (Thermo Fisher, 2012). Additionally, the Agency identified multiple SDSs for solvent mixtures used for laboratory analysis that contained 1,2-dichloroethane (0.1–2.5% purity) (R Corporation, 2019; SPEX CertiPrep LLC, 2019; Phenova, 2018; Spex Certiprep LLC, 2018 6284287; Cerilliant, 2012). EPA also identified multiple SDSs for laboratory chemicals used to manufacture substances which contained 1,2-dichloroethane (≥90–100% purity) (Ladd Research, 2018; MilliporeSigma, 2016; Polysciences Inc, 2013). It was also reported to EPA that 1,2-dichloroethane is used as a fuel additive for the purposes of combustion research in NASA facilities (EPA-HQ-OPPT-2018-0427-0041) and as a lab reactant in biocide analysis of cooling water at nuclear facilities (EPA-HQ-OPPT-2018-0427-0070). As listed in Table 1-1, this OES includes the following COUs: Laboratory chemical (*e.g.,* reagent) and part of Fuels and related products.

3.10.1 Process Description

1,2-Dichloroethane may be received in transport containers ranging from 0.5 mL to 200 L (U.S. EPA, 2023b). After receiving the chemical, it is typically weighed or measured using a balance, then added to labware such as a beaker, flask, test tube, or glass plate. If necessary, 1,2-dichloroethane may be diluted with water or mixed with another laboratory chemical to form a solution. Analytical tests may be performed such as extraction, distillation, chromatography, titration, filtration, or spectroscopy Figure 3-6 below highlights typical release and exposure points during the use of laboratory chemicals.



Environmental Releases:

1. Release to air from transferring volatile chemicals from transport containers.
2. Release to air, water, incineration, or landfill from transferring solid powders.
3. Release to water, incineration, or land from cleaning or disposal of transport containers.
4. Release to air from cleaning containers used for volatile chemicals.
5. Labware equipment cleaning residuals released to water, incineration, or landfill.
6. Release to air during labware equipment cleaning for volatile chemicals.
7. Release to air from laboratory analyses for volatile chemicals.
8. Release to water, incineration, or landfill from laboratory waste disposal.

Figure 3-6. Typical Release Points During the Laboratory Use of 1,2-Dichloroethane (U.S. EPA, 2023b)

3.10.2 Number of Facilities and Release Days

No facilities using 1,2-dichloroethane in laboratories were identified in the 2020 CDR (U.S. EPA, 2020a). EPA identified 14 relevant facilities in DMR and NEI. See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to laboratory use that reported to CDR, TRI, DMR, and/or NEI.

EPA estimated the total production volume of 1,2-dichloroethane for laboratory use using the CDR reporting thresholds. Sites are required to report a use if it exceeds either 25,000 lb (11,340 kg) or 5% of the site's reported production volume, whichever value is smaller. Based on this approach, the total production volume for this OES was estimated at 182,640 kg/yr, assuming that 5% of the production volume reported by each unique site in CDR is used for laboratory use (U.S. EPA, 2020a).

EPA assumed between 174 and 260 (default) days of operation according to the Use of Laboratory Chemicals GS (U.S. EPA, 2023b).

3.10.3 Release Assessment

3.10.3.1 Environmental Release Points

EPA expects releases to occur during the use of 1,2-dichloroethane as a laboratory chemical. The Agency estimated releases using a Monte Carlo simulation with 100,000 iterations and the Latin Hypercube sampling method using the models and approaches described in Appendix A.3. Input parameters and release points for the models were determined using data from literature and the Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b). Specific release sources considered for estimating releases are shown numbered as 1 through 8 in Appendix A.3. Per the GS, EPA expects fugitive or stack air releases from unloading containers, cleaning containers, cleaning laboratory equipment, and performing laboratory analyses. Additionally, because 1,2-dichloroethane is considered hazardous, EPA also expects releases to incineration or landfill.

3.10.3.2 Environmental Release Assessment Results

EPA used 2015 to 2024 DMR, 2015 to 2024 TRI, and 2014, 2017, and 2020 NEI to estimate environmental releases during the use of 1,2-dichloroethane in commercial laboratories, as presented in Table 3-14. The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively. According to reported data, 1,2-dichloroethane is released through the following environmental media: surface water, fugitive air, and stack air.

EPA estimated releases using a Monte Carlo simulation with 100,000 iterations and the Latin Hypercube sampling method using the models and approaches described in Appendix A.3 for this OES. Input parameters for the models were determined using data from literature and the Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b). EPA estimated 1,2-dichloroethane by simulating a scenario of an annual production volume of 1,2-dichloroethane of 11,340 kg per year across all laboratories. The releases presented below are for one generic site. When comparing modeled releases to measured data, a key consideration should be that the modeled values are a product of generic parameter inputs. As such, they are designed to represent the inherent variability in the true distribution of releases. Therefore, when comparing modeled releases to limited measured data, the values may not show concordance.

Water releases are not considered in the model as it is assumed that in a laboratory setting wastewater would be captured and disposed of as hazardous waste, rather than releases to surface water. Appendix A.3 summarizes the estimated release results for 1,2-dichloroethane use in laboratory chemicals based on the scenario applied. The high-end releases are the 95th percentile of the respective simulation output and the central tendencies are the 50th percentile.

Table 3-14. Summary of Environmental Releases for the Commercial Use of 1,2-Dichloroethane as a Laboratory Chemical

Environmental Media	Estimated Annual Release Range (kg-site/yr)		Number of Release Days	Estimated Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface Water	1.1E−02	0.38	260	4.1E−05	1.4E−03	4	2015–2024 TRI/DMR
Fugitive air	1.3	10		5.2E−03	3.8E−02	6	2014, 2017, and 2020 NEI[b]
Stack air	126	233		0.48	0.90	2	2014, 2017, and 2020 NEI[b]
Fugitive or stack air	1.7	11	174 to 260	7.3E−03	4.5E−02	1	Monte Carlo Modeling
Hazardous Landfill or Incineration	15	812		6.5E−02	3.5	1	Monte Carlo Modeling

NEI = National Emissions Inventory; OES = occupational exposure scenario; TRI = Toxics Release Inventory
[a] The number of release days presented in this table is based on simulation outputs for the annual release divided by the daily release (grouped by high-end or central tendency estimate), rounded to the closest integer. Annual totals may not add exactly due to rounding.
[b] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

3.11 Waste Handling, Treatment, and Disposal

As listed in Table 1-1, this OES includes the following COU: Disposal.

3.11.1 Process Description

Each of the COUs of 1,2-dichloroethane may generate waste streams of the chemical that are collected and transported to third-party sites for disposal or treatment, and these activities are assessed under this COU. Industrial sites that treat or dispose onsite wastes generated by different processes in their facility are assessed within that relevant COU assessment. Similarly, point source discharges of 1,2-dichloroethane to surface water are assessed within that relevant condition of use in Sections 3.1 through 3.10.

EPA's practice for this COU is also to include releases from sites mapped to remediation. Remediation involves the containment and mitigation of contaminants following prior releases to the ground and subsequently the groundwater. Releases evaluated in this assessment are generated during the remediation processes (*e.g.,* through pump and treat) and are subsequently released into surface waters and ambient air. Some of these releases may be permitted under other statutes (*e.g.,* NPDES under the CWA). Remediation sites that release 1,2-dichloroethane to surface water and air were identified based on 2015 to 2020 DMR data and 2014 and 2017 NEI. Some of these sites were listed on the EPA RCRA Corrective Action (CA) sites list.[9]

[9] https://ordspub.epa.gov/ords/cimc/f?p=121:15:15956202467222 (accessed October 9, 2025).

Wastes of 1,2-dichloroethane that are generated during a COU and sent to a third-party site for treatment, disposal, or recycling may include the following:

- Wastewater: 1,2-dichloroethane may be contained in wastewater discharged to POTW or other, non-public treatment works for treatment. Industrial wastewater containing 1,2-dichloroethane discharged to a POTW may be subject to EPA or state authorized NPDES pretreatment programs. The assessment of wastewater discharges to POTWs and non-public treatment works of 1,2-dichloroethane is included in each of the COU assessments in Sections 3.1 through 3.10. Releases at POTW or non-POTW WWT sites may occur through volatilization during loading/unloading and wastewater treatment, fugitive leaks, or container cleaning.
- Solid Wastes: Solid wastes are defined under RCRA as any material that is discarded by being abandoned, inherently waste-like, a discarded military munition, or recycled in certain ways (certain instances of the generation and legitimate reclamation of secondary materials are exempted as solid wastes under RCRA). Solid wastes may subsequently meet RCRA's definition of hazardous waste by either being listed as a waste at 40 CFR 261.30 to 261.35 or by meeting waste-like characteristics as defined at 40 CFR 261.20 to 261.24. Solid wastes that are hazardous wastes are regulated under the more stringent requirements of Subtitle C of RCRA, whereas non-hazardous solid wastes are regulated under the less stringent requirements of Subtitle D of RCRA.
- 1,2-Dichloroethane is a "U-listed hazardous waste" under code U077 under RCRA; therefore, discarded, unused pure and commercial grades of 1,2-dichloroethane are regulated as a hazardous waste under RCRA (40 CFR 261.33(f)).
- Wastes Exempted as Solid Wastes Under RCRA: Certain COUs of 1,2-dichloroethane may generate wastes of 1,2-dichloroethane that are exempted as solid wastes under 40 CFR 261.4(a). For example, the generation and legitimate reclamation of hazardous secondary materials of 1,2-dichloroethane may be exempt as a solid waste.

2020 TRI data lists off-site transfers of 1,2-dichloroethane to land disposal, wastewater treatment, incineration, and recycling facilities. Over 95% of off-site transfers were sent to incineration, about 3% to recycling and energy recover, and less than 1% to wastewater treatment/landfills. (U.S. EPA, 2021b).

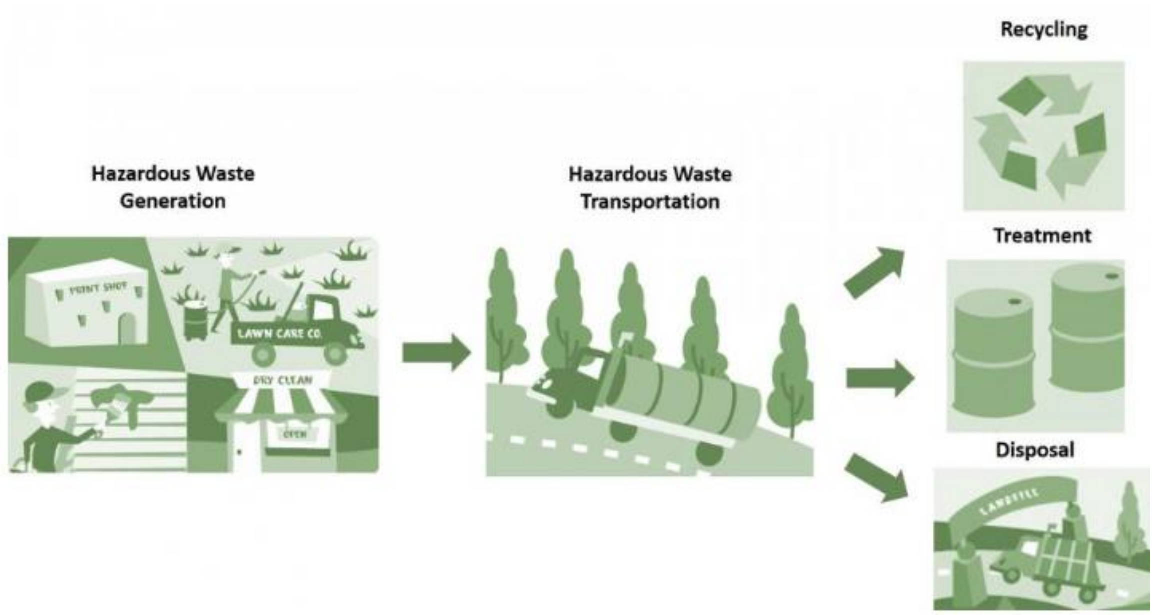


Figure 3-7. Typical Waste Disposal Process (U.S. EPA, 2019b)

Municipal Waste Incineration
Municipal waste combustors (MWCs) that recover energy are generally located at large facilities comprising an enclosed tipping floor and a deep waste storage pit. Typical large MWCs range in capacity from 250 to over 1,000 tons per day. At facilities of this scale, waste materials are not generally handled directly by workers. Trucks may dump the waste directly into the pit, or waste may be tipped to the floor and later pushed into the pit by a worker operating a front-end loader. A large grapple from an overhead crane is used to grab waste from the pit and drop it into a hopper, where hydraulic rams feed the material continuously into the combustion unit at a controlled rate. The crane operator also uses the grapple to mix the waste within the pit to both provide a fuel consistent in composition and heating value and to pick out hazardous or problematic waste.

Facilities burning refuse-derived fuel (RDF) conduct on-site sorting, shredding, and inspection of the waste prior to incineration to recover recyclables and remove hazardous waste or other unwanted materials. Sorting is usually an automated process that uses mechanical separation methods, such as trommel screens, disk screens, and magnetic separators. Once processed, the waste material may be transferred to a storage pit, or it may be conveyed directly to the hopper for combustion.

Tipping floor operations may generate dust. Air from the enclosed tipping floor, however, is continuously drawn into the combustion unit via one or more forced air fans to serve as the primary combustion air and minimize odors. Dust and lint present in the air is typically captured in filters or other cleaning devices to prevent the clogging of steam coils, which are used to heat the combustion air and help dry higher-moisture inputs (Kitto and Stultz, 1992). Incineration may result in releases of 1,2-dichloroethane to air or water through volatilization at loading and unloading points, or container cleaning. Overall, this is considered to be a low potential for incomplete combustion and EPA assessed a 99.99% destruction and removal efficiency (DRE) for incineration.

Hazardous Waste Incineration
Commercial scale hazardous waste incinerators are generally two-chamber units, a rotary kiln followed by an afterburner, that accept both solid and liquid waste. Liquid wastes pumped through pipes are fed to the unit through nozzles that atomize the liquid for optimal combustion. Solids may be fed to the kiln as loose solids gravity fed to a hopper, or in drums or containers using a conveyor (ETC, 2018; Heritage, 2018). Incoming hazardous waste is usually received by truck or rail, and an inspection is required for all waste received. Receiving areas for liquid waste generally comprise a docking area, pumphouse, and some kind of storage facilities. For solids, conveyor devices are typically used to transport incoming waste (ETC, 2018; Kitto and Stultz, 1992). Smaller scale units that burn municipal solid waste or hazardous waste (such as infectious and hazardous waste incinerators at hospitals) may require more direct handling of the materials by facility personnel. Units that are batch-loaded require the waste to be placed on the grate prior to operation and may involve manually dumping waste from a container or shoveling waste from a container onto the grate. Incineration may result in releases of 1,2-dichloroethane to air or water through volatilization at loading and unloading points, or container cleaning. Overall, this is considered to be a low potential for incomplete combustion and EPA assessed a 99.99% DRE for incineration.

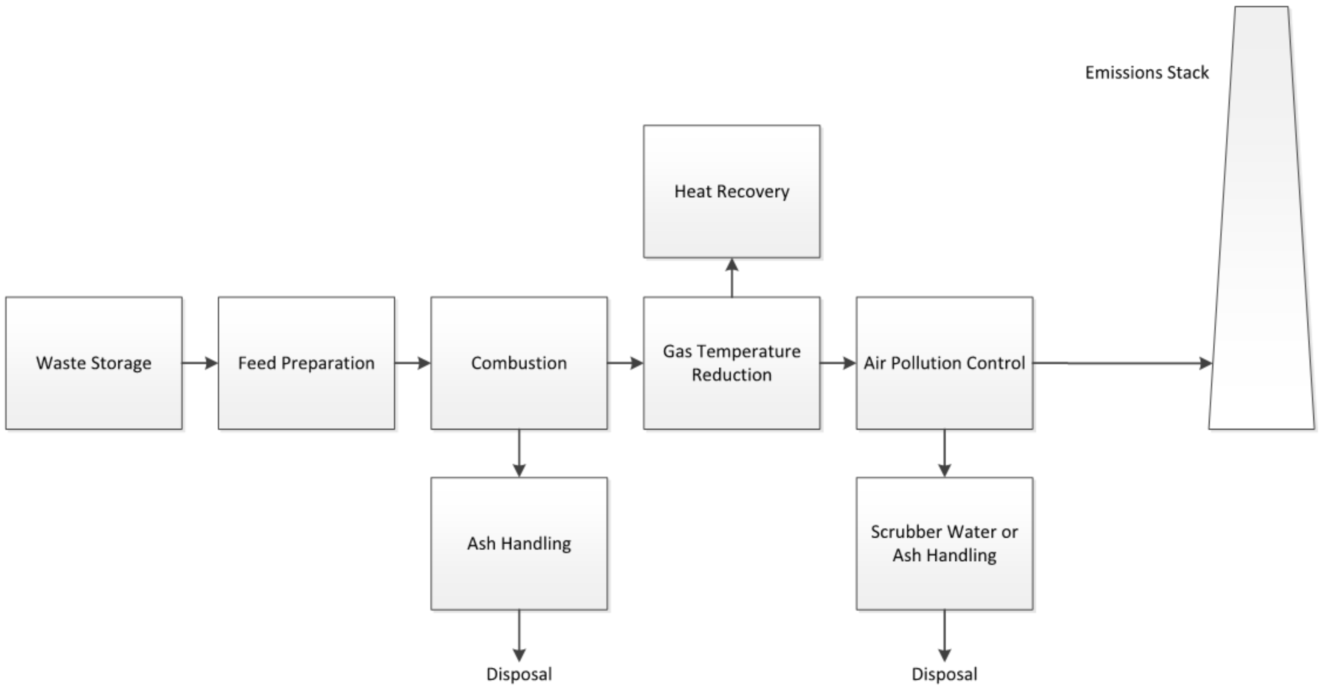


Figure 3-8. Typical Industrial Incineration Process

Municipal Waste Landfill

Municipal solid waste landfills are discrete areas of land or excavated sites that receive household wastes and other types of non-hazardous wastes (*e.g.,* industrial and commercial solid wastes). Standards and requirements for municipal waste landfills include location restrictions, composite liner requirements, leachate collection and removal system, operating practices, groundwater monitoring requirements, closure-and post-closure care requirements, corrective action provisions, and financial assurance. Non-hazardous solid wastes are regulated under RCRA Subtitle D, but states may impose more stringent requirements. Municipal solid wastes may be first unloaded at waste transfer stations for temporary storage, prior to being transported to the landfill or other treatment or disposal facilities. There are pathways for substances that are listed as hazardous wastes to be properly disposed of in non-hazardous waste landfills (non-subtitle C landfills) if certain criteria are met or if they are a part of certain exempt categories. Releases of 1,2-dichloroethane at landfill sites may occur through volatilization to air and leachate release to groundwater.

Hazardous Waste Landfill

Hazardous waste landfills are excavated or engineered sites specifically designed for the final disposal of non-liquid hazardous wastes. Design standards for these landfills require double liner, double leachate collection and removal systems, leak detection system, run on, runoff and wind dispersal controls, and construction quality assurance program (U.S. EPA, 2018). There are also requirements for closure and post-closure, such as the addition of a final cover over the landfill and continued monitoring and maintenance. These standards and requirements prevent potential contamination of groundwater and nearby surface water resources. Hazardous waste landfills are regulated under Part 264/265, Subpart N. Releases of 1,2-dichloroethane at landfill sites may occur through volatilization to air and leachate release to groundwater.

3.11.2 Number of Facilities and Release Days

Using release data, EPA identified the following number of facilities for different types of disposal methods under this OES:

- Incinerator: 86 facilities;
- Landfill: 694 facilities;
- Non-POTW WWT: 18 facilities;
- POTW: 176 facilities; and
- Remediation: 52 facilities.

See *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of all facilities mapped to waste handling, treatment, and disposal that reported to CDR, TRI, DMR, and/or NEI.

Due to the lack of data on the annual PV of 1,2-dichloroethane for waste handling, treatment, and disposal, EPA did not present annual or daily site throughputs. The Agency did not identify data on facility operating schedules; therefore, EPA assumed 250 days/year of operation as discussed in Section 2.3.2.

3.11.3 Release Assessment

3.11.3.1 Environmental Release Points

Sources of potential environmental release include the unloading of solid or liquid waste containers. Releases may occur while connecting and disconnecting of transfer lines and hoses, and during the treatment of waste. EPA expects releases to air of volatile 1,2-dichloroethane during waste handling, treatment, and disposal. EPA also expects releases of solid or liquid waste to land.

The Agency presents five subcategories for Waste handling, disposal, and treatment: Incinerator, landfill, WWT (non-POTW), POTW, and remediation, as these types of facilities were classified separately. As discussed in Section 3.11.1, wastewater releases are either sent to WWT or POTW, while remediation sites, such as pump-and-treat remediation sites, contain 1,2-dichloroethane from previous releases that have seeped into the ground and groundwater and where 1,2-dichloroethane is subsequently re-released into either air or water following remediation. For example, treated water is returned to environmental media at concentrations consistent with the site Record of Decision and applicable permit limits (*e.g.,* NPDES).

3.11.3.2 Environmental Release Assessment Results

EPA used 2015 to 2024 DMR, 2015 to 2024 TRI, and 2014, 2017, and 2020 NEI to estimate environmental releases during incineration (Table 3-15), landfill (Table 3-16), and non-POTW WWT (

Table 3-17). The 50th and 95th percentile values are calculated to estimate the central tendency and high-end releases, respectively.

For non-POTW, there is facility release data on releases of 1,2-dichloroethane to surface water, fugitive air, and stack air.

Table 3-15. Summary of Environmental Releases During Waste Handling, Treatment, and Disposal (Incinerator)

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	5.8E−03	116	250	2.3E−05	0.46	7	2015–2024 TRI/DMR
Fugitive air	1.2	310		4.7E−03	1.2	20	2015–2024 TRI
Stack air	0.48	263		1.9E−03	1.1	22	2015–2024 TRI
Fugitive air	0.49	97		2.0E−03	0.39	26	2014, 2017, and 2020 NEI[a]
Stack air	3.0E−02	39		1.2E−04	0.16	61	2014, 2017, and 2020 NEI[a]
Land	6.4	2.3E04		2.5E−02	91	9	2015–2024 TRI

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; OES = occupational exposure scenario; TRI = Toxics Release Inventory

[a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

Table 3-16. Summary of Environmental Releases During Waste Handling, Treatment, and Disposal (Landfill)

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	5.0E−02	11	250	2.0E−04	4.5E−02	8	2015−2024 TRI/DMR
Fugitive air	5.1	33		2.1E−02	0.13	665	2014, 2017, and 2020 NEI[a]
Stack air	0.41	22		1.6E−03	8.9E−02	145	2014, 2017, and 2020 NEI[a]

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; OES = occupational exposure scenario; TRI = Toxics Release Inventory

[a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

Table 3-17. Summary of Environmental Releases During Waste Handling, Treatment, and Disposal (Non-POTW WWT)

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	1.2	272	250	4.7E−03	1.1	8	2015−2024 TRI/DMR
Fugitive air	7.7	329		3.1E−02	1.3	12	2014, 2017, and 2020 NEI[a]
Stack air	1.1	186		4.4E−03	0.74	9	2014, 2017, and 2020 NEI[a]

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; OES = occupational exposure scenario; POTW = publicly owned treatment works; TRI = Toxics Release Inventory; WWT = wastewater treatment
[a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

EPA used 2015 to 2024 DMR and 2014, 2017, and 2020 NEI to estimate environmental releases during waste handling, treatment, and disposal (POTW), as presented in Table 3-18.

Table 3-18. Summary of Environmental Releases During Waste Handling, Treatment, and Disposal (POTW)

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	1.9	134	365	5.1E−03	0.37	122	2015−2024 DMR
Fugitive air	7.0	128	365	2.8E−02	0.51	29	2014, 2017, and 2020 NEI[a]
Stack air	15	37		6.0E−02	0.15	3	2014, 2017, and 2020 NEI[a]

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; OES = occupational exposure scenario; POTW = publicly owned treatment works; TRI = Toxics Release Inventory
[a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

Higher releases at non-POTWs may reflect differences in treatment effectiveness relative to POTWs; however, without facility-specific information for the sites show in Table 3-17 and Table 3-18, the cause of the difference cannot be determined.

EPA used 2015 to 2024 DMR and 2014, 2017, and 2020 NEI to estimate environmental releases during waste handling, treatment, and disposal (remediation), as presented in Table 3-19. For remediation, 1,2-dichloroethane is released through the surface water, fugitive air, and stack air.

Table 3-19. Summary of Environmental Releases During Waste Handling, Treatment, and Disposal (Remediation)

Environmental Media	Estimated Yearly Release Range Across Sites (kg/yr)		Number of Release Days	Daily Release (kg/site-day)		Number of Facilities	Source(s)
	Central Tendency	High-End		Central Tendency	High-End		
Surface water	4.3E−02	2.0	365	1.2E−04	5.5E−03	29	2015−2024 TRI/DMR
Fugitive air	1.8	29		4.8E−03	8.0E−02	30	2014, 2017, and 2020 NEI[a]
Stack air	18	1,369		4.8E−02	3.8	5	2014, 2017, and 2020 NEI[a]

DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; OES = occupational exposure scenario; TRI = Toxics Release Inventory

[a] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

4 SUMMARY OF ENVIRONMENTAL RELEASE ESTIMATES

Table 4-1 provides a summary for each of the occupational exposure scenarios (OESs) by indicating the media of release and number of facilities. EPA provides central tendency and high-end daily and yearly release estimates. Central tendency and high-end releases are calculated using the 50th and 95th percentiles of reported or modeled releases. Note that the number of facilities listed in this table are not unique, as a single facility may report releases to multiple media or multiple databases; for example, TRI and NEI are presented separately and there may be facility overlap between the two "number of facilities" numbers reported in Table 4-1. These estimates are based on TRI and DMR data from reporting years 2015 to 2020 and NEI data from reporting years 2014 and 2017.

The relevant supplemental files contain the calculations of the central tendency and high-end annual and daily releases for each OES that used EPA databases to estimate releases. Land release calculations are in *Land Releases for 1,2-Dichloroethane* (U.S. EPA, 2026j); water release calculations are in *Water Releases for 1,2-Dichloroethane* (U.S. EPA, 2026q); and air release calculations are in *Air Releases for 1,2-Dichloroethane* (U.S. EPA, 2026b).

Table 4-1. Summary of Environmental Releases for Each OES

Occupational Exposure Scenario (OES)	Estimated Annual Release (kg/site-yr) [a]		Type of Discharge,[b] Air Emission,[c] or Transfer for Disposal [d]	Estimated Daily Release (kg/site-day) [e]		Production Volume Assessed (kg/site-yr)	Number of Facilities [f]	Source(s)
	Central Tendency [g]	High-End		Central Tendency	High-End			
Manufacturing	1.4	190	Surface water	3.9E−03	0.54	N/A [l]	70	2015−2024 TRI/DMR
	3,174	1.7E04	Fugitive air	9.1	48		22	2015−2024 TRI
	1,102	1.2E04	Stack air	3.1	35		23	2015−2024 TRI
	2,665	1.0E04	Fugitive air	7.6	29		21	2014, 2017, and 2020 NEI[k]
	833	6,192	Stack air	2.4	18		23	2014, 2017, and 2020 NEI[k]
	6.8	621	Land	1.9E−02	1.8		18	2015−2024 TRI
Repackaging	4.1E−02	227	Surface water	1.6E−04	0.91	1.1E04	27	2015−2024 TRI/DMR
	113	227	Fugitive air	0.45	0.91		4	2015−2024 TRI
	38	227	Stack air	0.15	0.91		4	2015−2024 TRI
	1.4E−02	105	Fugitive air	5.7E−05	0.42		28	2014, 2017, and 2020 NEI[k]
	2.0	545	Stack air	7.8E−03	2.2		11	2014, 2017, and 2020 NEI[k]
	3.6	5.8	Fugitive or stack air	8.4E−02	0.15		N/A	Environmental release modeling
	275	320	Hazardous waste landfill or incineration [j]	6.5	10		N/A	Environmental release modeling

Occupational Exposure Scenario (OES)	Estimated Annual Release (kg/site-yr) [a]		Type of Discharge,[b] Air Emission,[c] or Transfer for Disposal [d]	Estimated Daily Release (kg/site-day) [e]		Production Volume Assessed (kg/site-yr)	Number of Facilities [f]	Source(s)
	Central Tendency [g]	High-End		Central Tendency	High-End			
Processing as a Reactant	0.26	227	Surface water	7.4E−04	0.65	N/A [l]	38	2015−2024 TRI/DMR
	37	399	Fugitive air	0.10	1.1		11	2015−2024 TRI
	5.4	445	Stack air	1.6E−02	1.3		10	2015−2024 TRI
	63	4,216	Fugitive air	0.18	12		17	2014, 2017, and 2020 NEI[k]
	14	1,622	Stack air	3.9E−02	4.6		14	2014, 2017, and 2020 NEI[k]
	6.8	621	Land	1.9E−02	1.8		4	2015−2024 TRI
Processing into Formulation, Mixture, or Reaction Product	0.50	18	Surface water	1.7E−03	6.1E−02	N/A [l]	40	2015−2024 TRI/DMR
	72	3,012	Fugitive air	0.24	10		11	2015−2024 TRI
	31	2,167	Stack air	0.10	7.2		9	2015−2024 TRI
	113	438	Fugitive air	0.38	1.5		10	2014, 2017, and 2020 NEI[k]
	8.6	1,595	Stack air	2.9E−02	5.3		9	2014, 2017, and 2020 NEI[k]
	227	1.3E04	Land	0.76	42		3	2015−2024 TRI
Industrial Application of Adhesives and Sealants	1.8	261	Fugitive air	6.9E−03	1.0	4,536	39	2014, 2017, and 2020 NEI[k]
	4.6	274	Stack air	1.8E−02	1.1		69	2014, 2017, and 2020 NEI[k]

Occupational Exposure Scenario (OES)	Estimated Annual Release (kg/site-yr) [a]		Type of Discharge,[b] Air Emission,[c] or Transfer for Disposal [d]	Estimated Daily Release (kg/site-day) [e]		Production Volume Assessed (kg/site-yr)	Number of Facilities [f]	Source(s)
	Central Tendency [g]	High-End		Central Tendency	High-End			
Industrial Application of Adhesives and Sealants (*continued*)	4,400 [h]	4,400 [h]	Fugitive or stack air	59	162	4,536	N/A	Environmental release modeling
	155	174	Hazardous landfill or incineration [j]	2.1	5.8		N/A	Environmental release modeling
Industrial Application of Lubricants and Greases	7.3E−02	82	Fugitive air	2.9E−04	0.33	N/A [l]	2	2014, 2017, and 2020 NEI[k]
	8.8E−03		Stack air	3.5E−05			1	2014, 2017, and 2020 NEI[k]
Industrial and Commercial Non-Aerosol Cleaning/ Degreasing	0.43	13	Surface water	1.7E−03	5.0E−02		4	2015−2024 TRI/DMR
	4.1	1,738	Fugitive air	1.6E−02	7.0		1	2015−2024 TRI
	11	995	Stack air	4.5E−02	4.0		1	2015−2024 TRI
	2.2	42	Fugitive air	8.9E−03	0.17		13	2014, 2017, and 2020 NEI[k]
	3.0	402	Stack air	1.2E−02	1.6		15	2014, 2017, and 2020 NEI[k]
	0.5	9	Land	1.8E−03	3.8E−02		1	2015−2024 TRI
	1.3E04	4.2E04	Fugitive or stack air	42	141	4,536	N/A	Environmental release modeling
	662	2,606	Wastewater treatment	2.2	8.8		N/A	Environmental release modeling

Occupational Exposure Scenario (OES)	Estimated Annual Release (kg/site-yr) [a]		Type of Discharge,[b] Air Emission,[c] or Transfer for Disposal [d]	Estimated Daily Release (kg/site-day) [e]		Production Volume Assessed (kg/site-yr)	Number of Facilities [f]	Source(s)
	Central Tendency [g]	High-End		Central Tendency	High-End			
Industrial and Commercial Non-Aerosol Cleaning/ Degreasing (*continued*)	7,152	3.1E04	Hazardous waste incineration	24	103	4,536	N/A	Environmental release modeling
	64	255	Hazardous waste landfill [j]	0.24	0.86		N/A	Environmental release modeling
Commercial Aerosol Products	379	382	Fugitive air	1.5	1.5	379 (central tendency) 382 (high-end)	N/A	Environmental release modeling
Laboratory Use	1.1E−02	0.38	Surface water	4.1E−05	1.4E−03	17 (central tendency) 820 (high-end)	4	2015−2024 TRI/DMR
	1.3	10	Fugitive air	5.2E−03	3.8E−02		6	2014, 2017, and 2020 NEI[k]
	126	233	Stack air	0.48	0.90		2	2014, 2017, and 2020 NEI[k]
	1.4	12	Fugitive or stack air	6.2E−03	5.0E−02		N/A	Environmental release modeling
	15	812	Hazardous landfill or incineration [j]	6.5E−02	3.5		N/A	Environmental release modeling
Waste Handling, Treatment, and Disposal (Incinerator)	5.8E−03	116	Surface water	2.3E−05	0.46	N/A [l]	7	2015−2024 TRI/DMR
	1.2	310	Fugitive air	4.7E−03	1.2		20	2015−2024 TRI
	0.48	263	Stack air	1.9E−03	1.1		22	2015−2024 TRI

Occupational Exposure Scenario (OES)	Estimated Annual Release (kg/site-yr) [a]		Type of Discharge,[b] Air Emission,[c] or Transfer for Disposal [d]	Estimated Daily Release (kg/site-day) [e]		Production Volume Assessed (kg/site-yr)	Number of Facilities [f]	Source(s)
	Central Tendency [g]	High-End		Central Tendency	High-End			
Waste Handling, Treatment, and Disposal (Incinerator) (*continued*)	0.49	97	Fugitive air	2.0E−03	0.39	N/A [l]	26	2014, 2017, and 2020 NEI[k]
	3.0E−02	39	Stack air	1.2E−04	0.16		61	2014, 2017, and 2020 NEI[k]
	6.4	2.3E04	Land	2.5E−02	91		9	2015−2024 TRI
Waste Handling, Treatment, and Disposal (Landfill)	5.0E−02	11	Surface water	2.0E−04	4.5E−02		8	2015−2024 TRI/DMR
	5.1	33	Fugitive air	2.1E−02	0.13		665	2014, 2017, and 2020 NEI[k]
	0.41	22	Stack air	1.6E−03	8.9E−02		145	2014, 2017, and 2020 NEI[k]
Waste Handling, Treatment, and Disposal (Non-POTW WWT)	1.2	272	Surface water	4.7E−03	1.1		8	2015−2024 TRI/DMR
	7.7	329	Fugitive air	3.1E−02	1.3		12	2014, 2017, and 2020 NEI[k]
	1.1	186	Stack air	4.4E−03	0.74		9	2014, 2017, and 2020 NEI[k]
Waste Handling, Treatment, and Disposal (POTW)	1.9	134	Surface water	5.1E−03	0.37		122	2015−2024 DMR
	7.0	128	Fugitive air	2.8E−02	0.51		29	2014, 2017, and 2020 NEI[k]
	15	37	Stack air	6.0E−02	0.15		3	2014, 2017, and 2020 NEI[k]
Waste Handling, Treatment, and Disposal (Remediation)	4.3E−02	2.0	Surface water	1.2E−04	5.5E−03	N/A [l]	29	2015−2024 TRI/DMR
	1.8	29	Fugitive air	4.8E−03	8.0E−02		30	2014, 2017, and 2020 NEI[k]
	18	1,369	Stack air	4.8E−02	3.8		5	2014, 2017, and 2020 NEI[k]

Occupational Exposure Scenario (OES)	Estimated Annual Release (kg/site-yr) [a]		Type of Discharge,[b] Air Emission,[c] or Transfer for Disposal [d]	Estimated Daily Release (kg/site-day) [e]		Production Volume Assessed (kg/site-yr)	Number of Facilities [f]	Source(s)
	Central Tendency [g]	High-End		Central Tendency	High-End			
Facilities not mapped to an OES	N/A						617 [i]	–

DMR = Discharge Monitoring Report; N/A = Not applicable; NEI = National Emissions Inventory; OES = occupational exposure scenario; POTW = publicly owned treatment works; TRI = Toxics Release Inventory; WWT = wastewater treatment

[a] For modeled results, the presented central tendency and high-end are the 50th and 95th percentile values of the modeled distribution. For programmatic data, the presented central tendency is calculated from the median reported release amounts and high-end from the reported maximum release amounts. The specific central tendency and high-end values presented depends on the number of sites with programmatic data. For databases with 6 or more reporting facilities, EPA estimated central tendency and high-end releases using the 50th and 95th percentile values, respectively. For 3–5 facilities, EPA estimated the central tendency and high-end releases using the 50th percentile and maximum values, respectively. For 2 sites, EPA presented the midpoint and the maximum value. Finally, EPA presented sites with only 1 data point as-is from the programmatic database.

[b] Direct discharge to surface water; indirect discharge to non-POTW WWT; indirect discharge to POTW

[c] Emissions via fugitive air; stack air; or treatment via incineration

[d] Transfer to surface impoundment, land application, or landfills

[e] Where available, EPA used peer reviewed literature (*e.g.,* GSs or ESDs) to provide a basis to estimate the number of release days of 1,2-dichloroethane within a COU.

[f] Where available, EPA used the 2020 CDR (U.S. EPA, 2020a), NEI (U.S. EPA, 2023a), DMR (U.S. EPA, 2022b), and TRI databases (U.S. EPA, 2022d), 2020 U.S. County Business Practices (U.S. Census Bureau, 2022), and Monte Carlo models to estimate the number of sites that use 1,2-dichloroethane for each COU. Some modeled OES calculated the number of facilities/sites, presented as 50th and 95th percentiles. Other modeled OESs set the number of facilities deterministically, presented as 1 value.

[g] The central tendency values for NEI air were calculated using the median of the reported releases at each site.

[h] These central tendency and high-end releases appear equivalent in the table due to rounding.

[i] There were 617 facilities not mapped to an OES with 1,2-dichloroethane releases that EPA was unable to map due to the lack of information regarding the activity of 1,2-dichloroethane at the site. These sites do not fit in any of the 1,2-dichloroethane OES since they are mainly hotels, businesses, and various chemical facilities where 1,2-dichloroethane use is unknown.

[j] 1,2-dichloroethane is a U-listed hazardous waste under code U0777 under RCRA; therefore, discarded, unused pure and commercial grades of 1,2-dichloroethane are regulated as a hazardous waste under RCRA (40 CFR § 261.33(f)). Hazardous waste landfill or incineration are grouped together due to uncertainty in modeled release to environmental media.

[k] Between draft and final risk evaluation, EPA incorporated 2020 NEI release data. In the general population inhalation exposure assessment (U.S. EPA, 2026h), EPA modeled and mapped only the NEI releases selected for the air assessment (not all reported NEI releases). As a result, some 2020 NEI releases for this OES may not appear in the table. See Section 2.3.3 and the supplemental file (U.S. EPA, 2026b) for details on NEI sites that were not mapped.

[l] For this OES, the production volume was not used to estimate releases because EPA was able to compile facility-reported releases.

5 WEIGHT OF SCIENTIFIC EVIDENCE CONCLUSIONS FOR ENVIRONMENTAL RELEASES

For each OES, EPA considered the assessment approach, the quality of the data and models, and the strengths, limitations, assumptions, and key sources of uncertainties in the assessment results to determine a weight of scientific evidence rating. EPA also considered factors that increase or decrease the strength of the evidence supporting the release estimate—including quality of the data/information, applicability of the release data to the OES (including considerations of temporal relevance, locational relevance), and the representativeness of the estimate across the entire industry. The best professional judgment is summarized using the descriptors of robust, moderate, slight, or indeterminant, according to EPA's Draft Systematic Review Protocol (U.S. EPA, 2021a). For example, a conclusion of moderate is appropriate where there is measured release data from a limited number of sources such that there is a limited number of data points that may not cover most or all the sites within the OES. A conclusion of slight is appropriate where there is limited information that does not sufficiently cover all sites within the OES, and the assumptions and uncertainties are not fully known or documented. See the Protocol (U.S. EPA, 2021a) for additional information on weight of scientific evidence conclusions.

Weight of scientific evidence ratings for the environmental release estimates for each OES, including details on the basis EPA used to determine the rating, are provided in the sections and tables below.

5.1 Strengths, Limitations, Assumptions, and Key Sources of Uncertainties

EPA estimated air, water, and land releases of 1,2-dichloroethane using various methods and information sources, including TRI, DMR, and NEI data, and GS/ESD modeling with Monte Carlo. TRI, DMR, and NEI were determined to have overall quality data ratings of high through EPA's systematic review process. EPA determined that the various GSs had overall data quality ratings of medium.

Strengths

TRI (which reports releases to air, land, and water), DMR (reports releases to water), and NEI (reports releases to air) provided a comprehensive amount of release data for 1,2-dichloroethane. A strength of using TRI is that it compiles the best readily available release data for all facilities that reported to EPA. For air releases, NEI data captures additional sources that are not included in TRI due to reporting thresholds. Additionally, point sources in NEI report at the emission-unit level.

A strength of using DMR data and the Pollutant Loading Tool is that the tool calculates an annual pollutant load by integrating monitoring period release reports provided to the EPA and extrapolating over the course of the year. However, this approach assumes average quantities, concentrations, and hydrologic flows for a given period are representative of other times of the year.

Although 1,2-dichloroethane monitoring data are preferred to modeled data, in some cases EPA strengthened modeled estimates by using Monte Carlo modeling to allow for variation in environmental release calculation input parameters according to the GS and other literature sources.

Limitations

When using TRI data to analyze chemical releases, it is important to acknowledge that because TRI reporting does not include all releases of the chemical, the number of sites for a given OES may be underestimated. For each OES that had TRI, DMR, or NEI data, the analysis of releases for those OESs was limited to the facilities that reported releases to TRI, DMR, or NEI. Therefore, it is uncertain the extent to which sites not captured in these databases have air, water, or land releases of 1,2-dichloroethane.

EPA was unable to map certain facilities to an OES due to the lack of information regarding the activity of 1,2-dichloroethane at the site. Therefore, some facilities are mapped to an Unknown OES. There were 183 facilities not mapped to an OES: 45 in NEI, 1 in TRI, and 138 in DMR. Please see *Number of Sites for 1,2-Dichloroethane* (U.S. EPA, 2026l) for a list of these unknown facilities.

Assumptions
To assess daily air and water discharges, EPA assumed that the number of facility operating days was equal to the number of release days. The Agency has developed generic estimates of operating days for each OES, as described in Section 2.3.2. For the modeled releases, EPA assumed the number of operating days based on the relevant ESD or GS.

There is uncertainty that all sites for a given OES operate for the assumed duration; therefore, the average daily releases may be higher if sites have fewer release days or lower if they have greater release days. Furthermore, 1,2-dichloroethane concentrations in air emissions and wastewater release to receiving waterbodies at each facility may vary from day-to-day such that on any given day the actual daily releases may be higher or lower than the estimated average daily discharge. Thus, this approach minimizes variations in emissions and discharges. EPA did not estimate daily land releases due to the high level of uncertainty in the number of release days associated with land releases. The Agency expects that sites may not send waste to landfills every day and are more likely to accumulate waste for periodic shipments to landfills. However, sites that release to municipal landfills may have more frequent release days based on the frequency of shipments.

Uncertainties
Uncertainties for using TRI, DMR, and NEI data include underestimation of the number of sites for a given OES due to reporting thresholds in TRI; the accuracy of EPA's mapping of sites reporting to TRI, DMR, and NEI to a specific OES; and quality of the data reported to TRI, DMR, and NEI.

Some uncertainties of using DMR data include the accuracy of EPA's mapping of sites reporting to DMR to a specific OES, and quality of the data reported to DMR. Also, an uncertainty of using the ECHO Pollutant Loading Tool Advanced Search option is that average measurements may be reported as a quantity (kg/day) or a concentration (mg/L). Calculating annual loads from concentrations requires adding wastewater flow to the equation, which increases the uncertainty of the calculated annual load. In addition, for facilities that reported having zero pollutant loads to DMR, the EZ Search Load Module uses a combination of setting non-detects equal to zero and as one-half the detection limit to calculate the annual pollutant loadings. This method could cause overestimation or underestimation of annual and daily pollutant loads.

Some uncertainties of using NEI data include the accuracy of EPA's mapping of sites reporting to NEI to a specific OES. For point sources, there may be multiple OES at a single facility. Area/nonpoint sources are aggregated on a county level. As a result, EPA augments SLT-provided HAP data with other information to better estimate point, nonpoint, and mobile source HAP emissions. NEI does not require stack testing or continuous emissions monitoring, and reporting agencies may use different emission estimation methods with varying degrees of reliability. These methodologies include continuous emissions monitoring, stack testing, site- and vendor-specific emission factors, SLT and/or other emission factors, and engineering judgment.

One uncertainty in applying GSs and ESDs for the assessment of releases of 1,2-dichloroethane is the lack of specific information on 1,2-dichloroethane uses that is needed to identify the OES to be assessed under the COU. Additionally, a key parameter in using GS and ESDs is the estimate of facility throughput (kg of 1,2-dichloroethane per site-yr) for a given OES. Having data for this parameter helps to improve the confidence in the release estimates that are based on this throughput value. Another uncertainty is lack of information on controls applied to air emissions that can be generated during the activities within an OES and consideration for release controls. The estimates from the GS and ESD on air emissions of volatile chemicals can have uncertainty as a result (U.S. EPA, 2023b, 2022a). Actual releases to air may be less than estimated if facilities utilize pollution control methods.

In some cases, the number of facilities for a given OES was estimated using data from the U.S. Census. In such cases, the average daily release calculated from sites reporting to TRI, NEI, or DMR was applied to the total number of sites reported in (U.S. Census Bureau, 2015). It is uncertain how accurate this average release is to actual releases at these sites; therefore, releases may be higher or lower than the calculated amount.

Table 5-1 summarizes EPA's overall confidence in the environmental release estimates for each OES.

Table 5-1. Summary of Assumptions, Uncertainty, and Overall Confidence in Release Estimates by OES

OES [a]	Weight of Scientific Evidence Conclusion in Release Estimate
Manufacturing	For this OES, EPA had release information from water, land, and air from TRI, water from DMR, and air from NEI. Water releases were assessed using reported releases from 2015–2024 TRI and DMR. These databases received a high data quality rating in systematic review. The primary strength of TRI data is that TRI compiles the best readily available release data for all reporting facilities. Factors that decrease the overall confidence for this estimate include the uncertainty in the accuracy of reported releases, and uncertainty in mapping sites to DMR to the Manufacturing OES. Most facilities only report NAICS code; therefore, it is uncertain whether the site performs manufacturing or another chemical process, such as processing as a reactant. Additionally, there are 15 manufacturing sites that report releases to other media in other reporting databases (DMR, NEI, etc.), but do not report releases to water in TRI. It is unclear whether these sites do not release to water, or the site does not meet reporting thresholds for TRI. Air releases were assessed using reported releases from 2015–2024 TRI, and 2014, 2017, and 2020 NEI. A strength of NEI data is that NEI captures additional sources that are not included in TRI due to reporting thresholds. Factors that decrease the overall confidence for this OES include the uncertainty in the accuracy of reported releases, and the limitations in representativeness to all sites because TRI and NEI may not capture all relevant sites. Additionally, EPA made assumptions on the number of operating days to estimate daily releases. Land releases were assessed using reported releases from 2015–2024 TRI. The primary strength of TRI data is that TRI compiles the best readily available release data for all reporting facilities. Factors that decrease the overall confidence for this estimate include the uncertainty in the accuracy of reported releases, and the limitations in representativeness to all sites because TRI and DMR may not capture all relevant sites. Based on other reporting databases (CDR, DMR, NEI, etc.), there are 30 additional manufacturing sites that report releases to other media but do not report releases to land. In conclusion, though there is uncertainty of whether the databases capture all sites releasing to each medium, the release data are rated high in systematic review and provide releases directly from a wide number of manufacturing facilities. Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a moderate-to-robust confidence and provides a plausible estimate of releases in consideration of the strengths and limitations of reasonably available data.
Repackaging	For this OES, EPA had release information for water and air from TRI, water from DMR, and air from NEI. Water releases were assessed using reported releases from 2015–2024 TRI and DMR. The primary strength of TRI data is that TRI compiles the best readily available release data for all reporting facilities. Factors that decrease the overall confidence for this estimate include the uncertainty in the accuracy of reported releases, and the limitations in representativeness to all sites because TRI and DMR may not capture all relevant sites. There is uncertainty in mapping sites to TRI and DMR as most facilities only report NAICS code; therefore, it is uncertain what type of chemical process the site

OES [a]	Weight of Scientific Evidence Conclusion in Release Estimate
Repackaging *(continued)*	performs and whether it is directly applicable to the assessed OES. Based on other reporting databases (CDR, NEI, etc.), there are 47 additional manufacturing sites that report releases to other media but do not report releases to water. Air releases were assessed using reported releases from 2015–2024 TRI as well as 2014, 2017, and 2020 NEI. A strength of NEI data is that NEI captures additional sources that are not included in TRI due to reporting thresholds. Factors that decrease the overall confidence for this OES include the uncertainty in the accuracy of reported releases, and the limitations in representativeness to all sites because TRI and NEI may not capture all relevant sites. Additionally, EPA made assumptions on the number of operating days to estimate daily releases. Based on other reporting databases (CDR, DMR etc.), there are 16 additional repackaging sites that report releases to other media but do not report releases to air. Land releases were assessed using reported releases from 2015–2024 TRI, however there were no land releases reported to any database for repackaging of 1,2-dichloroethane. These releases needed to be modeled, as there may be releases from container cleaning that are sent to landfill, based on typical releases during the repackaging process. In conclusion, though there is uncertainty of whether the databases capture all sites releasing to each medium, the release data are rated high in systematic review and provide releases directly from a wide number of repackaging facilities. For the modeling, EPA assessed releases using the assumptions and values from the July 2022 Chemical Repackaging GS (U.S. EPA, 2022a), which the systematic review process rated high for data quality. The Agency used EPA Office of Pollution Prevention and Toxics (OPPT) models combined with Monte Carlo modeling to estimate releases to the environment, with media of release assessed using assumptions from the GS and EPA/OPPT models. EPA believes a strength of the Monte Carlo modeling approach is that variation in model input values and a range of potential releases values is more likely than a discrete value to capture actual releases at sites. Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a moderate to robust confidence and provides a plausible estimate of releases in consideration of the strengths and limitations of reasonably available data.
Processing as a Reactant	For this OES, EPA had release information from water, land, and air from TRI, water from DMR, and air from NEI. Water releases were assessed using reported releases from 2015–2024 TRI and DMR, which both have a high overall data quality determination from the systematic review process. The primary strength of TRI data is that TRI compiles the best readily available release data for all reporting facilities. The water release assessment is based on 28 reporting sites. There is uncertainty in mapping sites to TRI and DMR as most facilities only report NAICS code; therefore, it is uncertain what type of chemical process the site performs (manufacturing, processing as a reactant, etc.). Based on other reporting databases (CDR, NEI, etc.), there are 14 additional sites that report releases to other media but do not report releases to water.

OES [a]	Weight of Scientific Evidence Conclusion in Release Estimate
Processing as a Reactant *(continued)*	Air releases were assessed using reported releases from 2015–2024 TRI as well as 2014, 2017, and 2020 NEI. A strength of NEI data is that NEI captures additional sources that are not included in TRI due to reporting thresholds. Factors that decrease the overall confidence for this OES include the uncertainty in the accuracy of reported releases and the limitations in representativeness to all sites because TRI and NEI may not capture all relevant sites. Based on other reporting databases (CDR, DMR, etc.), 12 additional sites that report releases to other media but do not report releases to air. Land releases were assessed using reported releases from 2015–2024 TRI. The primary limitation is that the land release assessment is based on 4 reporting sites and EPA did not have additional sources to estimate land releases from this OES. Based on other reporting databases (CDR, DMR, NEI, etc.), there are 38 additional sites that report releases to other media but do not report releases to land. In conclusion, though there is uncertainty of whether the databases capture all sites releasing to each medium, the release data are rated high in systematic review and provide releases directly from a wide number of facilities that process 1,2-dichloroethane as a reactant. Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a moderate to robust estimate of releases in consideration of the strengths and limitations of reasonably available data.
Processing into Formulation, Mixture, or Reaction Product	For this OES, EPA had release information from water and air from TRI, water from DMR, and air from NEI. Water releases were assessed using reported releases from 2015–2024 TRI and DMR, which both have a high overall data quality determination from the systematic review process. The primary strength of TRI data is that TRI compiles the best readily available release data for all reporting facilities. The water release assessment is based on 18 reporting sites. There is uncertainty in mapping sites to TRI and DMR as most facilities only report NAICS code; therefore, it is uncertain what type of chemical process the site performs and whether it is directly applicable to the assessed OES. Based on other reporting databases (CDR, NEI, etc.), there are 6 additional sites that report releases to other media but do not report releases to water. Air releases were assessed using reported releases from 2015–2024 TRI as well as the 2014, 2017, and 2020 NEI. A strength of NEI data is that NEI captures additional sources that are not included in TRI due to reporting thresholds. Factors that decrease the overall confidence for this OES include the uncertainty in the accuracy of reported releases, and the limitations in representativeness to all sites because TRI and NEI may not capture all relevant sites. Based on other reporting databases (CDR, DMR, etc.), there are nine additional sites that report releases to other media but do not report releases to air. In conclusion, though there is uncertainty of whether the databases capture all sites releasing to each medium, the release data are rated high in systematic review and provide releases directly from a wide number of facilities that use 1,2-dichloroethane during processing into formulation, mixture, or reaction product. Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a moderate to robust estimate of releases in consideration of the strengths and limitations of reasonably available data.

OES[a]	Weight of Scientific Evidence Conclusion in Release Estimate
Application of Adhesives and Sealants	For this OES, EPA had release information only for air from NEI. EPA identified 83 facilities reporting air releases of 1,2-dichloroethane that were potentially relevant to the application of adhesives and sealants. EPA determined these data are not sufficient to confidently capture the entirety of environmental releases for this scenario due to the fact they were from the NEI database and only reported on releases to air. Therefore, releases to the environment were also assessed using the ESD on Use of Adhesives (OECD, 2015). This ESD has a high data quality rating from the systematic review process (U.S. EPA, 2023b). EPA used this ESD combined with Monte Carlo modeling to estimate releases to the environment, with media of release assessed using assumptions from the ESD Model. More information about the details and assumptions of the model can be found in Appendix A.5. EPA believes a strength of the Monte Carlo modeling approach is that variation in model input values and a range of potential releases values is more likely than a discrete value to capture actual releases at sites. The Agency further believes the primary limitation to be the uncertainty in the representativeness of values toward the true distribution of potential releases. In addition, EPA lacks 1,2-dichloroethane chemical throughput data (*i.e.,* kg of chemical used per site per year); therefore, the number of facilities is based on one generic site, and a maximum throughput of 10,000 lb/yr was assumed based on TRI reporting thresholds. Comparison of modeled values with the NEI data is difficult due to uncertainty on the throughput (kg/site-yr) of 1,2-dichloroethane at the NEI sites in comparison to the throughput value used in the modeling. Overall, EPA concludes that the weight of scientific evidence for this assessment is slight to moderate.
Application of Lubricants and Greases	For this OES, EPA had release information for air from NEI. EPA identified 4 facilities reporting air releases of 1,2-dichloroethane in NEI. A strength of NEI data is that NEI captures additional sources that are not included in TRI due to reporting thresholds. Factors that decrease the overall confidence for this OES include the uncertainty in the accuracy of reported releases, and the limitations in representativeness to all sites because NEI may not capture all relevant sites. This is a particular concern for application of lubricants and greases because only 4 facilities were mapped to this use. To bolster the limited release data provided by NEI, Application of Lubricants and Greases can also be assessed by modeling the release of 1,2-dichloroethane due to the use of aerosol product. EPA applied a methodology, described in Section 3.9, based on a 100% release scenario to fugitive air which means that all 1,2-dichloroethane used in this scenario is assumed to be released to fugitive air. This methodology calculated the release amounts using the amount of 1,2-dichloroethane used per application, number of applications per job, and number of jobs per site-year. The release model uses data from the California Air Resources Board (CARB) to estimate 1,2-dichloroethane use rates; 100% of the sprayed 1,2-dichloroethane is expected to be released to air. The Agency used this methodology combined with Monte Carlo modeling to estimate releases to the environment with media of release assessed only for fugitive air. More information about the details and assumptions of the model can be found in Appendix A.6.

OES [a]	Weight of Scientific Evidence Conclusion in Release Estimate
Application of Lubricants and Greases (*continued*)	EPA believes a strength of the Monte Carlo modeling approach is that variation in model input values and a range of potential releases values is more likely than a discrete value to capture actual releases at sites. The Agency believes the primary limitation to be the uncertainty in the representativeness of values toward the true distribution of potential releases. In addition, EPA lacks 1,2-dichloroethane chemical throughput data, number of facilities, and estimates for other release media. Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a slight to moderate estimate of releases in consideration of the strengths and limitations of reasonably available data.
Industrial and Commercial Non-Aerosol Cleaning/ Degreasing	For this OES, EPA had release information for water and air from TRI and for air from NEI. EPA identified 25 facilities reporting air releases of 1,2-dichloroethane. Due to the difficulty of determining the exact activities that occur at each site and the method of use (aerosol vs non-aerosol), EPA assumed that the 25 sites may potentially use non-aerosol cleaning/degreasing based on the industry and source classification codes for each source. Since so few sites reported to the databases and data points from NEI report only air releases, EPA also chose to model releases for non-aerosol cleaning and degreasing to obtain estimates for releases to other media. Therefore, releases to the environment are also assessed using the ESD on the Use of Vapour Degreasers (OECD, 2013). This ESD has a high data quality rating from the systematic review process (U.S. EPA, 2023b). EPA used this ESD combined with Monte Carlo modeling to estimate releases to the environment, with media of release assessed using assumptions from the ESD model. More information about the details and assumptions of the model can be found in Appendix A.4. Water releases were assessed using reported releases from 2015–2024 TRI and DMR, which both have a high overall data quality determination from the systematic review process. The primary strength of TRI data is that TRI compiles the best readily available release data for all reporting facilities. The water release assessment is based on 3 reporting sites. There is uncertainty in mapping sites to TRI and DMR as most facilities only report NAICS code; therefore, it is uncertain what type of chemical process the site performs and whether it is directly applicable to the assessed OES. Based on other reporting databases (CDR, NEI, etc.), there are 2 additional sites that report releases to other media but do not report releases to water. Air releases were assessed using reported releases from 2014, 2017, and 2020 NEI. A strength of NEI data is that NEI captures additional sources that are not included in TRI due to reporting thresholds. Factors that decrease the overall confidence for this OES include the uncertainty in the accuracy of reported releases, and the limitations in representativeness to all sites because NEI may not capture all relevant sites. Based on other reporting databases (CDR, DMR, etc.), 3 additional sites that report releases to other media but do not report releases to air. To bolster the limited release data for this OES, EPA also modeled this OES under the assumption that vapor degreasing is the method used for cleaning and degreasing using products containing 1,2-dichloroethane. EPA believes a strength of the Monte Carlo modeling approach is that variation in model input values and a range of potential release values is more likely than a discrete value to capture actual releases at sites. EPA further believes the primary limitation to be the uncertainty in the

OES [a]	Weight of Scientific Evidence Conclusion in Release Estimate
Industrial and Commercial Non-Aerosol Cleaning/ Degreasing (*continued*)	actual method when 1,2-dichloroethane is used in non-aerosol cleaning and degreasing (vapor degreasing was chosen as a conservative assumption), and uncertainty about the representativeness of values toward the true distribution of potential releases. In addition, EPA lacks 1,2-dichloroethane throughput data and number of facilities; therefore, the number of facilities and throughput estimates are based on throughputs provided by the ESD and applying conservative assumptions to public comments provided to EPA (see Appendix A.4). Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a slight to moderate estimate of releases in consideration of the strengths and limitations of reasonably available data.
Industrial and Commercial Aerosol Products	For this OES, EPA had no release information from standard sources. The lack of release information from the databases introduces some uncertainty to the estimation since EPA could only rely on modeled results. EPA applied a methodology based on a 100% release scenario to fugitive air, which means that all 1,2-dichloroethane used in this scenario is assumed to be released to fugitive air. This methodology calculated the release amounts using the amount of 1,2-dichloroethane used per application, number of applications per job, and number of jobs per site-year. The release model uses data from CARB to estimate 1,2-dichloroethane use rates; 100% of the sprayed 1,2-dichloroethane is expected to be released to air. EPA used this methodology combined with Monte Carlo modeling to estimate releases to the environment, with media of release assessed only for fugitive air. More information about the details and assumptions of the model can be found in Appendix A.6. EPA believes a strength of the Monte Carlo modeling approach is that variation in model input values and a range of potential releases values is more likely than a discrete value to capture actual releases at sites. The Agency further believes the primary limitation to be the uncertainty in the representativeness of values toward the true distribution of potential releases. In addition, EPA lacks 1,2-dichloroethane chemical throughput data, number of facilities, and estimates for other release media. Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a slight to moderate estimate of releases in consideration of the strengths and limitations of reasonably available data.
Laboratory Use	For this OES, EPA had release information for water from DMR and for air from NEI. EPA identified 14 facilities reporting water and air releases of 1,2-dichloroethane. However, EPA determined this data is not sufficient to capture the entirety of environmental releases for this scenario. Therefore, releases to the environment were assessed using the Draft GS on the Use of Laboratory Chemicals, which has a high data quality rating from the systematic review process (U.S. EPA, 2023b). EPA used EPA/OPPT models combined with Monte Carlo modeling to estimate releases to the environment, with media of release assessed using assumptions from the ESD and EPA/OPPT models. EPA assumed that the media of release for disposal of laboratory waste is to hazardous waste landfill or incineration, per the GS.

OES [a]	Weight of Scientific Evidence Conclusion in Release Estimate
Laboratory Use (*continued*)	EPA believes a strength of the Monte Carlo modeling approach is that variation in model input values and a range of potential releases values is more likely than a discrete value to capture actual releases at sites. The Agency believes the primary limitation to be the uncertainty in the representativeness of values toward the true distribution of potential releases. In addition, EPA lacks 1,2-dichloroethane laboratory chemical throughput data; therefore, throughput estimates are based on stock solution throughputs from the *Draft GS on the Use of Laboratory Chemicals* and on CDR reporting thresholds. The Agency also has an estimate for the number of laboratories only through the 14 facilities reporting to DMR and NEI, which may not capture all sites if some laboratories do not report to the programmatic databases. EPA has more certainty regarding the use of 1,2-dichloroethane for this OES from SDSs and combines that with the facility release data available and supporting evidence from the model. Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a moderate estimate of releases in consideration of the strengths and limitations of reasonably available data.
Waste Handling, Treatment, and Disposal	***Waste Handling, Treatment, and Disposal (Incinerator, Landfill, and Non-POTW WWT)*** For these OES, EPA had release information for air and water from TRI, for water from DMR, and for air from NEI. Water releases for non-POTW sites were assessed using reported releases from 2015–2024 TRI and DMR. The primary strength of TRI data is that TRI compiles the best readily available release data for all reporting facilities. EPA did not identify additional sources to estimate water releases from this OES. For non-POTW sites, the primary limitation is that the water release assessment is based on only the 22 reporting sites reported under TRI, while according to other reporting databases such as NEI, there are 822 additional sites that report releases to other media but do not report releases to water. Air releases for non-POTW sites were assessed using reported releases from 2015–2024 TRI as well as the 2014, 2017, and 2020 NEI. A strength of NEI data is that NEI captures additional sources that are not included in TRI due to reporting thresholds. Factors that decrease the confidence for this OES include the uncertainty in the accuracy of reported releases, and the limitations in representativeness to all sites because TRI and NEI may not capture all relevant sites. Additionally, EPA made assumptions on the number of operating days to estimate daily releases. Based on this information, EPA has concluded that the weight of scientific evidence for this assessment provides a moderate estimate of releases in consideration of the strengths and limitations of reasonably available data. ***Waste Handling, Treatment, and Disposal (POTW and Remediation)*** For this OES, EPA had release information for water from TRI, for water from DMR, and for air from NEI. Water releases for POTW and remediation sites were assessed using reported releases from 2015–2024 DMR and 2014, 2017, and 2020 NEI. DMR has a high overall data quality determination from the systematic review process and NEI has a high rating. Of note, the variability and uncertainty data quality metric were determined to be medium. A strength of using DMR data and the Pollutant Loading Tool is that the tool calculates an annual pollutant load by integrating monitoring period

OES [a]	Weight of Scientific Evidence Conclusion in Release Estimate
Waste Handling, Treatment, and Disposal (*continued*)	release reports provided to the EPA and extrapolating over the course of the year. However, this approach assumes average quantities, concentrations, and hydrologic flows for a given period are representative of other times of the year. Based on this information, for POTW releases, EPA has concluded that the weight of scientific evidence for this assessment provides a moderate to robust estimate of releases in consideration of the strengths and limitations of reasonably available data.

COU = condition of use; DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; OES = occupational exposure scenario; POTW = publicly owned treatment works; TRI = Toxics Release Inventory; WWT = wastewater treatment
[a] OESs for Distribution in Commerce is not present in this table because it was not quantitatively assessed for this TSD.

6 CONCLUSIONS

EPA considered all reasonably available information identified by the Agency through its systematic review process under TSCA (U.S. EPA, 2026p) to characterize the environmental release of 1,2-dichloroethane. 1,2-Dichloroethane has a total PV in the United States between 13.6 to 18.1 billion kg from the 2020 CDR reporting period. It is used primarily in the synthesis of VCM. Secondary uses include processing as a reactant and incorporation into formulation, mixture, or reaction product such as fuels and fuel additives, adhesives and sealants, lubricants and greases, oxidizing/reducing agents, degreasing and cleaning solvents. It is found in imported consumer plastic and rubber articles such as decorative ornaments and squishy toys (U.S. EPA, 2026o).

EPA evaluated environmental releases for each OES, which are developed based on a set of occupational activities and conditions such that similar environmental releases are expected from the use(s) covered under each OES. The Agency used release data from the TRI, NEI, and DMR databases to assess releases to air, land, and water for most of 1,2-dichloroethane uses (9 of the total 11 OESs). Modeling was performed for three OESs to supplement existing data and one OES where reported data were not available.

The OESs with the highest expected releases were Manufacturing and some industrial uses such as Application of adhesives and sealants as well as Non-aerosol cleaning/degreasing.

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APPENDICES

Appendix A MODEL APPROACHES AND PARAMETERS

This appendix presents the modeling approach and model equations used in estimating environmental releases for each of the applicable OESs. Note that though this assessment focuses only on environmental releases, the models often include occupational exposure estimates as well, and these are also presented here so the entirety of the models used can be portrayed. The models were developed through review of the literature and consideration of existing EPA/OPPT models, ESDs, and/or GSs. An individual model input parameter could either have a discrete value or a distribution of values. The Agency assigned statistical distributions based on reasonably available literature data. A Monte Carlo simulation (a type of stochastic simulation) was conducted to capture variability in the model input parameters. The simulation was conducted using the Latin hypercube sampling method in @Risk Industrial Edition, Version 7.0.0. The Latin hypercube sampling method generates a sample of possible values from a multi-dimensional distribution and is considered a stratified method, meaning the generated samples are representative of the probability density function (variability) defined in the model. EPA performed the model at 100,000 iterations to capture a broad range of possible input values, including values with low probability of occurrence.

EPA used both the 50th and 90th percentile Monte Carlo simulation model result values for assessment. The 95th percentile value represents the high-end release amount or exposure level, whereas the 50th percentile value represents the typical release amount or central tendency exposure level. The following subsections detail the model design equations and parameters used for each of the OESs.

A.1 EPA/OPPT Standard Models

This section discusses the standard models used by EPA to estimate environmental releases of chemicals. All the models presented in this section are models that were previously developed by the Agency and are not the result of any new model development work for this risk evaluation. Therefore, this appendix does not provide the details of the derivation of the model equations that have been provided in other documents such as the *ChemSTEER User Guide* (U.S. EPA, 2015), Chemical Engineering Branch Manual for the Preparation of Engineering Assessments, Volume 1 (CEB, 1991), Evaporation of pure liquids from open surfaces (Arnold and Engel, 2001), Evaluation of the Mass Balance Model Used by the References Environmental Protection Agency for Estimating Inhalation Exposure to New Chemical Substances (Fehrenbacher and Hummel, 1996), and Releases During Cleaning of Equipment (PEI Associates, 1988). The models address loss fraction as well as estimating chemical vapor generation rates used in subsequent model equations to estimate the volatile releases to air and occupational inhalation exposure concentrations. The parameters in the equations of this appendix section are specific to calculating environmental releases of 1,2-dichloroethane.

The EPA/OPPT Penetration Model estimates releases to air from evaporation of a chemical from an open, exposed liquid surface. This model is appropriate for determining volatile releases from activities that are performed indoors or when air velocities are expected to be less than or equal to 100 feet per minute. It calculates the average vapor generation rate of the chemical from the exposed liquid surface using the following equation:

Equation_Apx A-1.

$$G_{activity} = \frac{(8.24 \times 10^{-8}) * \left(MW_{1,2-DCA}^{0.835}\right) * F_{correction\_factor} * VP * \sqrt{Rate_{air\_speed}} * \left(0.25\pi D_{opening}^{2}\right) \sqrt[4]{\frac{1}{29} + \frac{1}{MW_{1,2-DCA}}}}{T^{0.05} * \sqrt{D_{opening}} * \sqrt{P}}$$

Where:

$G_{activity}$	=	Vapor generation rate for activity (g/s)
$MW_{1,2-DCA}$	=	1,2-Dichloroethane molecular weight (g/mol)
$F_{correction\_factor}$	=	Vapor pressure correction factor (unitless)
VP	=	1,2-Dichloroethane vapor pressure (torr)
$Rate_{air\_speed}$	=	Air speed (cm/s)
$D_{opening}$	=	Diameter of opening (cm)
T	=	Temperature (K)
P	=	Pressure (torr)

The EPA/OPPT Mass Transfer Coefficient Model estimates releases to air from the evaporation of a chemical from an open, exposed liquid surface. This model is appropriate for determining this type of volatile release from activities that are performed outdoors or when air velocities are expected to be greater than 100 feet per minute. It calculates the average vapor generation rate of the chemical from the exposed liquid surface using the following equation:

Equation_Apx A-2.

$$G_{activity} = \frac{(1.93 \times 10^{-7}) * \left({MW_{1,2-DCA}}^{0.78}\right) * F_{correction\_factor} * VP * Rate_{air\_speed}^{0.78} * \left(0.25\pi D_{opening}^{2}\right) \sqrt[3]{\frac{1}{29} + \frac{1}{MW_{1,2-DCA}}}}{T^{0.4} D_{opening}^{0.11} \left(\sqrt{T} - 5.87\right)^{2/3}}$$

Where:

$G_{activity}$	=	Vapor generation rate for activity (g/s)
$MW_{1,2-DCA}$	=	1,2-Dichloroethane molecular weight (g/mol)
$F_{correction\_factor}$	=	Vapor pressure correction factor (unitless)
VP	=	1,2-Dichloroethane vapor pressure (torr)
$Rate_{air\_speed}$	=	Air speed (cm/s)
$D_{opening}$	=	Diameter of opening (cm)
T	=	Temperature (K)

The EPA's Office of Air Quality Planning and Standards (OAQPS) AP-42 Loading Model estimates releases to air from the displacement of air containing chemical vapor as a container/vessel is filled with a liquid. This model assumes that the rate of evaporation is negligible compared to the vapor loss from the displacement and is used as the default for estimating volatile air releases during both loading activities and unloading activities. It is used for unloading activities because it is assumed that while one vessel is being unloaded, another is loaded. The EPA/OAQPS AP-42 Loading Model calculates the average vapor generation rate from loading or unloading using the following equation:

Equation_Apx A-3.

$$G_{activity} = \frac{F_{saturation\_factor} * MW_{1,2-DCA} * V_{container} * 3785.4\frac{cm^3}{gal} * F_{correction\_factor} * VP * \frac{RATE_{fill}}{3600\frac{s}{hr}}}{R * T}$$

Where:

$G_{activity}$	=	Vapor generation rate for activity (g/s)
$F_{saturation\_factor}$	=	Saturation factor (unitless)
$MW_{1,2-DCA}$	=	1,2-Dichloroethane molecular weight (g/mol)
$V_{container}$	=	Volume of container (gal/container)
$F_{correction\_factor}$	=	Vapor pressure correction factor (unitless)
VP	=	1,2-Dichloroethane vapor pressure (torr)
$RATE_{fill}$	=	Fill rate of container (containers/h)
R	=	Universal gas constant (L*torr/mol-K)
T	=	Temperature (K)

For each of the vapor generation rate models, the vapor pressure correction factor ($F_{correction\_factor}$) can be estimated using Raoult's Law and the mole fraction of 1,2-dichloroethane in the liquid of interest.

If calculating an environmental release, the vapor generation rate calculated from one of the above models is then used along with an operating time to calculate the release amount (Equation_Apx A-4):

Equation_Apx A-4.

$$Release\_Year_{activity} = Time_{activity} * G_{activity} * 3600\frac{s}{hr} * 0.001\frac{kg}{g}$$

Where:

$Release\_Year_{activity}$	=	1,2-Dichloroethane released for activity per site-year (kg/site-yr)
$Time_{activity}$	=	Operating time for activity (h/site-yr)
$G_{activity}$	=	Vapor generation rate for activity (g/s)

In addition to the vapor generation rate models, EPA uses various loss fraction models to calculate environmental releases, including the following:

- EPA/OPPT Small Container Residual Model
- EPA/OPPT Drum Residual Model
- EPA/OPPT Multiple Process Vessel Residual Model
- EPA/OPPT Single Process Vessel Residual Model

The loss fraction models apply a given loss fraction to the overall throughput of 1,2-dichloroethane for the given process. The loss fraction value or distribution of values differs for each model; however, the models each follow the same general equation:

Equation_Apx A-5.

$$Release\_Year_{activity} = PV * F_{activity\_loss}$$

Where:

$Release\_Year_{activity}$	=	1,2-Dichloroethane released for activity per site-year (kg/site-yr)
PV	=	Production volume throughput of 1,2-dichloroethane (kg/site-yr)
$F_{activity\_loss}$	=	Loss fraction for activity (unitless)

The EPA/OPPT Mass Balance Inhalation Model estimates a worker inhalation exposure to an estimated concentration of chemical vapors within the worker's breathing zone using a one box model. The model estimates the amount of chemical inhaled by a worker during an activity in which the chemical has volatilized and the airborne concentration of the chemical vapor is estimated as a function of the source vapor generation rate or the saturation level of the chemical in air. First, the applicable vapor generation rate model is used to calculate the vapor generation rate for the given activity. With this vapor generation rate, the EPA/OPPT Mass Balance Inhalation Model calculates the volumetric concentration of 1,2-dichloroethane using the following equation:

Equation_Apx A-6.

$$Cv_{activity} = Minimum: \begin{cases} \left[\dfrac{170{,}000 * T * G_{activity}}{MW_{1,2-DCA} * Q * k}\right] \\ \left[\dfrac{1{,}000{,}000ppm * F_{correction\_factor} * VP}{P}\right] \end{cases}$$

Where:

$Cv_{activity}$	=	Exposure activity volumetric concentration [ppm]
$G_{activity}$	=	Exposure activity vapor generation rate [g/s]
MW_{TCEP}	=	1,2-Dichloroethane molecular weight (g/mol)
Q	=	Ventilation rate (ft^3/min)
k	=	Mixing factor (unitless)
T	=	Temperature (K)
$F_{correction\_factor}$	=	Vapor pressure correction factor (unitless)
VP	=	1,2-dichloroethane vapor pressure (torr)
P	=	Pressure (torr)

Mass concentration can be estimated by multiplying the volumetric concentration by the molecular weight of 1,2-dichloroethane and dividing by molar volume at standard temperature and pressure.

A.2 Repackaging Model Approaches and Parameters

This appendix presents the modeling approach and equations used to estimate environmental releases and occupational exposures for 1,2-dichloroethane during the Repackaging OES. This approach utilizes the ESD for Transport and Storage of Chemicals (OECD, 2009b) combined with Monte Carlo simulation (a type of stochastic simulation).

Based on the ESD, EPA identified the following release sources from repackaging operations:

- Release source 1: Transfer operation losses to air from emptying drum
- Release source 2: Releases during storage [not assessed]
- Release source 3: Transfer operation losses to air from filling small containers
- Release source 4: Open surface losses to air during drum cleaning
- Release source 5: Drum cleaning releases to landfill or incineration

Environmental releases and occupational exposures for 1,2-dichloroethane during repackaging are a function of 1,2-dichloroethane's physical properties, container size, mass fractions, and other model parameters. Although physical properties are fixed, some model parameters are expected to vary. EPA used a Monte Carlo simulation to capture variability in the following model input parameters for environmental releases: container loss fraction, saturation factor, container volume, and air speed. For occupational exposure, additional model parameters were ventilation rate, mixing factor, air speed, saturation factor, loss factor, and container sizes. The Agency used the outputs from a Monte Carlo simulation with 100,000 iterations and the Latin Hypercube sampling method in @Risk to calculate release amounts and exposure concentrations for this OES.

A.2.1 Model Equations

Table_Apx A-1 provides the models and associated variables used to calculate environmental releases for each release source within each iteration of the Monte Carlo simulation. EPA used these environmental releases to develop a distribution of release outputs for the Repackaging OES. The variables used to calculate each of the following values include deterministic or variable input parameters, known constants, physical properties, conversion factors, and other parameters. The values for these variables are provided in Appendix A.2.2. The Monte Carlo simulation calculated the total 1,2-dichloroethane release (by environmental media) across all release sources during each iteration of the simulation. EPA then selected 50th and 95th percentile values to estimate the central tendency and high-end releases, respectively.

Table_Apx A-1. Models and Variables Applied for Release Sources in the Repackaging OES

Release Source	Model(s) Applied	Variables Used
Release source 1: Transfer operation losses to air from emptying drum	EPA/OAQPS AP-42 Loading Model (Equation_Apx A-3)	Vapor Generation Rate: $F_{1,2-DCA}$; VP; $F_{saturation\_unloading}$; $MW_{1,2-DCA}$; V_{import_cont}; R; T; $RATE_{fill\_drum}$ Operating Time: $RATE_{fill\_drum}$
Release source 2: Releases during Storage (not assessed)	Not assessed; release is not expected to lead to significant losses to the environment unless there is an accident.	Not applicable
Release source 3: Transfer operation losses to air from filling small containers	EPA/OAQPS AP-42 Loading Model (Equation_Apx A-3)	Vapor Generation Rate: $F_{1,2-DCA}$; VP; $F_{saturation\_loading}$; $MW_{1,1-DCA}$; V_{fill_cont}; R; T; $RATE_{fill\_smallcont}$ Operating Time: $RATE_{fill\_smallcont}$
Release source 4: Open surface losses to air during drum cleaning	EPA/OPPT Penetration Model or EPA/OPPT Mass Transfer Coefficient Model, based on air speed (Equation_Apx A-1, Equation_Apx A-2, Equation_Apx A-3)	Vapor Generation Rate: $F_{1,2-DCA}$; $MW_{1,1-DCA}$; VP; $RATE_{air\_speed}$; $D_{opening\_cont-cleaning}$; T; P Operating Time: $RATE_{fill\_drum}$
Release source 5: Drum cleaning releases to incineration or landfill	EPA/OPPT Drum Residual Model (Equation_Apx A-5)	PV; F_{loss_cont}
OES = occupational exposure scenario; OAQPS = EPA Office of Air Quality Planning and Standards; OPPT = EPA Office of Pollution Prevention and Toxics		

Appendix A.2.6 provides equations and discussion for release source operating times used to calculate releases to air as included in Equation_Apx A-4.

A.2.2 Model Input Parameters

Table_Apx A-2 summarizes the model parameters and their values for the Repackaging Monte Carlo simulation. Additional explanations of EPA's selection of the distributions for each parameter are provided following this table.

Table_Apx A-2. Summary of Parameter Values and Distributions Used in the Repackaging Models

Input Parameter	Symbol	Unit	Deterministic Values	Uncertainty Analysis Distribution Parameters				Rationale/Basis
			Value	Lower Bound	Upper Bound	Mode	Distribution Type	
Air Speed	$RATE_{air\_speed}$	cm/s	10	1.3	202.2	–	Lognormal	See Section A.2.7
Container Loss Fraction	F_{loss_cont}	kg/kg	0.025	0.017	0.03	0.025	Triangular	See Section A.2.8
Saturation Factor Unloading	$F_{saturation\_unloading}$	Unitless	0.5	0.5	1.45	0.5	Triangular	See Section A.2.9
Saturation Factor Loading	$F_{saturation\_loading}$	Unitless	0.5	0.5	1.45	0.5	Triangular	See Section A.2.10
Import Container Volume	V_{import_cont}	gal/container	20,000	10,000	20,000	20,000	Triangular	See Section A.2.11
Small Container Volume	V_{prod_cont}	gal/container	5	5	20	5	Triangular	See Section A.2.11
Number of Sites	Ns	Sites	1	–	–	–	–	"What-if" scenario input
Production Volume	PV	kg/year	11,340	–	–	–	Uniform	"What-if" scenario input
Import Concentration	$F_{1,2\text{-}dichloroethane\_import}$	kg/kg	1.0	–	–	–	–	Assumed pure 1,2-dichloroethane repackaged
Temperature	T	Kelvin	298	–	–	–	–	Process parameter
Pressure	P	Torr	760	–	–	–	–	Process parameter
Gas Constant	R	L*torr/(mol×K)	62.36367	–	–	–	–	Universal constant
1,2-Dichloroethane Vapor Pressure	VP	Torr	78.9	–	–	–	–	Physical property
1,2-Dichloroethane Density	$\rho_{1,2\text{-}dichloroethane}$	kg/m^3	1,256.9	–	–	–	–	Physical property
1,2-Dichloroethane Molecular Weight	$MW_{1,2\text{-}dichloroethane}$	g/mol	98.96	–	–	–	–	Physical property
Fill Rate of Rail Car	$RATE_{fill\_rail}$	containers/h	1	–	–	–	–	See Section A.2.12
Fill Rate of Drum	$RATE_{fill\_drum}$	containers/h	20	–	–	–	–	See Section A.2.12
Fill Rate of Small Container	$RATE_{fill\_small}$	containers/h	60	–	–	–	–	See Section A.2.12
Diameter of Opening for Container Cleaning	$D_{opening\_cont\text{-}cleaning}$	Cm	7.6	–	–	–	–	See Section A.2.9

A.2.3 Throughput Parameters

The facility production rate is calculated as an input value to be used in the model equations during each iteration. The facility production rate is calculated using the following equation:

Equation_Apx A-7.

$$PV_{site} = \frac{PV}{N_s}$$

Where:

PV	=	Production volume (kg/year)
N_s	=	Number of sites (sites)
PV_{site}	=	Facility production rate (kg/site-year)

EPA assumed that one imported container was unloaded per day, thus the number of release days in a single year is also equivalent to the number of import containers unloaded for repackaging in a single year. The equation to calculate the number of import containers is in Appendix A.2.4.

A.2.4 Number of Containers per Year

EPA assumed that facilities unloaded one imported drum in a single day for repackaging. The Agency assumes 1,2-dichloroethane is imported in its pure form at 100% concentration. The number of import containers of 1,2-dichloroethane used by a site per year is calculated using the following equation:

Equation_Apx A-8.

$$N_{cont\_yr} = \frac{PV}{N_s * \rho_{1,1-DCA} * \left(0.00378541\ \frac{m^3}{gal}\right) * V_{import\_cont}}$$

Where:

PV	=	Production volume (kg/year)
$\rho_{1,2-DCA}$	=	1,2-dichloroethane density (kg/m^3)
V_{import_cont}	=	Import container volume (gal/container)
N_s	=	Number of sites (sites)
N_{cont_yr}	=	Annual number of import containers (container/site-year)

A.2.5 Release Days per Year

EPA calculated the number of release days in a single year using the following equation:

Equation_Apx A-9.

$$RD = \frac{PV_{site}}{\rho_{1,1-DCA} * \left(0.00378541\ \frac{m^3}{gal}\right) * V_{import\_cont}}$$

Where:

RD	=	Release days or Number of import containers (days/site-yr or containers/site-yr)
$\rho_{1,2-DCA}$	=	1,2-dichloroethane density (kg/m^3)
V_{import_cont}	=	Import container volume (gal/container)

As described in Appendix A.2.4, EPA assumed that the number of import containers unloaded in a single operating day was one. Therefore, the number of release days is equivalent to the number of import containers, with a range of 24 to 119.

A.2.6 Operating Hours and Exposure Durations

EPA estimated operating hours and exposure durations using calculations and parameters provided by the ESD on Transport and Storage of Chemicals (OECD, 2009b) and *ChemSTEER User Guide* (U.S. EPA, 2015). The operating time for release and exposure activities associated with unloading (release source 1 and 4; exposure points A and C) are calculated using the following equation:

Equation_Apx A-10.

$$Time_{RP1/RP4} = \frac{1}{RATE_{fill\_drum}}$$

Where:

$Time_{RP1/RP4}$	=	Operating time for release sources 1 and 4 (h/container)
$RATE_{fill\_drum}$	=	Fill rate of drum (containers/h)

For the emptying of drums, the *ChemSTEER User Guide* (U.S. EPA, 2015) indicates a drum fill rate of 20 drums per hour based on the Chemical Engineering Branch Manual for the Preparation of Engineering Assessments, Volume 1 [CEB Manual) (CEB, 1991). EPA assumed that one drum is imported and repackaged in a single operating day; therefore, equating the number of import containers received in a single year to the number of release days per year. For the cleaning of drums, the *ChemSTEER User Guide* (U.S. EPA, 2015) uses the same drum fill rate as emptying drums to estimate an exposure duration. EPA did not identify any other information on drum fill rates; therefore, the Agency used a single deterministic value for fill rate.

The operating hours for both release source 3 and exposure point B is calculated using the following equation:

Equation_Apx A-11.

$$Time_{RP3} = \frac{V_{import\_cont}}{V_{fill\_cont} * Rate_{fill_{smallcont}} * RD}$$

Where:

$Time_{RP3}$	=	Operating time for release source 3 (h/site-day)
V_{import_cont}	=	Import container volume (gal/container)
V_{fill_cont}	=	Small container volume (gal/container)
$RATE_{fill\_smallcont}$	=	Fill rate of small container (containers/h)
RD	=	Release days or number of import containers (days/site-yr or containers/site-yr)

For filling small containers, see Appendix A.2.11 for details on the distribution of small container volume and Appendix A.2.12 for details on the small container fill rate. Generally, EPA calculated the duration of filling small containers using the container volume and fill rate from the *ChemSTEER User Guide* (U.S. EPA, 2015). The calculated small container fill duration was used for both the release source (operating hours rate for release source 3) and exposure point (exposure duration for exposure point B).

A.2.7 Air Speed

Baldwin and Maynard measured indoor air speeds across a variety of occupational settings in the United Kingdom (Baldwin and Maynard, 1998), specifically, 55 work areas were surveyed. EPA analyzed the air speed data from Baldwin and Maynard and categorized the air speed surveys into settings representative of industrial facilities and representative of commercial facilities. The Agency fit separate distributions for these industrial and commercial settings and used the industrial distribution for this OES.

EPA fit a lognormal distribution for the dataset as consistent with the authors' observations that the air speed measurements within a surveyed location were lognormally distributed and the population of the mean air speeds among all surveys were lognormally distributed (Baldwin and Maynard, 1998). Because lognormal distributions are bound by zero and positive infinity, EPA truncated the distribution at the largest observed value among all of the survey mean air speeds.

EPA fit the air speed surveys representative of industrial facilities to a lognormal distribution with the following parameter values: mean of 22.414 cm/s and standard deviation of 19.958 cm/s. In the model, the lognormal distribution is truncated at a minimum allowed value of 1.3 cm/s and a maximum allowed value of 202.2 cm/s (largest surveyed mean air speed observed in Baldwin and Maynard) to prevent the model from sampling values that approach infinity or are otherwise unrealistically small or large (Baldwin and Maynard, 1998).

Baldwin and Maynard only presented the mean air speed of each survey. The authors did not present the individual measurements within each survey. Therefore, these distributions represent a distribution of mean air speeds and not a distribution of spatially variable air speeds within a single workplace setting. However, a mean air speed (averaged over a work area) is the required input for the model. EPA converted the units to ft/min prior to use within the model equations.

A.2.8 Container Residue Loss Fraction

EPA previously contracted PEI Associates, Inc. (PEI) to conduct a study for providing estimates of potential chemical releases during cleaning of process equipment and shipping containers (PEI Associates, 1988). The study used both a literature review (analyzing cleaning practices and release data) and a pilot-scale experiment to determine the amount of residual material left in vessels. The data from literature and pilot-scale experiments addressed different conditions for the emptying of containers and tanks, including various bulk liquid materials, different container constructions (*e.g.,* lined steel drums or plastic drums), and either a pump or pour/gravity-drain method for emptying. EPA reviewed the pilot-scale data from PEI and determined a range and average percentage of residual material remaining in vessels following emptying from drums by either pumping or pouring as well as tanks by gravity-drain (PEI Associates, 1988).

EPA previously used the study results to generate default central tendency and high-end loss fraction values for the residual models (*e.g.,* EPA/OPPT Small Container Residual Model, EPA/OPPT Drum Residual Model) provided in the *ChemSTEER User Guide* (U.S. EPA, 2015). The Agency used a combination of the PEI study results and that user guide default loss fraction values to develop probability distributions for various container sizes.

Specifically, EPA paired the data from the PEI study such that the residuals data for emptying drums by pouring was aligned with the default central tendency and high-end values from the EPA/OPPT Small Container Residual Model, and the residuals data for emptying drums by pumping was aligned with the default central tendency and high-end values from the EPA/OPPT Drum Residual Model. The Agency applied the EPA/OPPT Small Container Residual Model to containers with capacities less than 20 gallons, and the EPA/OPPT Drum Residual Model to containers with capacities between 20 and 100 gallons (U.S. EPA, 2015).

For unloading drums via pouring, the PEI study experiments showed average container residuals in the range of 0.03 to 0.79% with a total average of 0.32% (PEI Associates, 1988). The EPA/OPPT Small Container Residual Model recommends a default central tendency loss fraction of 0.3% and a high-end loss fraction of 0.6% (U.S. EPA, 2015). For unloading drums by pumping, the PEI study experiments showed average container residuals in the range of 1.7% to 4.7% with a total average of 2.6% (PEI Associates, 1988).

The EPA/OPPT Drum Residual Model from the *ChemSTEER User Guide* recommends a default central tendency loss fraction of 2.5% and a high-end loss fraction of 3.0% (U.S. EPA, 2015). The underlying distribution of the loss fraction parameter for small containers or drums is not known; therefore, EPA assigned a triangular distribution defined by the estimated lower bound, upper bound, and mode of the parameter values. The Agency assigned the mode and upper-bound values for the loss fraction triangular distributions using the central tendency and high-end values from the respective *ChemSTEER User Guide* (U.S. EPA, 2015). EPA assigned the lower-bound values for the triangular distributions using the minimum average percent residual measured in the PEI study for the respective drum emptying technique (pouring or pumping) (PEI Associates, 1988).

A.2.9 Diameters of Opening

The *ChemSTEER User Guide* indicates diameters for the openings for various vessels that may hold liquids in order to calculate vapor generation rates during different activities (U.S. EPA, 2015). In the simulation developed for the Repackaging OES based on the ESD for Transport and Storage of Chemicals (OECD, 2009b), EPA used the default diameters of vessels from the *ChemSTEER User Guide* for container cleaning.

For container cleaning activities, the *ChemSTEER User Guide* indicates a single default value of 5.08 cm (U.S. EPA, 2015). Therefore, EPA could not develop a distribution of values for this parameter and used the single value 5.08 cm from that user guide.

A.2.10 Saturation Factor

The Chemical Engineering Branch Manual for the Preparation of Engineering Assessments, Volume 1 (CEB Manual) indicates that during splash filling, the saturation concentration was reached or exceeded by misting with a maximum saturation factor of 1.45 (CEB, 1991). The CEB Manual indicates that saturation concentration for bottom filling was expected to be about 0.5 (CEB, 1991). The underlying distribution of this parameter is not known; therefore, EPA assigned a triangular distribution based on the lower bound, upper bound, and mode of the parameter. Because a mode was not provided for this parameter, EPA also assigned a mode value of 0.5 for bottom filling as bottom filling minimizes volatilization (CEB, 1991). This value also corresponds to the typical value provided in the *ChemSTEER User Guide* for the EPA/OAQPS AP-42 Loading Model (U.S. EPA, 2015).

A.2.11 Container Size

The *ChemSTEER User Guide* (U.S. EPA, 2015) indicates a range of 20 to less than 100 gallons for the volume capacity of drums modeled in container-related activities, and the ESD for Transport and Storage of Chemicals (OECD, 2009b) suggests nearly 80% of all steel drums in the United States have a capacity of 55 gallons. The underlying distribution import drum sizes is not known; therefore, EPA assigned a lower bound of 20 gallons, an upper bound of 100 gallons, and a mode of 55 gallons for the import container volume distribution.

The *ChemSTEER User Guide* (U.S. EPA, 2015) indicates a range of 5 to less than 20 gallons for the volume capacity of small containers modeled in container-related activities with 5 gallons as the default volume size. Therefore, EPA assigned a lower bound of 5 gallons, an upper bound of 20 gallons, and a mode of 5 gallons for the small container volume distribution.

A.2.12 Container Fill Rates

The *ChemSTEER User Guide* (U.S. EPA, 2015) provides a typical fill rate of 20 containers per hour for containers with 20 to 100 gallons of liquid and a typical fill rate of 60 containers per hour for containers with less than 20 gallons of liquid.

A.3 Laboratory Chemical Model Approach and Parameters

This appendix presents the modeling approach and equations used to estimate environmental releases for 1,2-dichloroethane during the Commercial Use as a Laboratory Chemical OES. This approach utilized the Use of laboratory chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b) combined with Monte Carlo.

Based on the GS, EPA identified the following release sources from laboratory operations:

- Release source 1: Release to air from transferring volatile chemicals from transport containers
- Release source 2: Release to air, water, incineration, or landfill from transferring solid powders (not assessed)
- Release source 3: Release to water, incineration, or land from cleaning or disposal of transport containers
- Release source 4: Release to air from cleaning containers used for volatile chemicals
- Release source 5: Labware equipment cleaning residuals released to water, incineration, or landfill
- Release source 6: Release to air during labware equipment cleaning for volatile chemicals
- Release source 7: Release to air from laboratory analyses for volatile chemicals
- Release source 8: Release to water, incineration, or landfill from laboratory waste disposal

Environmental releases for 1,2-dichloroethane during use as a laboratory chemical are a function of 1,2-dichloroethane's physical properties, container size, mass fractions, and other model parameters. While some parameters are fixed, others are expected to vary. EPA used a Monte Carlo simulation to capture variability in the following model input parameters: air speed, saturation factor, loss factor, container sizes, operating days, daily throughput of solutions, and frequency of release. The Agency used the outputs from a Monte Carlo simulation with 100,000 iterations and the Latin Hypercube sampling method in @Risk to calculate release amounts and exposure concentrations for this OES.

A.3.1 Model Equations

Table_Apx A-3 provides the models and associated variables used to calculate environmental releases for each release source within each iteration of the Monte Carlo simulation. EPA used these environmental releases to develop a distribution of release outputs for the Laboratory Chemical OES. The variables used to calculate each of the following values include deterministic or variable input parameters. The values for these variables are provided in Appendix A.3.2. The Monte Carlo simulation calculated the total 1,2-dichloroethane release (by environmental media) across all release sources during each iteration of the simulation. EPA then selected 50th and 95th percentile values to estimate the central tendency and high-end releases, respectively.

Table_Apx A-3. Models and Variables Applied for Release Sources in Laboratory Chemical OES

Release Source	Model(s) Applied	Variables Used
Release source 1: Release during unloading of liquid	EPA/OAQPS AP-42 Loading Model (Equation_Apx A-3)	Vapor Generation Rate: $F_{1,2-DCA}$; VP; $F_{saturation\_unloading}$; $MW_{1,2-DCA}$; Q_{cont}; R; T; $RATE_{fill\ smallcont}$ Operating Time: $RATE_{fill\_smallcont}$; $N_{cont\ unload\ yr}$; OP_{days}
Release source 2: Release during unloading of solids	Not assessed; release is not expected since 1,2-dichloroethane is assumed to be managed as a liquid	Not applicable
Release source 3: Release from cleaning transport container	EPA/OPPT Small Container Residual Model (Equation_Apx A-5)	$Q_{chem\ site\ day\ (recalc)}$; $F_{loss\_smallcont}$; OP_{days}
Release source 4: Open surface losses to air during container cleaning	EPA/OPPT Penetration Model or EPA/OPPT Mass Transfer Coefficient Model, based on air speed (Equation_Apx A-1 and Equation_Apx A-2)	Vapor Generation Rate: $F_{1,2-DCA}$; $MW_{1,2-DCA}$; VP; $RATE_{air\_speed}$; $D_{container}$; T; P Operating Time: $RATE_{fill\_smallcont}$; $N_{cont\ unload\ yr}$; OP_{days}
Release source 5: Labware equipment cleaning	EPA/OPPT Multiple Process Residual Model (Equation_Apx A-5)	$Q_{chem\ site\ day\ (recalc)}$; F_{loss_equip}; OP_{days}
Release source 6: Open surface losses during equipment cleaning	EPA/OPPT Penetration Model or EPA/OPPT Mass Transfer Coefficient Model, based on air speed (Equation_Apx A-1 and Equation_Apx A-2)	Vapor Generation Rate: $F_{1,2-DCA}$; $MW_{1,2-DCA}$; VP; $RATE_{air\_speed}$; $D_{container}$; T; P Operating Time: OH_{equip}
Release source 7: Releases to air during laboratory analyses	EPA/OPPT Penetration Model or EPA/OPPT Mass Transfer Coefficient Model, based on air speed (Equation_Apx A-1 and Equation_Apx A-2)	Vapor Generation Rate: $F_{1,2-DCA}$; $MW_{1,2-DCA}$; VP; $RATE_{air\_speed}$; $D_{container\ lab\ analysis}$; T; P Operating Time: $OH_{sampling}$
Release source 8: Release from disposal	No model applicable; all chemicals used in the laboratory are expected to be disposed at the end of each working day. Remaining chemical not released from the previous release sources is released here	Not applicable
OES = occupational exposure scenario; OAQPS = EPA Office of Air Quality Planning and Standards; OPPT = EPA Office of Pollution Prevention and Toxics		

A.3.2 Model Input Parameters

Table_Apx A-4 summarizes the parameters/values for the laboratory chemical Monte Carlo simulation.

Table_Apx A-4. Summary of Parameter Values and Distributions Used in the Laboratory Chemical Model

Input Parameter	Symbol	Unit	Deterministic Values	Uncertainty Analysis Distribution Parameters				Rationale/Basis
				Lower Bound	Upper Bound	Mode	Distribution Type	
Air Speed	$RATE_{air\_speed}$	cm/s	10	1.3	202.2	–	Lognormal	See Section A.3.8
Loss Fraction for Small Containers	$F_{loss\_smallcont}$	kg/kg	0.003	0.0003	0.006	0.003	Triangular	See Section A.3.9
Saturation Factor Unloading	$F_{saturation\_unloading}$	unitless	0.5	0.5	1.45	0.5	Triangular	See Section A.3.11
Daily Throughput of Stock Solutions	$Q_{stock\_site\_day}$	mL/site-day	2,000	0.5	4,000	2,000	Triangular	See Section A.3.4
Diameter of Laboratory Analysis Containers	$D_{container\_lab\_analysis}$	cm	2.5	2.5	10	2.5	Triangular	See Section A.3.14
Operating Days	$TIME_{operating\_days}$	days/yr	260	173	261	260	Triangular	See Section A.3.6
Production Volume Assessed	PV_lb	lb/yr	25,000	–	–	–	–	"What-if" scenario input
Production Volume	PV	kg/yr	11,340	–	–	–	–	PV input converted to kg
Temperature	T	K	298	–	–	–	–	Process parameter
Pressure (torr)	P_torr	torr	760	–	–	–	–	Process parameter
Pressure (atm)	P_atm	Atm	1	–	–	–	–	Process parameter
Gas Constant	R	L*torr/mol-K	62.36367	–	–	–	–	Universal constant
1,2-dichloroethane Vapor Pressure	VP	torr	78.9	–	–	–	–	Physical property
1,2-dichloroethane Molecular Weight	$MW_{1,2\text{-}dichloroethane}$	g/mol	98.96	–	–	–	–	Physical property
Molar Volume	$Vm_{1,2\text{-}dichloroethane}$	L/mol	24.45	–	–	–	–	Physical property
Fill Rate of Small Container	$RATE_{fill\_smallcont}$	containers/h	60	–	–	–	–	See Section A.3.12
Container Volume	Q_{cont}	gal/container	1	–	–	–	–	See Section A.3.10
Loss Fraction for Equipment Cleaning	F_{loss_equip}	kg/kg	0.02	–	–	–	–	See Section A.3.13
Hours per Equipment Cleaning	OH_{equip_clean}	hr	4	–	–	–	–	See Section A.3.7
Hours per Analysis Sampling	$OH_{sampling}$	hr	1	–	–	–	–	See Section A.3.7

Input Parameter	Symbol	Unit	Deterministic Values	Uncertainty Analysis Distribution Parameters				Rationale/Basis
				Lower Bound	Upper Bound	Mode	Distribution Type	
Diameter of Opening for Container	$D_{container}$	cm	5.08	–	–	–	–	See Section A.3.14
Product Density	$\rho_{product}$	kg/m^3	–	Multiple distributions depending on product data			Uniform	See Section A.3.15
Product Concentration	$F_{1,2\text{- dichloroethane\_prod}}$	kg/kg	–	Multiple distributions depending on product data			Uniform	See Section A.3.15

A.3.3 Number of Sites

The Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b) provides a method of determining the number of laboratory sites based on the total annual production volume and annual throughput per site of the chemical of interest. The total annual production volume is 182,640 kg/year (see Section 3.10.2). The annual throughput per site of 1,2-dichloroethane is determined according to Appendix A.3.4.

Equation_Apx A-12.

$$N_{sites} = \frac{PV}{Q_{chem\ site\ yr}}$$

Where:

N_{sites}	=	Number of sites (site)
PV	=	Annual production volume (kg/year)
$Q_{chem\ site\ yr}$	=	Annual throughput of 1,2-dichloroethane (kg/site-yr)

A.3.4 Throughput Parameters

The Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b) provides daily throughput of 1,2-dichloroethane required for laboratory stock solutions. According to the GS, laboratory liquid use rate ranges from 0.5 mL up to 4 L per day. Laboratory stock solutions are used for multiple analyses and eventually need to be replaced. The expiration or replacement times range from daily to 6 months (U.S. EPA, 2023b). For this scenario, EPA assumes stock solutions are prepared daily. Therefore, EPA assigned a triangular distribution for the daily throughput of laboratory stock solutions with upper and lower bounds corresponding to the high and low throughputs, 4,000 and 0.5 mL respectively, with a mode of 2,000 mL The daily throughput of 1,2-dichloroethane is calculated using the following equation:

Equation_Apx A-13.

$$Q_{chem\ site\ day} = \frac{Q_{stock\ site\ day}}{\rho_{product} * F_{1,1-DCA\ prod} * 1000\,\frac{L}{m^3} * 1000\,\frac{mL}{L}}$$

Where:

$Q_{chem\ site\ day}$	=	Daily throughput of 1,2-dichloroethane (kg/site-day)
$Q_{stock\ site\ day}$	=	Daily throughput of Stock Solutions (kg/site-day)
$\rho_{product}$	=	Product density (kg/m^3)
F_{TCEP_prod}	=	Weight fraction of 1,2-dichloroethane in product (unitless)

The annual throughput of 1,2-dichloroethane is calculated using Equation_Apx A-14 by multiplying the daily throughput by the number of operating days. The number of operating days is determined according to Appendix A.3.6.

Equation_Apx A-14.

$$Q_{chem\ site\ yr} = Q_{chem\ site\ day} * TIME_{operating\ days}$$

Where:

$TIME_{operating\ days}$	=	Operating days (days/year)

The annual throughput of 1,2-dichloroethane cannot exceed the production volume limit of 25,000 lb/year. Therefore, in the event an iteration of the simulation does calculate an annual throughput greater than the production volume limit, EPA set the number of sites equal to one, and the annual throughput equal to the total annual production volume. The model then recalculated the number of operating days using Equation_Apx A-15 below.

Equation_Apx A-15.

$$TIME_{operating\ days\ (recalc)} = \frac{PV}{N_{sites} * Q_{chem\ site\ day}}$$

Where:

$TIME_{operating\ days\ (recalc)}$ = Recalculated number of operating days (days/year)

A.3.5 Number of Containers Unloaded Annually per Site

EPA estimated the number of containers unloaded annually per site using the Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b), as well as other parameters. The total number of containers unloaded annually per site is calculated based on the annual throughput (see Appendix A.3.4), product concentration (see Appendix A.3.15), and container volume (see Appendix A.3.10). The total number of containers unloaded annually per site is calculated using Equation_Apx A-16 below.

Equation_Apx A-16.

$$N_{cont\ unload\ yr} = \frac{Q_{chem\ site\ yr}}{F_{1,1-DCA\ prod} * Q_{cont}}$$

Where:

$N_{cont\ unload\ yr}$ = Number of Containers Unloaded Annually per site (container/site-yr)
Q_{cont} = Container volume (gal/container)

A.3.6 Operating Days

The Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b), estimates the number of operating days from employment data obtained through the U.S. Bureau of Labor Statistics (BLS) Occupational Employment Statistics. The U.S. BLS assumes the operating duration per NAICS code or a "year-round, full-time" hours figure, to be 2,080 hours (U.S. EPA, 2023b). Using this annual duration and an assumed daily shift lengths of 8,10, and 12 hours/day, EPA calculated 260, 208, and 174 operating days/year, respectively.

A.3.7 Operating Hours

EPA estimated operating hours using the Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b), as well as other parameters and equations. The operating hours for release sources 1 and 4 are calculated using the number of product containers used at the site, the container fill rate, and operating days (see Appendix A.3.6A.3.6). The following equation provides the calculation:

Equation_Apx A-17.

$$Time_{RP1/4} = \frac{N_{cont\ unload\ yr}}{TIME_{operating\ days\ (recalc)} * RATE_{fill\_smallcont}}$$

Where:

$Time_{RP1/4}$ = Operating times for release sources 1 and 4 (h/site-day)
$RATE_{fill\_smallcont}$ = Fill rate of small container (containers/h)

For equipment cleaning, the Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b) uses the multiple vessel model with a default release duration of 4 hours per day. Therefore, EPA assumes 4 hours per day as the release for release source 6.

For laboratory analyses, the Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b) provides a default release estimate of 1 hour per day based on the default for sampling. EPA assumes 1 hour per day for release source 7.

A.3.8 Air Speed

Baldwin and Maynard measured indoor air speeds across a variety of occupational settings in the United Kingdom (Baldwin and Maynard, 1998). Fifty-five work areas were surveyed across a variety of workplaces. EPA analyzed the air speed data from Baldwin and Maynard and categorized the air speed surveys into settings representative of industrial facilities and representative of commercial facilities. The Agency fit separate distributions for these industrial and commercial settings and used the industrial distribution for this OES.

EPA fit a lognormal distribution for the dataset as consistent with the authors' observations that the air speed measurements within a surveyed location were lognormally distributed and the population of the mean air speeds among all surveys were lognormally distributed (Baldwin and Maynard, 1998). Because lognormal distributions are bound by zero and positive infinity, EPA truncated the distribution at the largest observed value among all of the survey mean air speeds.

The Agency fit the air speed surveys representative of industrial facilities to a lognormal distribution with the following parameter values: mean of 22.414 cm/s and standard deviation of 19.958 cm/s. In the model, the lognormal distribution is truncated at a minimum allowed value of 1.3 cm/s and a maximum allowed value of 202.2 cm/s (largest surveyed mean air speed observed) to prevent the model from sampling values that approach infinity or are otherwise unrealistically small or large (Baldwin and Maynard, 1998).

Baldwin and Maynard only presented the mean air speed of each survey. The authors did not present the individual measurements within each survey. Therefore, these distributions represent a distribution of mean air speeds and not a distribution of spatially variable air speeds within a single workplace setting. However, a mean air speed (averaged over a work area) is the required input for the model. EPA converted the units to ft/min prior to use within the model equations.

A.3.9 Container Residue Loss Fraction

EPA previously PEI to conduct a study for providing estimates of potential chemical releases during cleaning of process equipment and shipping containers (PEI Associates, 1988). The study used both a literature review of cleaning practices and release data as well as a pilot-scale experiment to determine the amount of residual material left in vessels. The data from literature and pilot-scale experiments addressed different conditions for the emptying of containers and tanks, including various bulk liquid materials, different container constructions (*e.g.,* lined steel drums or plastic drums), and either a pump or pour/gravity-drain method for emptying. EPA reviewed the pilot-scale data from PEI and determined a range and average percentage of residual material remaining in vessels following emptying from drums by either pumping or pouring as well as tanks by gravity-drain (PEI Associates, 1988).

EPA previously used the study results to generate default central tendency and high-end loss fraction values for the residual models (*e.g.,* EPA/OPPT Small Container Residual Model, EPA/OPPT Drum Residual Model) provided in the *ChemSTEER User Guide* (U.S. EPA, 2015). Previously, EPA adjusted the default loss fraction values based on rounding the PEI study results or due to policy decisions. The Agency used a combination of the PEI study results and *ChemSTEER User Guide* default loss fraction values to develop probability distributions for various container sizes.

Specifically, EPA paired the data from the PEI study such that the residuals data for emptying drums by pouring was aligned with the default central tendency and high-end values from the EPA/OPPT Small Container Residual Model, and the residuals data for emptying drums by pumping was aligned with the default central tendency and high-end values from the EPA/OPPT Drum Residual Model. The Agency applied the EPA/OPPT Small Container Residual Model to containers with capacities less than 20 gallons, and the EPA/OPPT Drum Residual Model to containers with capacities between 20 and 100 gallons (U.S. EPA, 2015). For unloading drums by pouring, the PEI study experiments showed average container residuals in the range of 0.03 to 0.79% with a total average of 0.32% (PEI Associates, 1988). The EPA/OPPT Small Container Residual Model recommends a default central tendency loss fraction of 0.3% and a high-end loss fraction of 0.6% (U.S. EPA, 2015). For unloading drums by pumping, the PEI study experiments showed average container residuals in the range of 1.7 to 4.7% with a total average of 2.6% (PEI Associates, 1988).

The EPA/OPPT Drum Residual Model from the *ChemSTEER User Guide* recommends a default central tendency loss fraction of 2.5% and a high-end loss fraction of 3.0% (U.S. EPA, 2015). The underlying distribution of the loss fraction parameter for small containers or drums is not known; therefore, EPA assigned a triangular distribution defined by the estimated lower bound, upper bound, and mode of the parameter values. The Agency assigned the mode and upper bound values for the loss fraction triangular distributions using the central tendency and high-end values from the respective *ChemSTEER User Guide* model (U.S. EPA, 2015). The Agency assigned the lower bound values for the triangular distributions using the minimum average percent residual measured in the PEI study for the respective drum emptying technique (pouring or pumping) (PEI Associates, 1988).

A.3.10 Product Container Volume

EPA did not identify container sizes for 1,2-dichloroethane use in laboratories from available literature. Therefore, EPA assumes that 1,2-dichloroethane is transported in 1 L containers to small vials for use per the Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b).

A.3.11 Saturation Factor

The CEB Manual indicates that during splash filling, the saturation concentration was reached or exceeded by misting with a maximum saturation factor of 1.45 (CEB, 1991). The Manual indicates that saturation concentration for bottom filling was expected to be about 0.5 (CEB, 1991). The underlying distribution of this parameter is not known; therefore, EPA assigned a triangular distribution based on the lower bound, upper bound, and mode of the parameter. Because a mode was not provided for this parameter, EPA assigned a mode value of 0.5 for bottom filling as bottom filling minimizes volatilization (CEB, 1991). This value also corresponds to the typical value provided in the *ChemSTEER User Guide* for the EPA/OAQPS AP-42 Loading Model (U.S. EPA, 2015).

A.3.12 Container Fill Rates

The *ChemSTEER User Guide* (U.S. EPA, 2015) provides a typical fill rate of 60 containers per hour for containers with less than 20 gallons of liquid.

A.3.13 Equipment Cleaning Loss Fraction

The Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b) recommends using the EPA/OPPT Multiple Process Residual Model to estimate the releases from equipment cleaning. The model, as detailed in the *ChemSTEER User Guide* (U.S. EPA, 2015) provides an overall loss fraction of 2% from equipment cleaning.

A.3.14 Diameters of Opening

The *ChemSTEER User Guide* indicates diameters for the openings for various vessels that may hold liquids in order to calculate vapor generation rates during different activities (U.S. EPA, 2015). In the simulation developed for the Use in Laboratory Chemicals OES based on the Use of Laboratory Chemicals – Generic Scenario for Estimating Occupational Exposures and Environmental Releases (U.S. EPA, 2023b), EPA used default diameters of vessels from the *ChemSTEER User Guide* for container and equipment cleaning, and laboratory analyses. For container and equipment cleaning, EPA assessed a single value of 5.08 cm (U.S. EPA, 2015). For laboratory analyses, EPA applied the EPA/OPPT Penetration Model and assumed two container sizes for sampling liquid product. For a typical release estimate, the model assumes sampling occurs from a 2.5 cm diameter bottle opening; and for a worst-case release estimate, it also assumes sampling occurs from a 10 cm diameter beaker opening. The underlying distribution for laboratory container sizes is not known; therefore, EPA assigned this parameter a triangular distribution with lower bound of 2.5 cm, upper bound or 10 cm, and mode of 2.5 cm.

A.3.15 Product Data (Concentration and Density)

EPA compiled 1,2-dichloroethane concentration and product density information from laboratory products containing 1,2-dichloroethane to develop distributions for concentration and density in the simulation. SDSs for 1,2-dichloroethane laboratory products provided a single value for the 1,2-dichloroethane concentration and product density in each product. Therefore, EPA used the values from the SDSs as discrete input parameters. The Agency did not have information on the prevalence or market share of different laboratory products in commerce; therefore, EPA assumed a uniform distribution of laboratory products. The model first selects a laboratory product for the iteration and then based on the product selected, selects a concentration and density associated with that product. Table_Apx A-5 provides the 1,2-dichloroethane-containing laboratory products used in the model along with product-specific concentration and density values used.

Table_Apx A-5. 1,2-Dichloroethane Concentrations and Densities for Commercial Use as a Laboratory Chemical OES

Product	1,2-Dichloroethane Concentration (Mass Fraction)	Concentration Distribution	Density (kg/m^3)	Source Reference(s)
1,2-Dichloroethane	0.95 to 1	Distribution (range)	1,250	(Thermo Fisher, 2012)
36279/USP Class 1 Residual Solvent Mixture	0.025	Discrete (single value)	1,104	(R Corporation, 2019 6286584)
5 Component Mix in Dimethyl Sulfoxide (Stock VO)	0.025	Discrete (single value)	1,128	(Spex Certiprep LLC, 2018 6284287)
Residual Solvents Mixture Class 1 in DMSO	0.025	Discrete (single value)	12,567	(Cerilliant, 2012)
DX0796	0.90 to 1	Distribution (range)	1,250	(MilliporeSigma, 2016)

Product	1,2-Dichloroethane Concentration (Mass Fraction)	Concentration Distribution	Density (kg/m^3)	Source Reference(s)
1,2-Dichloroethane	1	Discrete (single value)	1,256	(Ladd Research, 2018)
POLYVINYL FORMAL SOLUTION	0.91 to 1	Distribution (range)	1,256	(Polysciences Inc, 2013)
OES = occupational exposure scenario				

A.4 Vapor Degreasing Model Approach and Parameters

This appendix presents the modeling approach and equations used to estimate environmental releases and occupational exposures for 1,2-dichloroethane during the Industrial and Commercial Non-Aerosol Cleaning/Degreasing OES. The release approach utilizes the ESD on the Use of Vapour Degreasers (OECD, 2017) combined with Monte Carlo simulation (a type of stochastic simulation).

Based on the ESD, EPA identified the following release sources from vapor degreasing operations:

- Release source 1: Transfer operation losses to fugitive or stack air from unloading transport containers
- Release source 2: Container residue releases to wastewater treatment, incineration, or landfill
- Release source 3: Vapor degreasing operations to fugitive or stack air
- Release source 4: Equipment cleaning and waste solvent disposal to incineration
- Release source 5: Vapor degreasing wastewater to wastewater treatment

An individual model input parameter could either have a discrete value or a distribution of values. EPA assigned statistical distributions based on available literature data. A Monte Carlo simulation (a type of stochastic simulation) was conducted to capture variability in the model input parameters. The simulation was conducted using the Latin hypercube sampling method in @Risk Industrial Edition, Version 7.0.0. The Latin hypercube sampling method is a statistical method for generating a sample of possible values from a multi-dimensional distribution. Latin hypercube sampling is a stratified method, meaning it guarantees that its generated samples are representative of the probability density function (variability) defined in the model. EPA performed the model at 100,000 iterations to capture the range of possible input values (*i.e.,* including values with low probability of occurrence).

Model results from the Monte Carlo simulation are presented as 95th and 50th percentile values. The statistics were calculated directly in @Risk. The 95th percentile value was selected to represent high-end release and exposure levels, whereas the 50th percentile value was selected to represent typical release and exposure levels. The following subsections detail the model design equations and parameters for the Vapor Degreasing OES.

A.4.1 Model Equations

Table_Apx A-6 provides the models and associated variables used to calculate environmental releases for each release source within each iteration of the Monte Carlo simulation. EPA used these environmental releases to develop a distribution of release outputs for the Vapor Degreasing OES. The variables used to calculate each of the following values include deterministic or variable input parameters. The values for these variables are provided in Appendix A.4.2. The Monte Carlo simulation calculated the total 1,2-dichloroethane release (by environmental media) across all release sources during each iteration of the simulation. EPA then selected 50th and 95th percentile values to estimate the central tendency and high-end releases, respectively.

Table_Apx A-6. Models and Variables Applied for Release Sources in the Vapor Degreasing OES

Release Source	Model(s) Applied	Variables Used
Release source 1: Transfer operation losses to air from unloading transport containers	EPA/OAQPS AP-42 Loading Model (Equation_Apx A-3)	Vapor Generation Rate: $F_{1,2-DCA}$; VP; $F_{saturation\_unloading}$; $MW_{1,2-DCA}$; Q_{cont}; R; T; $RATE_{fill\ smallcont}$ Operating Time: $RATE_{fill\_smallcont}$; $N_{cont\ unload\ yr}$; OP_{days}
Release source 2: Container residue releases	EPA/OPPT Drum Residual Model (Equation_Apx A-5)	V_{drum}; F_{drum_disp}
Release source 3: Vapor degreasing operations	Equation_Apx A-18	$Q_{chem\ site\ day\ (recalc)}$; LF_{air}
Release source 4: Equipment cleaning and waste solvent disposal	Equation_Apx A-19	$Q_{chem\ site\ day\ (recalc)}$; $N_{container\_unload\_site\_yr}$; $FT_{changeout}$
Release source 5: Vapor degreasing wastewater	Equation_Apx A-20	WS_{chem};CF; $V_{wastewater}$
OES = occupational exposure scenario; OAQPS = EPA Office of Air Quality Planning and Standards; OPPT = EPA Office of Pollution Prevention and Toxics		

Equation_Apx A-18.

$$Elocal_{evap} = Q_{chem\_site\_day} \times LF_{air} \times (1 - EF_{control})$$

Where:

$Elocal_{evap}$	=	Daily release of chemical to air due to evaporative losses (kg/site-day)
$Q_{chem\_site\_day}$	=	Daily use rate of chemical of interest (kg/site-day)
LF_{air}	=	Fraction of chemical evaporated to air (unitless)
$EF_{control}$	=	Engineering control efficiency (unitless)

Equation_Apx A-19.

$$Elocal_{incin} = \frac{Q_{chem_{site_{yr}}} - \left\{\left(Elocal_{air} + Elocal_{container\_residue}\right) \times N_{container_{unload\_site\_yr}}\right\} - \left\{\left(Elocal_{evap} + Elocal_{wastewater}\right) \times TIME_{operating\_days}\right\}}{FT_{changeout}}$$

Where:

$Elocal_{incin}$	=	Daily release of chemical to incineration (kg/site-day)
$Q_{chem\_site\_yr}$	=	Annual use rate of chemical of interest (kg/site-yr)
$Elocal_{air}$	=	Daily release of chemical to air from container unloading (kg/site-day)
$Elocal_{container\_residue}$	=	Daily release of chemical to air from container residue (kg/site-day)
$N_{container_{unload\_site\_yr}}$	=	Number of transport containers unloaded at each site per year (containers/site-yr)
$Elocal_{evap}$	=	Daily release of chemical to air due to evaporative losses during degreaser operation (kg/site-day)
$Elocal_{wastewater}$	=	Daily release of chemical from wastewater (kg/site-day)
$TIME_{operating\_days}$	=	Number of operating days (days/year)

$FT_{changeout}$	=	Frequency of solvent changeout (days/year)

Equation_Apx A-20.

$$Elocal_{wastewater} = WS_{chem} \times CF \times V_{wastewater} \times \frac{3.785\ L}{gal} \times \frac{kg}{1000\ grams}$$

Where:

$Elocal_{wastewater}$	=	Daily release of chemical from wastewater (kg/site-day)
WS_{chem}	=	Water solubility of the vapour degreasing chemical of interest (g/L)
CF	=	A factor to account for any variability, such as a known or estimated correction of the water solubility of the chemical or other corrections (unitless)
$V_{wastewater}$	=	Daily volume of wastewater discharged (gal/day)

A.4.2 Model Input Parameters

Table_Apx A-7 summarizes the model parameters and their values for the vapor degreasing chemical Monte Carlo simulation. Additional explanations of EPA's selection of the distributions for each parameter are provided following this table.

Table_Apx A-7. Summary of Parameter Values and Distributions Used in the Vapor Degreasing Release Model

Input Parameter	Symbol	Unit	Deterministic Values	Uncertainty Analysis Distribution Parameters				Rationale/Basis
				Lower Bound	Upper Bound	Mode	Distribution Type	
Operating Days	$TIME_{operating\_days}$	days/yr	296	258	365	296	Triangular	See Appendix A.4.3
Concentration of 1,2-Dichloroethane	F_{chem}	unitless	1	Multiple distributions depending on product data			Uniform	See Appendix A.4.4
Solvent Annual Use Rate	$Q_{solv\_site\_yr}$	kg/site-yr	2,083	78	79,120	2,083	Triangular	See Appendix A.4.5
Drum Volume	V_{drum}	gal	55	20	100	55	Triangular	See Appendix A.4.9
Fill Rate of Drums	$RATE_{fill\_drum}$	containers/h	20	–	–	–	–	
Saturation Factor During Unloading	$F_{saturation\_unloading}$	unitless	0.5	0.5	1.45	0.5	Triangular	See Appendix A.4.12
Loss Fraction for Vapor Degreaser	LF_{air}	kg/kg	0.81	0.0084	1	0.81	Triangular	See Appendix A.4.13
Fraction of Solvent Residue in Drum	F_{drum_disp}	kg/kg	0.025	0.017	0.03	0.025	Triangular	See Appendix A.4.14
Wastewater Loss Fraction	$LF_{wastewater}$	kg/kg	0.057	0.0057	0.057	–	Uniform	See Appendix A.4.15
Production Volume	PV	kg/yr	182,640	–	–	–	Uniform	"What-if" scenario input
Temperature	T	K	298	–	–	–	–	Process parameter
Pressure (torr)	P_torr	torr	760	–	–	–	–	Process parameter
Pressure (atm)	P_atm	Atm	1	–	–	–	–	Process parameter
Gas Constant	R	L*torr/mol-K	62.36367	–	–	–	–	Universal constant
1,2-Dichloroethane Vapor Pressure	VP	torr	78.9	–	–	–	–	Physical property
1,2-Dichloroethane Molecular Weight	$MW_{1,2\text{-}dichloroethane}$	g/mol	98.96	–	–	–	–	Physical property
Frequency of Solvent Changeout	$FT_{changeout}$	days/yr	26	–	–	–	–	See Appendix A.4.16
Correction Factor	CF	Kg/kg	1	–	–	–	–	See Appendix A.4.17
Daily Volume of Wastewater Discharged	$V_{wastewater}$	Gal/day	2	–	–	–	–	See Appendix A.4.18
Water Solubility	WS_{chem}	g/L	5.3	–	–	–	–	Physical property

A.4.3 Operating Days

The ESD on the Use of Vapor Degreasers (U.S. EPA, 2023b; OECD, 2017), estimates the number of operating days from employment data obtained through the 2017 NEI. The ESD suggests 259 to 364 days/year with a mode of 296 days/year. For the purpose of building the model distribution, 258 to 365 days/year were used, but they were assigned a probability of zero. The effective range in the simulation is 259 to 364 days/year.

A.4.4 Concentration of 1,2-Dichloroethane

EPA used a two-dimensional sampling technique to model the 1,2-dichloroethane weight fraction. A discrete distribution is used to model the frequency of occurrence of each product type. For each product, the concentration of 1,2-dichloroethane was reported as a range. EPA used a uniform distribution to model the 1,2-dichloroethane weight fraction within each product type. On each iteration of the simulation, the model executes each product's weight fraction distribution and the product frequency distribution. The model then reads the product selected from the product frequency distribution and selects the weight fraction that was generated from the corresponding product's weight fraction distribution. Table_Apx A-8 provides a summary of the reported 1,2-dichloroethane content reported in the safety data sheets and the fractional probability of each product type.

Table_Apx A-8. Summary of 1,2-Dichloroethane-Based Solvent Formulations

Source	1,2-Dichloroethane Weight (%)	Fractional Probability
(Pharmco Products, 2013)	90–100	0.50
(Occidental Chemical Corp, 2015)	99–100	0.50
	Total	**1.00**

A.4.5 Solvent Annual Use Rate

The ESD on the Use of Vapor Degreasers (U.S. EPA, 2023b; OECD, 2017) complies data on annual machine-level solvent use rates ($Q_{solv\_site\_yr}$). For the Post-MACT (Maximum Achievable Control Technology) scenario, the ESD estimates 78 to 79,120 kg solvent/year, with a 50th percentile value of 2,083 kg solvent/year.

A.4.6 1,2-Dichloroethane Annual Use Rate

Daily use rate of 1,2-dichloroethane can be calculated using the annual solvent rate and the concentration of 1,2-dichloroethane in the solvent, per Equation_Apx A-21:

Equation_Apx A-21.

$$Q_{\text{chem\_site\_yr}} = Q_{\text{solv\_site\_yr}} \times F_{chem}$$

A.4.7 Daily Use Rate of 1,2-Dichloroethane

Daily use rate of 1,2-dichloroethane can be calculated using the annual 1,2-dichloroethane rate and the number of operating days per year:

Equation_Apx A-22.

$$Q_{\text{chem\_site\_day}} = \frac{Q_{\text{chem\_site\_yr}}}{\text{TIME}_{\text{operating\_days}}}$$

Where:

$Q_{chem\_site\_day}$	=	Daily use rate of 1,2-dichloroethane (kg/site-day)
$Q_{chem\_site\_yr}$	=	Annual use rate of 1,2-dichloroethane (kg/site-yr)
$TIME_{operating\_days}$	=	Number of operating days for the degreasing machine (days/year)

A.4.8 Number of Sites

The ESD on the Use of Vapor Degreasers (OECD, 2017) provides a method of determining the number of sites based on the total annual production volume and annual throughput per site of the solvent. The number of facilities using the chemical of interest (N_{sites}) depends on the total annual production of the chemical of interest ($Q_{solv\_site\_yr}$), the daily use rate of the chemical of interest ($Q_{solv\_site\_day}$), and the annual operating days ($TIME_{operating\_days}$). Equation_Apx A-23 demonstrates how the number of facilities performing vapor degreasing operations using a chemical of interest could be determined.

Equation_Apx A-23.

$$N_{\mathrm{sites}} = \frac{Q_{\mathrm{solv\_site\_yr}}}{Q_{\mathrm{solv\_site\_day}} \times \mathrm{TIME}_{\mathrm{operating\_days}}}$$

Where:

N_{sites} [10]	=	Number of sites using the vapor degreasing chemical (sites)
Q_{chem_yr}	=	Annual production volume of vapor degreasing chemical (kg solvent/year)
$Q_{chem\_site\_day}$	=	Daily use rate of vapor degreasing chemical (kg solvent/site-day)
$TIME_{operating\_days}$	=	Number of operating days for degreasing machines (days/site-yr)

A.4.9 Drum Volume

The ESD on the Use of Vapor Degreasers (U.S. EPA, 2023b) recommends assuming 55-gallon drums for transport of vapor degreasing solvent.

A.4.10 Number of Containers Unloaded Annually per Site

The number of containers unloaded at each site annually can be estimated using Equation_Apx A-24:

Equation_Apx A-24.

$$N_{container\_\mathrm{unload\_site\_yr}} = \frac{Q_{\mathrm{chem\_site\_day}} \times \mathrm{TIME}_{\mathrm{operating\_days}}}{F_{\mathrm{chem}} \times V_{\mathrm{container}} \times \rho_{formulation} \times 3.785 \frac{L}{\mathrm{gal}}}$$

Where:

$N_{container\_unload\_site\_yr}$	=	Number of transport containers unloaded at each site per year (containers/site-yr)
$Q_{chem\_site\_day}$	=	Daily use rate of 1,2-dichloroethane (kg/site-day)
F_{chem}	=	Weight fraction of 1,2-dichloroethane in the formulation as received (kg/kg)

[10] The value for N_{sites} should be rounded up to the nearest integer value. $Q_{chem\_site\_day}$ should then be adjusted for the N_{sites} integer value (to avoid errors due to rounding) as follows:

$$Q_{\mathrm{chem\_site\_day}} = \frac{Q_{\mathrm{chem\_yr}}}{N_{\mathrm{sites}} \times \mathrm{TIME}_{\mathrm{operating\_days}}}$$

$TIME_{operating\_days}$	=	Number of operating days (days/year)
$V_{container}$	=	Volume of transport container (gal)
$\rho_{formulation}$	=	Density of chemical formulation (kg/L formulation)

A.4.11 Container Fill Rates

The *ChemSTEER User Guide* (U.S. EPA, 2015) provides a typical fill rate of 60 containers per hour for containers with less than 20 gallons of liquid.

A.4.12 Saturation Factor During Unloading

The CEB Manual indicates that during splash filling, the saturation concentration was reached or exceeded by misting with a maximum saturation factor of 1.45 (CEB, 1991). The Manual indicates that saturation concentration for bottom filling was expected to be about 0.5 (CEB, 1991). The underlying distribution of this parameter is not known; therefore, EPA assigned a triangular distribution based on the lower bound, upper bound, and mode of the parameter. Because a mode was not provided for this parameter, the Agency assigned a mode value of 0.5 for bottom filling as bottom filling minimizes volatilization (CEB, 1991). This value also corresponds to the typical value provided in the *ChemSTEER User Guide* for the EPA/OAQPS AP-42 Loading Model (U.S. EPA, 2015).

A.4.13 Loss Fraction for Vapor Degreaser

The ESD on the Use of Vapor Degreasers (U.S. EPA, 2023b) estimates solvent loss fractions of 0.0084 to 1.0, with a default central tendency of 0.81.

A.4.14 Fraction of Residue in Drum

EPA previously contracted for a study for providing estimates of potential chemical releases during cleaning of process equipment and shipping containers (PEI Associates, 1988). The study used both a literature review (analyzing cleaning practices and release data) and a pilot-scale experiment to determine the amount of residual material left in vessels. The data from literature and pilot-scale experiments addressed different conditions for the emptying of containers and tanks, including various bulk liquid materials, different container constructions (*e.g.,* lined steel drums or plastic drums), and either a pump or pour/gravity-drain method for emptying. EPA reviewed the pilot-scale data from PEI and determined a range and average percentage of residual material remaining in vessels following emptying from drums by either pumping or pouring as well as tanks by gravity-drain (PEI Associates, 1988).

EPA previously used the study results to generate default central tendency and high-end loss fraction values for the residual models (*e.g.,* EPA/OPPT Small Container Residual Model, EPA/OPPT Drum Residual Model) provided in the *ChemSTEER User Guide* (U.S. EPA, 2015). Previously, EPA adjusted the default loss fraction values based on rounding the PEI study results or due to policy decisions. The Agency used a combination of the PEI study results and *ChemSTEER User Guide* default loss fraction values to develop probability distributions for various container sizes.

Specifically, EPA paired the data from the PEI study such that the residuals data for emptying drums by pouring was aligned with the default central tendency and high-end values from the EPA/OPPT Small Container Residual Model, and the residuals data for emptying drums by pumping was aligned with the default central tendency and high-end values from the EPA/OPPT Drum Residual Model. The Agency applied the EPA/OPPT Small Container Residual Model to containers with capacities less than 20 gallons, and the EPA/OPPT Drum Residual Model to containers with capacities between 20 and 100 gallons (U.S. EPA, 2015).

For unloading drums via pouring, the PEI study experiments showed average container residuals in the range of 0.03 to 0.79% with a total average of 0.32% (PEI Associates, 1988). The EPA/OPPT Small Container Residual Model recommends a default central tendency loss fraction of 0.3% and a high-end loss fraction of 0.6% (U.S. EPA, 2015). For unloading drums by pumping, the PEI study experiments showed average container residuals in the range of 1.7 to 4.7% with a total average of 2.6% (PEI Associates, 1988).

The EPA/OPPT Drum Residual Model from the *ChemSTEER User Guide* recommends a default central tendency loss fraction of 2.5% and a high-end loss fraction of 3.0% (U.S. EPA, 2015). The underlying distribution of the loss fraction parameter for small containers or drums is not known; therefore, EPA assigned a triangular distribution defined by the estimated lower bound, upper bound, and mode of the parameter values. The Agency assigned the mode and upper bound values for the loss fraction triangular distributions using the central tendency and high-end values from the respective *ChemSTEER User Guide* model (U.S. EPA, 2015). EPA assigned the lower bound values for the triangular distributions using the minimum average percent residual measured in the PEI study for the respective drum emptying technique (pouring or pumping) (PEI Associates, 1988).

A.4.15 Wastewater Loss Fraction

The ESD on the Use of Vapor Degreasers (U.S. EPA, 2023b) states that the default daily throughput of vapor degreasing chemicals is 7.04 kg/site-day. Using the range of 2 to 20 gallons of wastewater discharged per day, and the water solubility of 1,2-dichloroethane, the daily release would be 0.04 to 0.4 kg 1,2-dichloroethane/site day. This results in a loss fraction of 0.0057 to 0.057 kg/kg.

A.4.16 Frequency of Solvent Changeout

The ESD on the Use of Vapor Degreasers (U.S. EPA, 2023b) estimates that dirty solvent will be changed out once every 2 weeks, or 26 times per year.

A.4.17 Correction Factor

The ESD on the Use of Vapor Degreasers (U.S. EPA, 2023b) applies a correction factor (CF) to account for any variability, such as a known or estimated correction of the water solubility of the chemical or other corrections. The default correction factor is 1.

A.4.18 Daily Volume of Wastewater Discharged

The ESD on the Use of Vapor Degreasers (U.S. EPA, 2023b) estimates that the range of wastewater discharged is 2 to 20 gallons per day.

A.5 Application of Adhesives and Sealants Model Approach and Parameters

This appendix presents the modeling approach and equations used to estimate environmental releases for 1,2-dichloroethane during the Application of Adhesives and Sealants OES. This approach utilizes the ESD on Use of Adhesives (OECD, 2015) combined with Monte Carlo simulation (a type of stochastic simulation). EPA assessed this OES with 1,2-dichloroethane arriving on site as an additive in the solid component of a multi-component adhesive or sealant, which is then mixed and applied as a liquid.

Based on the ESD, EPA identified the following release and exposure sources from the application of adhesives and sealants:

- Release source 1: Container cleaning wastes to hazardous landfill or incineration
- Release source 2: Open surface losses during container cleaning to fugitive or stack air

- Release source 3: Transfer operation losses during unloading to fugitive or stack air
- Release source 4: Equipment cleaning wastes
- Release source 5: Open surface losses to fugitive or stack air during equipment cleaning
- Release source 6: Application losses to fugitive or stack air
- Release source 7: Evaporative losses to fugitive or stack air during curing/drying
- Release source 8: Trimming wastes to hazardous landfill or incineration.

Environmental releases of 1,2-dichloroethane during use of adhesives and sealants are a function of 1,2-dichloroethane's physical properties, container size, mass fractions, and other model parameters. Although physical properties are fixed, some model parameters are expected to vary. EPA used a Monte Carlo simulation to capture variability in the following model input parameters for environmental releases: container loss fraction, saturation factor, container volume, and air speed. The Agency used the outputs from a Monte Carlo simulation with 100,000 iterations and the Latin Hypercube sampling method in @Risk to calculate release amounts and exposure concentrations for this OES.

A.5.1 Model Equations

Table_Apx A-9 provides the models and associated variables used to calculate environmental releases for each release source within each iteration of the Monte Carlo simulation. EPA used these environmental releases to develop a distribution of release outputs for the Use of Adhesives and Sealants OES. The variables used to calculate each of the following values include deterministic or variable input parameters, known constants, physical properties, conversion factors, and other parameters. The values for these variables are provided in Appendix A.5.2. The Monte Carlo simulation calculated the total 1,2-dichloroethane release (by environmental media) across all release sources during each iteration of the simulation. EPA then selected 50th and 95th percentile values to estimate the central tendency and high-end releases, respectively.

Table_Apx A-9. Models and Variables Applied for Release Sources in the Application of Adhesives and Sealants OES

Release Source	Model(s) Applied	Variables Used
Release source 1: Container cleaning wastes	EPA/OAQPS AP-42 Small Container Residual Model	$Q_{1,2\_DCA\_day}$; $F_{residue}$
Release source 2: Open surface losses during container cleaning	EPA/OPPT Penetration Model or EPA/OPPT Mass Transfer Coefficient Model, based on air speed	Vapor Generation Rate: $F_{1,2\_DCA}$; MW; VP; $RATE_{air\_speed}$; $D_{container}$; T; P Operating Time: $N_{cont\_unload\_yr}$; $RATE_{fill\_cont}$
Release source 3: Transfer operation losses from unloading	EPA/OAQPS AP-42 Loading Model	Vapor Generation Rate: $F_{1,2\_DCA}$; MW; VP; $RATE_{air\_speed}$; $D_{container}$; T; P Operating Time: OH_{RP3}
Release source 4: Equipment cleaning wastes	EPA/OPPT Single Process Vessel Residual Model	$Q_{1,2\_DCA\_day}$; $F_{equipment\_cleaning}$
Release source 5: Open surface losses to air during equipment cleaning.	EPA/OPPT Penetration Model or EPA/OPPT Mass Transfer Coefficient Model, based on air speed	Vapor Generation Rate: F_{DCHP}; MW; VP; $RATE_{air\_speed}$; D_{equip_clean}; T; P Operating Time: OH_{equip_clean}
Release source 6: Application losses	EPA/OPPT Generic Model to Estimate Application Loss	$Q_{1,2\_DCA\_day}$; $F_{transfer\_eff}$ (assumed 90% transfer efficiency)

Release Source	Model(s) Applied	Variables Used
	Releases from Roll Coating and Curtain Coating Operations	
Release source 7: Evaporative losses to air during curing/drying	Based on Mass Balance	$Q_{1,2\_DCA\_day}$; Release estimates 1–6.
Release source 8: Trimming wstes	1,2-dichloroethane not expected to be present in cured adhesive	N/A
OES = occupational exposure scenario; OAQPS = EPA Office of Air Quality Planning and Standards; OPPT = EPA Office of Pollution Prevention and Toxics		

A.5.2 Model Input Parameters

Table_Apx A-10 summarizes the model parameters and their values for the Application of Adhesives and Sealants Monte Carlo simulation. Additional explanations of EPA's selection of the distributions for each parameter are provided following this table.

Table_Apx A-10. Summary of Parameter Values and Distributions Used in the Application of Adhesives and Sealants Model

Input Parameter	Symbol	Unit	Deterministic Values	Uncertainty Analysis Distribution Parameters				Rationale/Basis
			Value	Lower Bound	Upper Bound	Mode	Distribution Type	
1,2-Dichloroethane Production Volume for Adhesives/Sealants	PV_{total}	kg/year	1.83E05	–	–	–	–	See Appendix A.5.3
Annual Facility Throughput of Adhesive/Sealant	$Q_{product\_yr}$	kg/yr	1.41E05	1.0E03	1.0E06	1.4E05	Triangular	See Appendix A.5.4
Operating Hours for Equipment Cleaning	OH_{equip_clean}	h/day	1.0	–	–	–	–	See Appendix A.5.6
Coating Product 1,2-Dichloroethane Concentration	$F_{1,2\text{- dichloroethane}\_unload}$	kg/kg	0.918	–	–	0.918	Discrete	See Appendix A.5.7
Adhesive/Sealant 1,2-Dichloroethane Concentration	$F_{1,2\text{- dichloroethane}}$	kg/kg	0.918	0.60	0.918	0.918	Uniform	See Appendix A.5.7
Operating Days	OD	days/yr	250	49	251	250	Triangular	See Appendix A.5.8
Air Speed	$RATE_{air\_speed}$	ft/min	20	2.6	398	–	Lognormal	See Appendix A.5.9
Container Volume	V_{cont}	gal	55	–	–	0.918	Discrete	See Appendix A.5.10
Container Residual Loss Fraction	$F_{residue}$	kg/kg	0.025	0.017	0.03	0.025	Triangular	See Appendix A.5.11
Vapor Pressure at 25 °C	VP	mmHg	78.9	–	–	–	–	Physical property
Molecular Weight	MW	g/mol	98.96	–	–	–	–	Physical property
Gas Constant	R	atm-cm^3/gmol-L	82	–	–	–	–	Universal constant
Density of 1,2-dichloroethane	RHO	kg/L	1.26	–	–	–	–	Physical property
Temperature	T	K	298	–	–	–	–	Process parameter
Pressure	P	atm	1	–	–	–	–	Process parameter
Container Unloading Rate	$RATE_{unload\_cont}$	containers/h	20	–	–	–	–	See Appendix A.5.12
Diameter of Opening – Equipment Cleaning	D_{equip_clean}	cm	92	–	–	–	–	See Appendix A.5.13
Equipment Cleaning Loss Fraction	$F_{equipment\_cleaning}$	kg/kg	1.0E−02	–	–	–	–	See Appendix A.5.14

A.5.3 Production Volume and Number of Sites

EPA assessed this OES using a 1,2-dichloroethane production volume of 182,640 kg/year for adhesive and sealant products, which is based on CDR data (U.S. EPA, 2020a). Per 2020 U.S. Census Bureau data for the NAICS codes identified in the ESD on Use of Adhesives (OECD, 2015), there are 10,144 adhesive and sealant use sites (U.S. BLS, 2016). Therefore, this value is used as a bounding limit, not to be exceeded by the calculation. Number of sites is calculated using a per-site throughput and total production volume with the following equation:

Equation_Apx A-25.

$$N_s = \frac{PV_{total}}{Q_{1,2-DCA_{year}}}$$

Where:

N_s	=	Number of sites (sites)
PV_{total}	=	1,2-Dichloroethane production volume for adhesives/sealants (kg/year)
$Q_{1,2-DCA\_year}$	=	Facility annual throughput of 1,2-dichloroethane (see Appendix A.5.4) (kg/site-yr)

A.5.4 Throughput Parameters

The annual throughput of adhesive and sealant product is modeled using a triangular distribution with a lower bound of 1,000 kg/year, an upper bound of 1,000,000 kg/year, and mode of 141,498 kg/year. This is based on the ESD on Use of Adhesives (OECD, 2015). The ESD provides default adhesive use rates based on end-use category. EPA used the data for general assembly, which listed adhesives throughput from 11 submissions. The lower and upper bound adhesive use rates for these categories was 1,000 to 1,000,000 kg/year. The mode is based on overall average throughput.

The annual throughput of 1,2-dichloroethane in adhesives/sealants is calculated using Equation_Apx A-26 by multiplying the annual throughput of all adhesives and sealants by the concentration of 1,2-dichloroethane in the adhesives/sealants.

Equation_Apx A-26.

$$Q_{1,2-DCA\_year} = Q_{product\_yr} * F_{1,2-DCA}$$

Where:

Q_{DCHP_year}	=	Facility annual throughput of 1,2-dichloroethane (kg/site-yr)
$Q_{product\_yr}$	=	Facility annual throughput of all adhesives/sealants (kg/batch)
$F_{1,2\_DCA}$	=	Concentration of 1,2-dichloroethane in adhesives/sealants (see Appendix A.5.7) (kg/kg)

The daily throughput of 1,2-dichloroethane is calculated using Equation_Apx A-27 by dividing the annual production volume by the number of operating days. The number of operating days is determined according to Section A.5.8.

Equation_Apx A-27.

$$Q_{DCHP\_day} = \frac{Q_{DCHP\_year}}{OD}$$

Where:

Q_{DCHP_day}	=	Facility daily throughput of 1,2-dichloroethane (kg/site-day)
Q_{DCHP_year}	=	Facility annual throughput of 1,2-dichloroethane (kg/site-yr)
OD	=	Operating days (see Appendix A.5.8) (days/year)

A.5.5 Number of Containers per Year

The number of 1,2-dichloroethane raw material containers received and unloaded by a site per year is calculated using the following equation:

Equation_Apx A-28.

$$N_{cont\_unload\_yr} = \frac{Q_{1,2-DCA\_year}}{RHO * \left(3.79\ \frac{L}{gal}\right) * F_{1,2-DCA\_unload} * V_{cont}}$$

Where:

$N_{cont\_unload\_yr}$	=	Annual number of containers unloaded (container/site-year)
$Q_{1,2-DCA\_year}$	=	Facility annual throughput of 1,2-dichloroethane (see Appendix A.5.4) (kg/site-yr)
$F_{1,2-DCA\_unload}$	=	Concentration of 1,2-dichloroethane in solid products received on site (see Appendix A.5.7) (kg/kg)
RHO	=	1,2-dichloroethane density (kg/L)
V_{cont}	=	Container volume (see Appendix A.5.10) (gal/container)

A.5.6 Operating Hours

EPA estimated operating hours or hours of release duration using data provided from the ESD on Use of Adhesives (OECD, 2015), *ChemSTEER User Guide* (U.S. EPA, 2015), and/or through calculation from other parameters.

For container unloading (release point 3), the operating hours are calculated based on the number of containers unloaded at the site and the unloading rate using the following equation:

Equation_Apx A-29.

$$OH_{RP3} = \frac{N_{cont\_unload\_yr}}{RATE_{fill\_cont} * OD}$$

Where:

OH_{RP3}	=	Operating time for release point 3 (h/site-day)
$N_{cont\_unload\_yr}$	=	Annual number of containers unloaded (container/site-year)
$RATE_{fill\_cont}$	=	Container fill rate (containers/h)
OD	=	Operating days (days/site-year)

For equipment cleaning (release point 5), the ESD on Use of Adhesives (OECD, 2015) states that the default operating hours for equipment cleaning is one hour/batch multiplied by the number of batches per day. Per the ESD on Use of Adhesives (OECD, 2015), the default number of batches per day is one. Therefore, EPA assumes that equipment cleaning occurs for 1 hour/day.

A.5.7 Adhesive/Sealant 1,2-Dichloroethane Concentration

EPA determined 1,2-dichloroethane concentrations in the adhesive/sealant product ($F_{1,2}$-dichloroethane) using SDS information. There was only one product found, with a 1,2-dichloroethane concentration of 91.8% (Shinko Plastics Co, 2010). The Use of Adhesives Emission Scenario document provides a range of 60 to 75% for organic solvent adhesive components. Therefore, EPA applied a uniform distribution from 60 to 91.8% to capture all potential concentrations (OECD, 2015).

A.5.8 Operating Days

EPA modeled the operating days per year using a triangular distribution with a lower bound of 49 days/year, an upper bound of 251 days/year, and a mode of 250 days/year. To ensure that only integer values of this parameter were selected, EPA nested the triangular distribution probability formula within a discrete distribution that listed each integer between (and including) 49 to 251 days/year. This is based on the ESD on Use of Adhesives (OECD, 2015). For general assembly, the range of operating days is 50 to 250 days/year. The model uses 49 to 251 days/year for mathematical purposes for building the distribution. The mode of the distribution is based on the mode of 250 days/year for the available general assembly submissions.

A.5.9 Air Speed

Baldwin and Maynard measured indoor air speeds across a variety of occupational settings in the United Kingdom (Baldwin and Maynard, 1998). Fifty-five work areas were surveyed across a variety of workplaces. EPA analyzed the air speed data from Baldwin and Maynard and categorized the air speed surveys into settings representative of industrial facilities and representative of commercial facilities. The Agency fit separate distributions for these industrial and commercial settings and used the industrial distribution for this OES.

EPA fit a lognormal distribution for the dataset as consistent with the authors' observations that the air speed measurements within a surveyed location were lognormally distributed and the population of the mean air speeds among all surveys were lognormally distributed (Baldwin and Maynard, 1998). Since lognormal distributions are bound by zero and positive infinity, EPA truncated the distribution at the largest observed value among all of the survey mean air speeds.

EPA fit the air speed surveys representative of industrial facilities to a lognormal distribution with the following parameter values: mean of 22.414 cm/s and standard deviation of 19.958 cm/s. In the model, the lognormal distribution is truncated at a minimum allowed value of 1.3 cm/s and a maximum allowed value of 202.2 cm/s (largest surveyed mean air speed observed in Baldwin and Maynard) to prevent the model from sampling values that approach infinity or are otherwise unrealistically small or large (Baldwin and Maynard, 1998).

Baldwin and Maynard only presented the mean air speed of each survey. The authors did not present the individual measurements within each survey. Therefore, these distributions represent a distribution of mean air speeds and not a distribution of spatially variable air speeds within a single workplace setting. However, a mean air speed (averaged over a work area) is the required input for the model. EPA converted the units to ft/min prior to use within the model equations.

A.5.10 Container Size

EPA assumed adhesives was shipped in 55-gallon drums, as specified in the ESD on Use of Adhesives (OECD, 2015).

A.5.11 Container Residue Loss Fraction

EPA previously contracted PEI Associates, Inc (PEI) to conduct a study for providing estimates of potential chemical releases during cleaning of process equipment and shipping containers (PEI Associates, 1988). The study used both a literature review of cleaning practices and release data as well as a pilot-scale experiment to determine the amount of residual material left in vessels. The data from literature and pilot-scale experiments addressed different conditions for the emptying of containers and tanks, including various bulk liquid materials, different container constructions (*e.g.,* lined steel drums or plastic drums), and either a pump or pour/gravity-drain method for emptying. EPA reviewed the pilot-scale data from PEI and determined a range and average percentage of residual material remaining in vessels following emptying from drums by either pumping or pouring as well as tanks by gravity-drain (PEI Associates, 1988).

EPA previously used the study results to generate default central tendency and high-end loss fraction values for the residual models (*e.g.,* EPA/OPPT Small Container Residual Model, EPA/OPPT Drum Residual Model) provided in the *ChemSTEER User Guide* (U.S. EPA, 2015). Previously, EPA adjusted the default loss fraction values based on rounding the PEI study results or due to policy decisions. The Agency used a combination of the PEI study results and user guide default loss fraction values to develop probability distributions for various container sizes.

Specifically, EPA paired the data from the PEI study such that the residuals data for emptying drums by pouring was aligned with the default central tendency and high-end values from the EPA/OPPT Small Container Residual Model, and the residuals data for emptying drums by pumping was aligned with the default central tendency and high-end values from the EPA/OPPT Drum Residual Model. The Agency applied the EPA/OPPT Small Container Residual Model to containers with capacities less than 20 gallons and the EPA/OPPT Drum Residual Model to containers with capacities between 20 and 100 gallons (U.S. EPA, 2015).

For unloading drums by pouring, the PEI study experiments showed average container residuals in the range of 0.03 to 0.79% with a total average of 0.32% (PEI Associates, 1988). The EPA/OPPT Small Container Residual Model recommends a default central tendency loss fraction of 0.3% and a high-end loss fraction of 0.6% (U.S. EPA, 2015). For unloading drums by pumping, the PEI study experiments showed average container residuals in the range of 1.7 to 4.7% with a total average of 2.6% (PEI Associates, 1988). The EPA/OPPT Drum Residual Model from the *ChemSTEER User Guide* recommends a default central tendency loss fraction of 2.5% and a high-end loss fraction of 3.0% (U.S. EPA, 2015). The underlying distribution of the loss fraction parameter for small containers or drums is not known; therefore, EPA assigned a triangular distribution defined by the estimated lower bound, upper bound, and mode of the parameter values. The Agency assigned the mode and upper bound values for the loss fraction triangular distributions using the central tendency and high-end values from the respective *ChemSTEER User Guide* model (U.S. EPA, 2015). The Agency assigned the lower bound values for the triangular distributions using the minimum average percent residual measured in the PEI study for the respective drum emptying technique (pouring or pumping) (PEI Associates, 1988).

A.5.12 Container Unloading Rate

The *ChemSTEER User Guide* (U.S. EPA, 2015) provides a typical fill rate of 20 containers per hour for containers with 20 to less than 100 gallons of liquid.

A.5.13 Diameter of Opening

The *ChemSTEER User Guide* indicates diameters for the openings for various vessels that may hold liquids in order to calculate vapor generation rates during different activities (U.S. EPA, 2015). For equipment cleaning operations, the *ChemSTEER User Guide* indicates a single default value of 92 cm (U.S. EPA, 2015).

A.5.14 Equipment Cleaning Loss Fraction

EPA used the EPA/OPPT Single Process Residual Model to estimate the releases from equipment cleaning. This model, as detailed in the *ChemSTEER User Guide* (U.S. EPA, 2015), provides an overall loss fraction of 1% from equipment cleaning.

A.6 Aerosol Degreasing Model Approach and Parameters

This appendix presents the modeling approach and model equations used in the Aerosol Degreasing release Model. The release model uses data from CARB to estimate 1,2-dichloroethane use rates; 100% of the sprayed 1,2-dichloroethane is expected to be released to air.

The model uses the following parameters to estimate degreaser use rates:

- Concentration of 1,2-dichloroethane in the aerosol formulation;
- Amount of degreaser used per brake job;
- Number of degreaser applications per brake job;
- Time duration of brake job;
- Operating hours per week; and
- Number of jobs per work shift.

An individual model input parameter could either have a discrete value or a distribution of values. EPA assigned statistical distributions based on available literature data. A Monte Carlo simulation (a type of stochastic simulation) was conducted to capture variability in the model input parameters. The simulation was conducted using the Latin hypercube sampling method in @Risk Industrial Edition, Version 7.0.0. The Latin hypercube sampling method is a statistical method for generating a sample of possible values from a multi-dimensional distribution. Latin hypercube sampling is a stratified method, meaning it guarantees that its generated samples are representative of the probability density function (variability) defined in the model. EPA performed the model at 100,000 iterations to capture the range of possible input values (*i.e.,* including values with low probability of occurrence).

Model results from the Monte Carlo simulation are presented as 95th and 50th percentile values. The statistics were calculated directly in @Risk. The 95th percentile value was selected to represent high-end exposure level, whereas the 50th percentile value was selected to represent central tendency exposure level. The following subsections detail the model design equations and parameters for the brake servicing model.

A.6.1 Model Design Equations

In brake servicing, the vehicle is raised on an automobile lift to a comfortable working height to allow the worker (mechanic) to remove the wheel and access the brake system. Brake servicing can include inspections, adjustments, brake pad replacements, and rotor resurfacing. These service types often involve disassembly, replacement or repair, and reassembly of the brake system. Automotive brake cleaners are used to remove oil, grease, brake fluid, brake pad dust, or dirt. Mechanics may occasionally use brake cleaners, engine degreasers, carburetor cleaners, and general purpose degreasers interchangeably (CARB, 2000). Automotive brake cleaners can come in aerosol or liquid form (CARB, 2000): this model estimates exposures from aerosol brake cleaners (degreasers).

Based on data from CARB (2000), EPA assumes each brake job requires one 14.4-oz can of aerosol brake cleaner as described in further detail below. The model determines the application rate of 1,2-

dichloroethane using the weight fraction of 1,2-dichloroethane in the aerosol product. EPA uses a uniform distribution of weight fractions for 1,2-dichloroethane based on facility data for the aerosol products in use (CARB, 2000).

A.6.2 Model Parameters

Table_Apx A-11 summarizes the model parameters and their values for the aerosol degreasing release model. Each parameter is discussed in detail in the following subsections.

The specificity of more complex distributions (*e.g.,* triangular, lognormal) to characterize a model parameter value requires adequate data to demonstrate the distribution; if only an overall range is known, then a uniform distribution is the only possible distribution to use. There may be cases where a uniform distribution is appropriate if data indicate it as such, but generally, uniform distributions were used because no data were found to demonstrate a more sophisticated distribution.

Model parameters kept as constants were generally cases where data to describe variability or uncertainty of the parameter value were unknown. Additionally, some model parameters were kept as constants by choice (*i.e.,* temperature and pressure are constant as the model is isothermal and isobaric), and some were kept as constants appropriately (*i.e.,* molecular weight kept appropriately constant).

Table_Apx A-11. Summary of Parameter Values and Distributions Used in the Brake Servicing Near-Field/Far-Field Inhalation Exposure Model

Input Parameter	Symbol	Unit	Constant Model Parameter Values		Variable Model Parameter Values				Comments
			Value	Basis	Lower Bound	Upper Bound	Mode	Distribution Type	
1,2-Dichloroethane Weight Fraction	wtfrac	wt frac	–	–	0.90	1	–	Discrete	Discrete distribution of 1,2-dichloroethane-based aerosol product formulations based on products identified in SDS. Where the weight fraction of 1,2-dichloroethane in the formulation was given as a range, EPA assumed a uniform distribution within the reported range for the 1,2-dichloroethane concentration in the product. See Appendix A.6.3 for further discussion.
Degreaser Used per Brake Job	W_d	oz/ job	14.4	–	–	–	–	Constant Value	Based on data from CARB (2000).
Number of Applications per Job	N_A	Applications/ job	11	–	–	–	–	Constant Value	Calculated from the average of the number of applications per brake and number of brakes per job.
Amount Used per Application	Amt	g 1,2-Dichloroethane/ application	–	–	33.4	37.1	–	Calculated	Calculated from wtfrac, W_d, and N_A.
Number of Brake Jobs per Year	$Jobs_{site\text{-}yr}$	jobs/site-yr	936	–	–	–	–	Constant Value	Based on data from CARB (2000).

A.6.3 1,2-Dichloroethane Weight Fraction

EPA used a two-dimensional sampling technique to model the 1,2-dichloroethane weight fraction. A discrete distribution is used to model the frequency of occurrence of each product type. For each product, the concentration of 1,2-dichloroethane was reported as a range. The Agency used a uniform distribution to model the 1,2-dichloroethane weight fraction within each product type. On each iteration of the simulation, the model executes each product's weight fraction distribution and the product frequency distribution. The model then reads the product selected from the product frequency distribution and selects the weight fraction that was generated from the corresponding product's weight fraction distribution. Table_Apx A-12 provides a summary of the reported 1,2-dichloroethane content reported in the SDSs and the fractional probability of each product type.

Table_Apx A-12. Summary of 1,2-Dichloroethane-Based Solvent Formulations

Source	1,2-Dichloroethane Weight (%)	Fractional Probability
(Pharmco Products, 2013)	90–100	0.50
(Occidental Chemical Corp, 2015)	99–100	0.50
	Total	**1.00**

A.6.4 Volume of Degreaser Used per Brake Job

CARB (2000) assumed that brake jobs require 14.4 oz of aerosol product. EPA did not identify other information to estimate the volume of aerosol product per job; therefore, the Agency used a constant volume of 14.4 oz per brake job based on CARB (2000).

A.6.5 Number of Applications per Brake Job

Workers typically apply the brake cleaner before, during, and after brake disassembly. Workers may also apply the brake cleaner after brake reassembly as a final cleaning process (CARB, 2000). Therefore, EPA assumed a worker applies a brake cleaner three or four times per wheel. Because a brake job can be performed on either one or two axles (CARB, 2000), EPA also assumed a brake job may involve either two or four wheels. Therefore, the number of brake cleaner (aerosol degreaser) applications per brake job can range from 6 (3 applications/brake × 2 brakes) to 16 (4 applications/brake × 4 brakes). The Agency assumed a constant number of applications per brake job based on the midpoint of this range of 11 applications per brake job.

A.6.6 Amount of 1,2-Dichloroethane Used per Application

EPA calculated the amount of 1,2-dichloroethane used per application using Equation_Apx A-30. The calculated mass of 1,2-dichloroethane used per application ranges from 3.7 to 29.7 grams.

Equation_Apx A-30.

$$Amt = \frac{W_d \times wtfrac \times 28.3495\,\frac{g}{oz}}{N_A}$$

Where:

Amt	=	Amount of 1,2-dichloroethane used per application (g/application);
W_d	=	Weight of degreaser used per brake job (oz/job);
$Wtfrac$	=	Weight fraction of 1,2-dichloroethane in aerosol degreaser (unitless); and
N_A	=	Number of degreaser applications per brake job (applications/job).

This value was used as the daily amount released to the atmosphere.

A.6.7 Number of Brake Jobs per Year

CARB (2000) visited 137 automotive maintenance and repair shops and collected data on the number of brake jobs performed annually at each facility. CARB calculated an average of 936 brake jobs performed per facility per year.

Appendix B PROCEDURES FOR MAPPING FACILITIES FROM STANDARD ENGINEERING SOURCES TO OCCUPATIONAL EXPOSURE SCENARIOS AND CONDITIONS OF USE

B.1 Conditions of Use and Occupational Exposure Scenarios

Condition of Use (COU)
TSCA section 3(4) defines COUs as "the circumstances, as determined by the Administrator, under which a chemical substance is intended, known, or reasonably foreseen to be manufactured, processed, distributed in commerce, used, or disposed of." COUs included in the scope of EPA's risk evaluations are typically tabulated in scope documents and risk evaluation documents as summaries of life cycle stages, categories, and subcategories of use, as shown in Table_Apx B-1. Therefore, a COU is a combination of life cycle stage, category[ies], and subcategory[ies]. The Agency identifies COUs for chemicals during the scoping phase; this process is not discussed in this document.

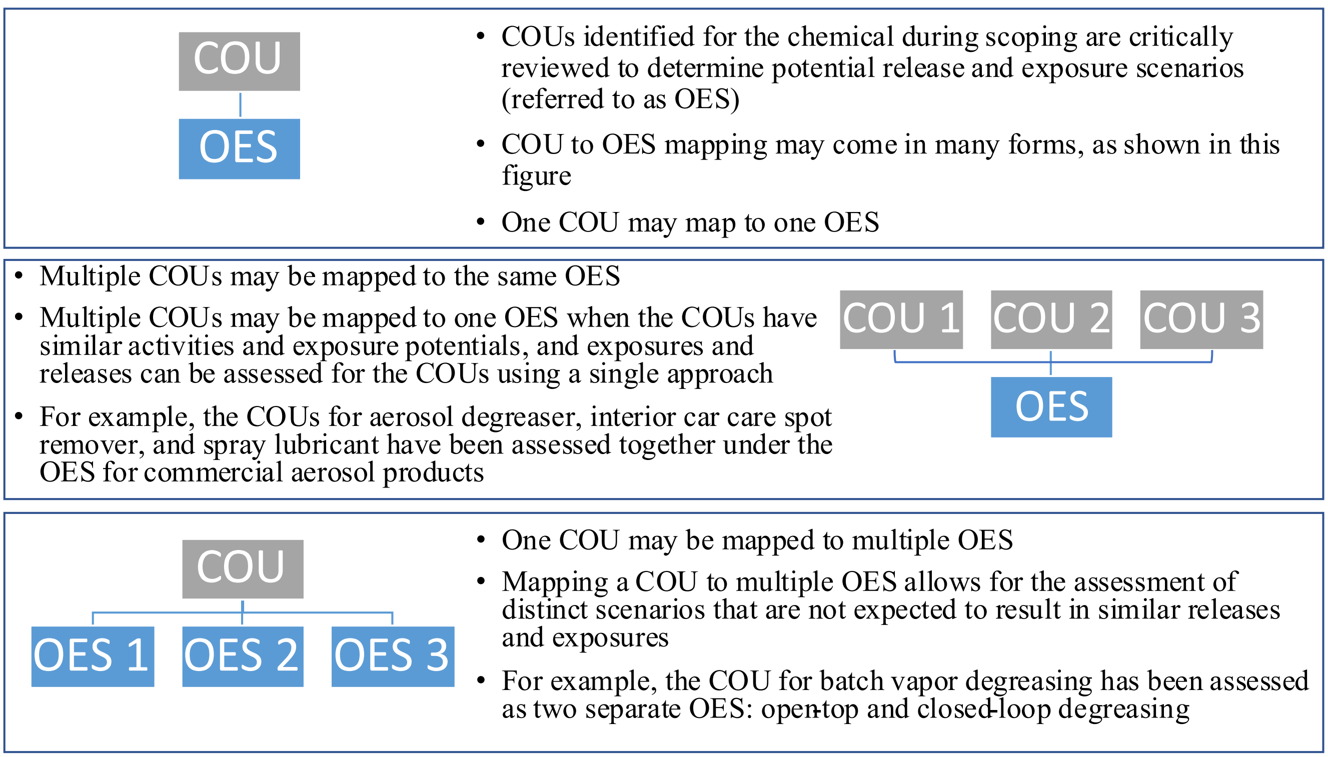
Occupational Exposure Scenario (OES)
Thus far, EPA has not adopted a standardized definition for OES. The purpose of an OES is to group or segment COUs for assessment of releases and exposures based on similarity of the operations and data availability for each COU. For example, EPA may assess a group of multiple COUs together as one OES due to similarities in release and exposure potential (*e.g.,* the COUs for Formulation of paints, Formulation of cleaning solutions, and Formulation of other products may be assessed together as a single OES). Alternatively, EPA may assess multiple OES for one COU because there are different release and exposure potentials for a given COU (*e.g.,* the COU for Batch vapor degreasing may be assessed as separate OES for open-top vapor degreasing and closed-loop vapor degreasing). OES determinations are also largely driven by the availability of data and modeling approaches to assess occupational releases and exposures. For example, even if there are similarities between multiple COUs, if there is sufficient data to separately assess releases and exposures for each COU, and evidence that the exposure scenarios are distinct enough that it would be appropriate to assess them separately, EPA would not group them into the same OES. This is depicted in Figure_Apx B-1.

For chemicals undergoing risk evaluation, EPA maps each industrial and commercial COU to one or more OESs based on reasonably available data and information (*e.g.,* CDR, use reports, process information, public and stakeholder comments), assumptions, and inferences that describe how release and exposure take place within a COU. The Agency identify OESs for COUs—not vice-versa (*i.e.,* COUs are not altered during OES mapping). The mapping of COUs to OES is separate from and occurs after the identification of COUs. Both the identification of COUs and subsequent mapping of COUs to OESs occur early in the risk evaluation process and are described in this document in Section 1.2. This section provides background context on COUs and OESs.

Table_Apx B-1. Example Condition of Use Table with Mapped Occupational Exposure Scenarios

COU			OES
Life Cycle Stage	**Category**[a]	**Subcategory**[b]	
Manufacturing	Domestic manufacturing	Domestic manufacturing	Manufacturing
	Import	Import	Repackaging
Processing	As a reactant	Intermediate in all other basic organic chemical manufacturing	Processing as a Reactant
	Processing – Incorporation into formulation, mixture, or reaction product	Solvents (for cleaning or degreasing)	Formulation
		Adhesives and sealant chemicals	
	Repackaging	Solvents (for cleaning or degreasing)	Repackaging
	Etc.		

COU = condition of use; OES = occupational exposure scenario
[a] Categories reflect Chemical Data Reporting (CDR) codes and broadly represent the industrial and/or commercial settings of the condition of use (COU).
[b] The subcategories reflect more specific COUs.



Figure_Apx B-1. Condition of Use to Occupational Exposure Scenario Mapping Options

B.2 Standard Sources Requiring Facility Mapping

The Agency utilizes release data from EPA programmatic databases and exposure data from standard sources to complete occupational exposure and environmental release assessments, which are described below (all hyperlinks accessed August 11, 2025):

- Chemical Data Reporting (CDR), to which import and manufacturing sites producing the chemical at or above a specified threshold must report. EPA uses CDR to identify COUs, OES, sites that import or manufacture the chemical, and for information on physical form and concentration of the chemical. In addition, EPA is currently developing the Tiered Data Reporting (TDR) rule, which would establish reporting requirements, including changes to CDR, to collect information that better meets data needs for the TSCA existing chemical program. The rule is expected to have reporting requirements tiered to specific stages of existing chemical assessments (*e.g.,* prioritization, risk evaluation) and harmonized to the Organization for Economic Co-operation and Development (OECD) risk assessment framework, which would help to better inform uses of chemicals and improve upon the OES mapping procedures in this document.
- Toxics Release Inventory (TRI), to which facilities handling a chemical covered by the TRI program at or above a specified threshold must report. EPA uses TRI data to quantify air, water, and land releases of the chemical undergoing risk evaluation.
- National Emissions Inventory (NEI), a compilation of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants from point and non-point source air emissions. EPA uses NEI data to quantify air emissions of the chemical undergoing risk evaluation.
- Discharge Monitoring Report (DMR), a periodic report required of National Pollutant Discharge Elimination System (NPDES)-permitted facilities discharging to surface waters. EPA uses NEI data to quantify surface water discharges of the chemical undergoing risk evaluation.
- Occupational Safety and Health Administration (OSHA): Chemical Exposure Health Data (CEHD), a compilation of industrial hygiene samples taken when OSHA monitors worker exposures to chemical hazards. EPA uses OSHA CEHD to quantify occupational inhalation exposures to the chemical undergoing risk evaluation.
- National Institute of Occupational Safety and Health (NIOSH): Health Hazard Evaluations (HHEs), a compilation of voluntary employee, union, or employer requested evaluations of health hazards present at given workplace. EPA uses NIOSH HHE data to quantify occupational inhalation exposures to the chemical undergoing risk evaluation.

To utilize the data from these sources, the facilities that report to each must first be mapped to an OES. There may be other sources of data for specific facilities that require mapping the facilities to an OES; however, this document covers the most common data sources. Additionally, EPA often uses data from sources such as public and stakeholder comments, generic scenarios, and process data that are usually not specific to an individual site; therefore, unlike the above sources, they do not involve the mapping of specific sites to an OES.

Mapping procedures for the above sources are discussed in detail in the subsequent sections; however, Table_Apx B-2 includes a summary of the type of information reported by companies in each database that helps to inform OES and COU mapping. This includes industrial classification codes such as those associated with the North American Industry Classification System (NAICS) and Standard Industrial Classification (SIC) system (both URLs accessed August 11, 2025). Note that the U.S. government replaced SIC codes with NAICS codes in 1997; however, SIC codes are still used in DMR and are applicable for data from all listed sources for years prior to 1997. Additionally, some of the sources in Table_Apx B-2 have specific reporting requirements that include flags for the type of processes that occur at the site.

Assessors should be sure that a facility that reports to multiple databases/sources is consistently mapped to the same OES, as applicable. This is not applicable if the facility reports separately for different areas/processes of their facility (*e.g.,* a large chemical plant may report 1 block of unit operations separate from another such that they have different OESs).

Table_Apx B-2. EPA Programmatic Database Information that Aids OES/COU Mapping

Source	Reported Information Useful for Mapping OES/COU	Reporting Frequency	Notes
CDR	- Indication if the chemical is imported or domestically manufactured - Indication if the chemical is imported but never at the site, used on-site, or exported	- Facilities must report to CDR every 4 years - New datasets take years to become publicly available - Latest reporting year with available data: 2020	- While CDR also includes information on downstream processing and use, it does not include site identities for these operations; thus, it does not inform reporting site OES/COU mapping. - Claims of confidential business information (CBI) can limit data utility in risk evaluations.
TRI	- NAICS codes - Flags for uses and sub-uses of the chemical - Release media information	- Facilities must report to TRI annually - New datasets become publicly available in October for the previous year - Latest reporting year with available data: 2021	- Reporters must select from specific uses (*e.g.,* manufacture, import, processing) and sub-uses (*e.g.,* formulation additive, degreaser, lubricant). - Sub-use information is only available in datasets starting in 2018. - Facilities may report with a Form A under certain circumstances; [a] Form A's do not require use/sub-use reporting.
NEI	- SCCs, which classify different types of activities that generate air emissions - Emissions Inventory System (EIS) Sectors, which classify industry sectors - NAICS codes - Process description free-text field (used for additional information about the process related to the emission unit) - Emission unit description free-text field	- Facilities must report to NEI every three years - New datasets take years to become publicly available - Latest reporting year with available date: 2020	- NEI contains specific SCC codes and industry sectors from which reporters select. - Free-text fields are not mandatory for the reporter to fill out.
DMR	- SIC codes - NPDES) permit numbers	- Facilities must report to DMR at the frequency specified in their NPDES permit, which is typically monthly - Data typically flows through the State DMR reporting platform to EPA's ECHO database continuously	- Sites that only report non-detection of the chemical for the year are generally excluded from mapping. - NPDES permit numbers can sometimes indicate the type of general permit, which can inform mapping (*e.g.,* remediation general permit).
OSHA	- NAICS or SIC codes	- OSHA conducts monitoring as-needed for site investigations - Monitoring data is available in CEHD	- CEHD includes data from 1984 and forward.

Source	Reported Information Useful for Mapping OES/COU	Reporting Frequency	Notes
		when the investigation and any subsequent litigation cases are closed - Latest year in CEHD with data: 2025	
NIOSH HHE	- Facility process information - Worker activities	- NIOSH conducts HHEs upon request - HHEs are published online when NIOSH is completed with the evaluation - Latest year with a published HHE: 2025	- NIOSH HHEs generally include narrative descriptions of facility processes and worker activities, with specific information on how the chemical being monitored for is used.

CDR = Chemical Data Reporting; CEHD = Chemical Exposure Health Data; COU = condition of use; DMR = Discharge Monitoring Report; ECHO = Enforcement and Compliance History Online; HHE = Health Hazard Evaluation; NAICS = North American Industry Classification System; NEI = National Emissions Inventory; NIOSH = National Institute for Occupational Safety and Health; NPDES = National Pollutant Discharge Elimination System; OES = occupational exposure scenario; OSHA = Occupational Safety and Health Administration; SIC = Standard Industrial Classification; TRI = Toxics Release Inventory

[a] Facilities may report using a Form A if the annual reportable release amount of the chemical did not exceed 500 lb for the reporting year, and the amounts manufactured, or processed, or otherwise used did not exceed 1 million lb for that year.

B.3 OES Mapping Procedures

This section contains procedures for mapping facilities to OES for each source discussed in Section B.2.

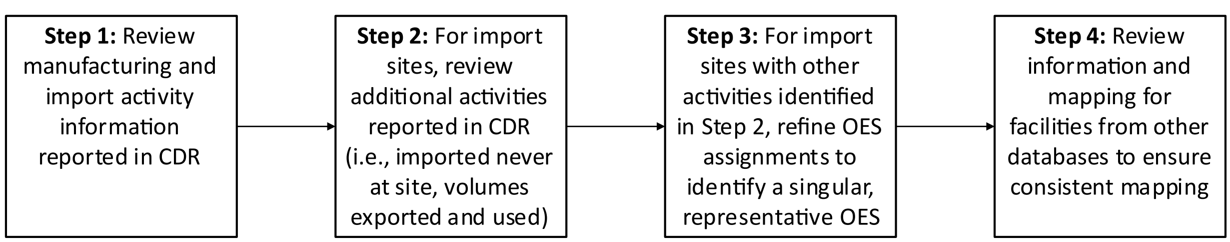
B.3.1 Chemical Data Reporting (CDR)

The only facilities required to report to CDR are those that manufacture or import specific chemicals at or above a specified threshold.[11] Therefore, sites that report for the chemical of interest in CDR will generally be mapped to either the Manufacturing or Import/Repackaging OES. These sites must also report the processing and uses of the chemical; however, these procedures are specific to mapping of the reporting site and not downstream processing or use sites.

CDR, under TSCA, requires manufacturers (including importers) to provide EPA with information on the production and use of chemicals in commerce. These facilities must report to CDR every four years. For risk evaluations conducted under the amended TSCA, EPA has primarily used 2016 and 2020 CDR. The procedures in this document are applicable to both 2016 and 2020 CDR data; however, there are some data elements that are only applicable to 2020 CDR, which are called out in the procedures where applicable. These procedures should be applicable to future CDR reporting, depending on changes to reporting requirements. If the TDR rule is promulgated, these procedures will be updated accordingly.

Chemical data reported under CDR is classified using Industrial Function Category (IFC) codes and/or commercial/consumer use product categories (PCs). CDR IFC codes describe the "intended physical or chemical characteristics for which a chemical substance or mixture is consumed as a reactant; incorporated into a formulation, mixture, reaction product, or article, repackaged; or used." Alternatively, PCs describe the consumer and commercial products in which each reportable chemical is used. EPA typically uses these CDR codes to identify the COUs for the chemical in the published scope documents.

Figure_Apx B-2 depicts the steps that should be followed to map CDR reporting sites to OES. Each step is explained in the text below the figure. Additionally, Section B.5.1 shows step-by-step examples for using the mapping procedures to determine the OES for three example CDR reporting facilities.



Figure_Apx B-2. OES Mapping Procedures for CDR

To map sites reporting to CDR, the following procedures should be used with the non-CBI CDR:

1. **Review Manufacturing and Import Activity Information:** The first step in the process is to review the reported activity information to identify if the facility imports or manufactures the chemical.

[11] See 2020 CDR reporting instructions (accessed August 11, 2025) for further information, including descriptions on the information required to be reported.

   a. If the facility reports domestic manufacturing, the Manufacturing OES should be assigned, even if the facility also reports importation or the facility may conduct other operations with the chemical. This is because manufacturing of the chemical is expected to be the primary operation, with any other processing or uses being ancillary operations.
   b. If the chemical is being manufactured as a byproduct (this is a voluntary reporting element starting in 2020 CDR), this may need to be considered separately from non-byproduct manufacturing depending on assessment needs for the chemical.
   c. If the facility does not manufacture the chemical and only imports the chemical, check if additional processes occur at the site as described in the subsequent steps.
2. **For Importation Sites, Review Fields for "Imported Never at Site," "Volume Exported," and "Volume Used":** The next step is to review these additional fields to determine if the reporting facility conducts more than just importation activities.
   a. If the facility imports the chemical, they must report if it is imported but never physically at the reporting site. If the facility indicates the chemical is imported and never at site, the facility does not handle the chemical and the only applicable OES is Importation. In such cases, the assessor should proceed to Step 4. If the facility does not indicate the chemical is imported and never at site, proceed to Step 2b.
   b. If the facility reports a quantity for "volume exported" and this quantity is the same as that imported, no additional OES occurs at the site beyond importation. In such cases, the assessor should proceed to Step 4. If the exported quantity is not equal to volume imported, assessors should check if any of the chemical is used at the reporting site per Step 2c.
   c. If the facility reports a quantity for "volume used," additional OES may be applicable to the facility beyond manufacturing or importation. Proceed to Step 3 to identify and refine additional OES.
3. **Refine OES Assignments:** If multiple OES were identified from the previous steps, a single primary OES must be selected using additional facility information. OES determinations should be made with the following considerations:
   a. 6-digit NAICS code reported by the facility in CDR – note that this is only a requirement starting in 2020 CDR (*e.g.,* for a facility that reported NAICS code was 325520, Adhesive Manufacturing, the incorporation into a formulation, mixture, or reaction product OES may be appropriate; for a facility reporting a NAICS code starting in 424690, Other Chemical and Allied Products Merchant Wholesalers, only the repackaging OES is likely applicable).
   b. Downstream processing and use information reported in CDR. The reporting site must provide information on downstream processing and use of the chemical for all sites, meaning it cannot be distinguished which processing and use information includes the reporting site operations versus downstream site operations. However, this information may still help inform the operations at the reporting site and should be reviewed. Specifically, for a given processing/use activity, if the submitter reports "Fewer than 10 sites" for the "number of sites" field (which is the lowest number of sites that can be reported), there is a likelihood that the facility's operations may be included in this processing/use activity. In such cases, review the corresponding fields for "type of processing or use operation," "industrial sector," and "function category" to help identify the OES. The greater number of sites that are reported, the more likely that the associated

processing and use information includes information from downstream sites and the less reliable the information is for mapping OESs to the reporting site.

c. Internet research of the types of products made at the facility (*e.g.,* if a facility's website indicates the facility manufactures plastic products, the chemical may be used as a processing aid or component in the plastic products, depending on the known uses of the chemical within the plastics industry).

d. Information from other reporting databases as described in Step 2c.

e. An evaluation of the OES that is most likely to result in a release (*e.g.,* for facilities that reported importation and may also conduct formulation per the reported NAICS code, the Formulation OESs may be assigned, because, in most cases, importation would have a lower likelihood of a release).

f. Grouped OESs for similar uses (*e.g.,* multiple facilities that may conduct formulation operations based on the reported NAICS code may be assigned a grouped formulation OES that covers all types of formulation [*e.g.,* adhesives, paints, cleaning products]).

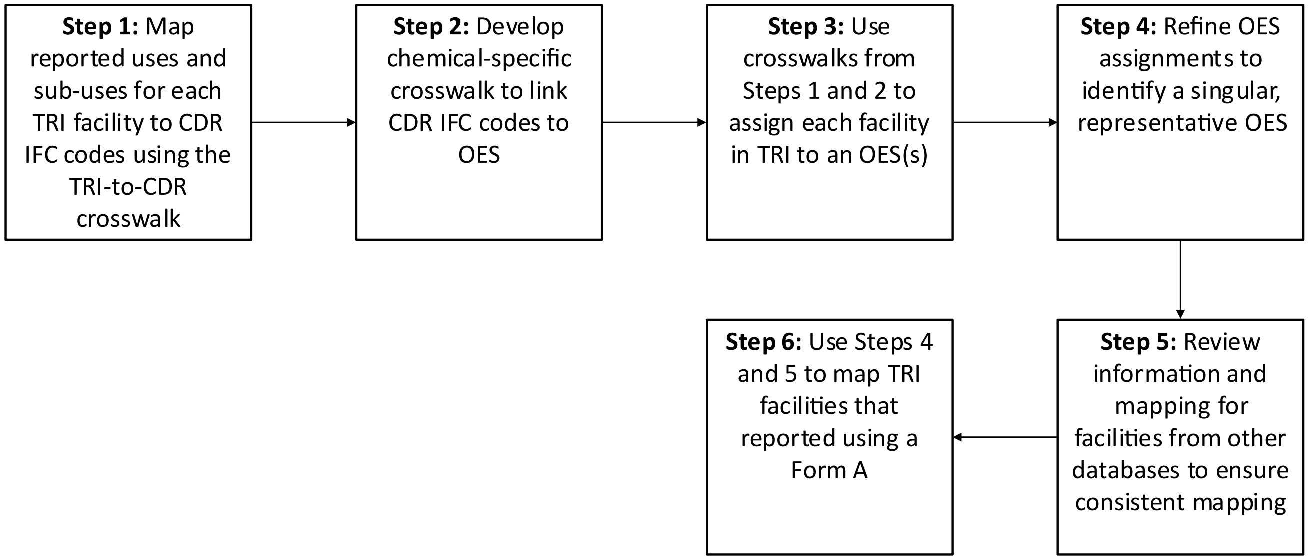
4. **Review Information from Other Databases:** Other databases/sources (such as TRI, NEI, and DMR) should be checked to see if the facility has reported to these. If so, the OES determined from the mapping procedures for those databases (discussed in other sections of this document) should also be used. It is important that the same facility is mapped consistently across multiple databases/sources. The facility's TRI identification number (TRFID) and Facility Registry Services identification number (FRS ID) can be used to identify sites that report to TRI, DMR, and NEI. If the facility does not report to these databases, but additional OESs are possible per Step 2, the assessor should search available facility information on the internet.

Given the information available in CDR, EPA expects that, for most chemicals, 100% of the sites reporting to CDR can feasibly be mapped to an OES.

B.3.2 Toxics Release Inventory (TRI)

TRI reporting is required for facilities that manufacture (including import), process, or otherwise use any TRI-listed chemical in quantities greater than the established threshold in the calendar year AND have 10 or more full-time employee equivalents (*i.e.,* a total of 20,000+ hours) and are included in a covered NAICS code. Therefore, unlike CDR reporters that are primarily manufacturers and importers, TRI reporters can be mapped to a variety of different OES.

Figure_Apx B-3 depicts the steps that should be followed to map TRI reporting sites to OES. Each step is explained in the text below the figure. Additionally, Section B.5.2 shows step-by-step examples for using the mapping procedures to determine the OES for three example TRI reporting facilities.



Figure_Apx B-3. OES Mapping Procedures for TRI

To map sites reporting to TRI, the following procedures should be used:

1. **Assign Chemical Data Reporting Codes Using TRI-to-CDR Crosswalk:** The first step in the TRI mapping process is to map the uses and sub-uses reported by each facility to one or more 2016 CDR IFC codes. To do this, first compile all TRI uses/sub-uses for the reporting facility into a single column, then map them to CDR IFC codes using the TRI-to-CDR Use Mapping crosswalk. This is a universal crosswalk that applies to all chemicals.
2. **Develop Chemical-Specific Crosswalk to Link CDR Codes to OES:** The next step is to develop a separate CDR IFC code-to-OES crosswalk that links CDR IFC codes to OES for the chemical. To create this crosswalk, match the COU categories and subcategories from the COU table in the published scope documents (such as the example provided in Table 1-1) to the list of 2016 CDR IFC codes in the CDR reporting instructions.[12] The categories and subcategories of COUs typically match the IFC code category. Recent examples of already completed CDR IFC code-to-OES crosswalk can be found for the fenceline chemicals (1-bromopropane, methylene chloride, n-Methylpyrrolidone, carbon tetrachloride, perchloroethylene, trichloroethylene, and 1,4-dioxane).
3. **Assign OESs:** Each TRI facility is then mapped to one or more OES using the CDR IFC codes assigned to each facility in Step 1 and the CDR IFC code-to-OES crosswalk developed in Step 2.
4. **Refine OES Assignments:** If a facility maps to more than one OES in Step 3, a single primary OES must be selected using additional facility information. OES determinations should be made with the following considerations:
    a. 6-digit NAICS codes reported by the facility in TRI (*e.g.,* for a facility that reported TRI uses for both formulation and use as cleaner, EPA assigned the Formulation OES if the NAICS code was 325199, All Other Basic Organic Chemical Manufacturing; another example is NAICS codes 562211, Hazardous Waste Treatment and Disposal, and

[12] IFC codes and their definitions can be found in Table 4-11 of the CDR reporting instructions: https://www.epa.gov/chemical-data-reporting/instructions-reporting-2016-tsca-chemical-data-reporting (accessed August 11, 2025).

327310, Cement Manufacturing, almost always correspond to the Disposal OES, regardless of the reported TRI uses and sub-uses).

b. Internet research of the types of products made at the facility (*e.g.,* if a facility's website indicates the facility manufactures metal parts, the facility is likely to use chemicals for degreasing or in a metalworking fluid) and information from sources cited in the COU table and scoping document, such as public and stakeholder comments (*i.e.,* EPA will review sources cited in the COU table and scoping document to see if there is any information specific to the reporting site that can be used to inform the mapping).

c. Information from other reporting databases as described in Step 5.

d. An evaluation of the OES that is most likely to result in a release (*e.g.,* facilities that reported both importation and formulation may be assigned a Formulation OES, because, in most cases, importation would have a lower likelihood of a release).

e. Grouped OES for similar uses/sub-uses (*e.g.,* facilities that reported cleaner and degreaser sub-uses may be assigned a grouped OES that covers both cleaning and degreasing because the specific cleaning/degreasing operation cannot be determined from the TRI data).

5. **Review Information from Other Databases:** Other databases/sources (including CDR, NEI, and DMR) should be checked to see whether the facility has reported to these. If so, the OES determined from the mapping procedures for those databases (discussed in other sections of this document) should also be used. It is important that the same facility is mapped consistently across multiple databases/sources. The facility's TRFID and FRS ID can be used to identify sites that report to TRI, DMR, and NEI.

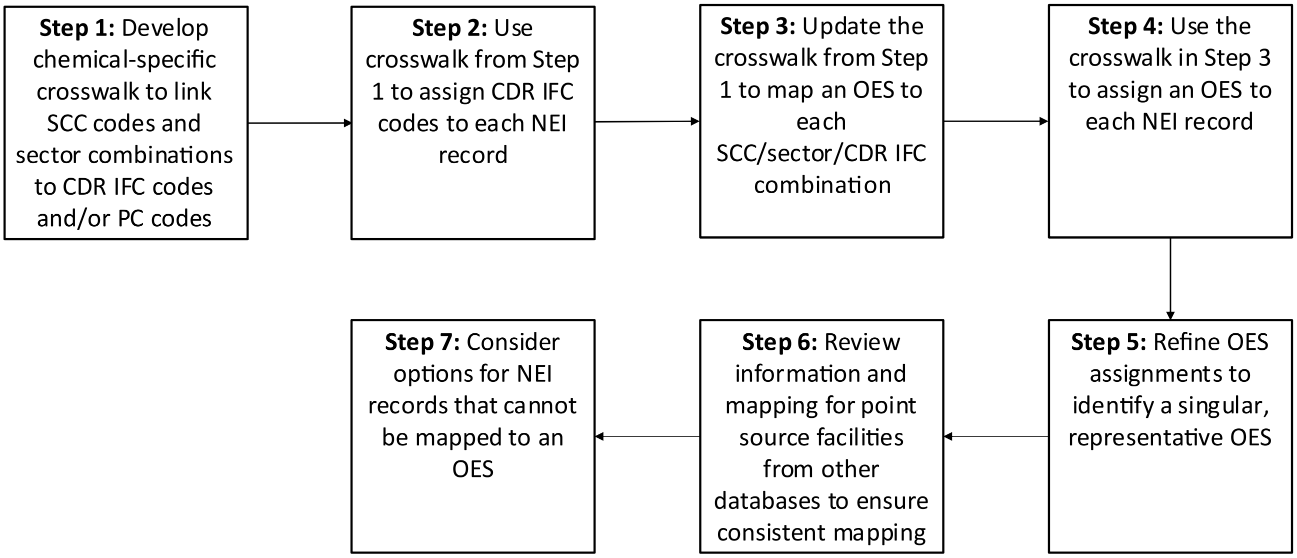
6. Note that facilities that submit using a TRI Form A do not report TRI uses/sub-uses. To determine the OES for these facilities, EPA will use information from Steps 4 and 5 above.

Given the information available in TRI, ERG/EPA expects that, for most chemicals, 100% of the sites reporting to TRI can feasibly be mapped to an OES.

B.3.3 National Emissions Inventory (NEI)

The NEI is a compilation of air emissions of criteria pollutants, criteria precursors, and hazardous air pollutants from point and non-point source air emissions. Air emissions data for the NEI are collected at the state, local, and tribal (SLT) level. The Air Emissions Reporting Requirement rule requires SLT air agencies to collect, compile, and submit criteria pollutant air emissions data to EPA. Many SLT air agencies also voluntarily submit data for pollutants on EPA's list of hazardous air pollutants. Major sources are required to report point source emissions data to their SLT air agency. Each SLT entity must, in turn, report point source emissions data to EPA every 1 to 3 years, depending upon the size of the source. Nonpoint estimates are typically developed by state personnel.

Figure_Apx B-4 depicts the steps that should be followed to map NEI reporting sites/records to OES. Each step is explained in the text below the figure. Additionally, Section B.5.3 shows step-by-step examples for using the mapping procedures to determine the OES for one point source example and one nonpoint source example.



Figure_Apx B-4. OES Mapping Procedures for NEI

To map sites reporting point source emissions and nonpoint emissions records for the chemical of interest to NEI, the following procedures should be used:

1. **Develop Crosswalks to Link NEI-Reported SCC and Sector Combinations to Chemical Data Reporting Codes:** The first step in mapping NEI data to potentially relevant OES is to develop a crosswalk to map each unique combination of NEI-reported Source Classification Code (SCC) (levels 1–4) and industry sectors to one or more CDR codes. This crosswalk is developed on a chemical-by-chemical basis rather than an overall crosswalk for all chemicals because SCCs correspond to emission sources rather than chemical uses such that the crosswalk to CDR codes may differ from chemical to chemical. In some cases, it may not be possible to assign all SCC sector combinations to CDR codes, in which case information from Step 5 can be used to help make OES assignments. Separate crosswalks are needed for point and nonpoint source records, as discussed below.
    a. For the point source NEI data, the crosswalk should map each unique combination of NEI-reported SCC and industry sectors to one or more *CDR IFC codes*.
    b. For nonpoint source NEI data, the crosswalk should link the SCC codes and sectors to *both CDR IFC codes and/or commercial/consumer use PCs*. This is because the nonpoint source data may include commercial operations, for which CDR PCs may be more appropriate.
2. **Use CDR Crosswalks to Assign CDR Codes:** Next, the chemical-specific CDR crosswalk developed in Step 1 should be used to assign CDR IFC codes to each point source NEI record and CDR IFC codes and/or commercial/consumer use PCs to each nonpoint source NEI record.
3. **Update CDR Crosswalks to Link CDR Codes to OESs:** The chemical-specific crosswalk developed in Step 1 is then used to link the SCCs, sectors, and CDR codes in the crosswalk to an OES. The OES will be assigned based on the chemical specific COU categories and subcategories and the OES mapped to them as discussed in Section B.1.
4. **Use CDR Crosswalks to Assign OESs:** The chemical-specific CDR crosswalks developed in Steps 1-3 are then used to assign OES to each point source and nonpoint source NEI data record (*i.e.,* each combination of facility-SCC-sector). Note that the individual facilities in the point

source dataset may have multiple emission sources, described by different SCC and sector combinations within NEI, such that multiple OES map to these NEI records. In such cases, a single, representative OES must be selected for each NEI record using the additional information described in Step 5. Similarly, the sectors reported by nonpoint sources may map to multiple CDR IFC or PC codes, such that multiple OES are applicable and must be refined to a single OES for each NEI record.

5. **Refine OES Assignments:** The initial OES assignments may need to be confirmed and/or refined to identify a single primary OES using the following information described below for point source and nonpoint source records.
   a. For point source records in NEI, use the following information to refine OES assignments:
      - Additional information available in NEI:
        - Facility name.
        - Primary NAICS code and description, populated from the EIS lookup tables.
        - Facility site description, which, when populated, is intended to describe the type of industry the facility operates (similar to a NAICS description).
        - Process description, which is a free-text field where reporters can provide additional information about the process related to their emission unit.
        - Emission unit description, which is a free-text field where reporters can provide additional information about their emission units.
      - Internet research of the types of products made at the facility (*e.g.,* if a facility's website indicates the facility manufactures metal parts, the facility is likely to use chemicals for degreasing or in a metalworking fluid) and information from sources cited in the COU table and scoping document, such as public and stakeholder comments (*i.e.,* EPA will review sources cited in the COU table and scoping document to see if there is any information specific to the reporting site that can be used to inform the mapping).
      - Information from other reporting databases as described in Step 5b.
      - An evaluation of the OES that is most likely to result in a release (*e.g.,* facilities that map to both lubricant use and vapor degreasing may be assigned a Vapor Degreasing OES, because, in most cases, vapor degreasing results in higher air emissions).
      - Grouped OES for similar uses/sub-uses (*e.g.,* facilities that map to both general cleaning and vapor degreasing may be assigned a grouped OES that covers both cleaning and degreasing because the specific cleaning/degreasing operation cannot be determined from the NEI data).
   b. For nonpoint source records in NEI, use the following information to refine OES assignments (there is no additional data reported to NEI by nonpoint sources that can help refine the OES mapping):
      - General knowledge about the use of the chemical in the reported sector, such as from scope documents, public or stakeholder comments, process descriptions, professional judgment, or already-identified sources from systematic review.

- Internet research of the uses of the chemical in the reported sector, if insufficient information is not already available per the previous bullet.
- An evaluation of the OES that is most likely to result in a release (*e.g.,* sectors that map to both lubricant use and vapor degreasing may be assigned a Vapor Degreasing OES, because, in most cases, vapor degreasing results in higher air emissions).
- Grouped OES for similar uses/sub-uses (*e.g.,* sectors that map to both general cleaning and vapor degreasing may be assigned a grouped OES that covers both cleaning and degreasing because the specific cleaning/degreasing operation cannot be determined from the NEI data).

6. **Review Information from Other Databases for Point Source Facilities:** Other databases/sources (including CDR, TRI, and DMR) should be checked to see if the point source facilities have reported to these. If so, the OES determined from the mapping procedures for those databases (discussed in other sections of this document) should also be used. It is important that the same facility is mapped consistently across multiple databases/sources. The facility's TRFID and FRS ID can be used to identify sites that report to TRI, DMR, and NEI.
7. **Consider Options for NEI Records that Cannot be Mapped to an OES:** Given the number of records in NEI and the information available, it may not always be feasible to achieve mapping of 100% of the sites reporting to NEI to an OES. For example, there may be NEI records for restaurants or the commercial cooking sector, which do not map to an in-scope COU or OES. Additionally, NEI records may include emissions from combustion byproducts for the chemical, which does not correspond to a COU or OES. In such cases, multiple options may be appropriate depending on assessment needs, such as:
    a. Assigning the sites as having an unknown OES with 250 release days/year. This allows for subsequent exposure modeling and the assessment of risk. For sites with identified risk, the OES can then be mapped using the below resources.
    b. Contacting the facility for clarification on the use of the chemical. Information Collection Request (ICR) requirements also apply when contacting 10 or more facilities.[13]

B.3.4 Discharge Monitoring Report (DMR)

Facilities must submit DMRs for chemicals when the following two conditions are met: (1) the facility has an NPDES permit for direct discharges to surface water, and (2) the NPDES permit contains monitoring requirements for the chemical of interest. Indirect discharges (*e.g.,* those sent to an off-site wastewater treatment plant or publicly owned treatment works) are not covered under the NPDES program.

If a facility has discharge monitoring requirements for the chemical of interest, these requirements are either technology-based or water-quality based. Typically, a facility has NPDES monitoring requirements for a chemical because the facility somehow manufactures, processes, or uses the chemical. However, it is possible for a facility to have monitoring requirements for a chemical they do not handle if the facility falls within a guideline containing requirements for that chemical, as described below.

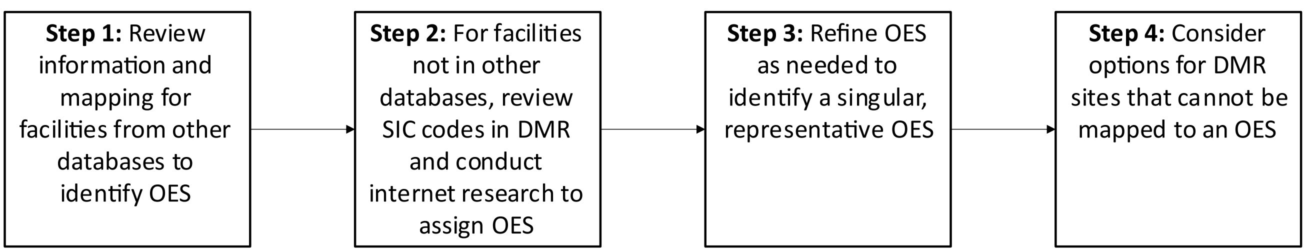
- **Technology-Based Guidelines:** If the facility falls within a certain industrial sector, it may be covered by a national effluent guideline. Effluent guidelines are industry-specific and contain

[13] More on Information Collection Requests can be found at https://www.epa.gov/icr/icr-basics (accessed August 11, 2025).

treatment technology-based guidelines for discharges of specified pollutants (chemicals) commonly found within that industry.[14] A common effluent guideline containing requirements for chemicals that have or are currently undergoing risk evaluation is the Organic Chemicals, Plastics & Synthetic Fibers (OCPSF) effluent guideline. Alternatively, if there is no applicable effluent guideline for the facility, the permitting authority may establish technology-based guidelines using best professional judgment. If a facility falls within an existing effluent guideline, the permitting authority will generally include monitoring requirements in the facility's NPDES permit that are consistent with the effluent guideline, even if the facility does not handle all the chemicals for which there are monitoring requirements. Therefore, under this reasoning, it is possible that a facility reporting for the chemical of interest in DMRs does not actually handle the chemical.[15]

- **Water Quality-Based Guidelines:** The receiving water for the facility's discharges is impaired such that the permitting authority sets general water-quality based effluent limits and monitoring requirements for chemicals that may further impair the water quality. It is possible that the permitting authority uses these same general water-quality based requirements for all facilities that discharge to the water body. Therefore, under this rationale, it is possible that a facility reporting for the chemical of interest in DMRs does not actually handle the chemical.[5]

Figure_Apx B-5 depicts the steps that should be followed to map DMR reporting sites to OESs. Each step is explained in the text below the figure. Additionally, Section B.5.4 shows step-by-step examples for using the mapping procedures to determine the OES for two example DMR reporting facilities.



Figure_Apx B-5. OES Mapping Procedures for DMR

To map sites reporting to DMR, the following procedures should be used:

1. **Review Information from Other Databases:** Given the limited facility information reported in DMRs, the first step for mapping facilities reporting to DMR should be to check other databases/sources (including CDR, TRI, and NEI). If so, the OES determined from the mapping procedures for those databases (discussed in other sections of this document) should be used. It is important that the same facility is mapped consistently across multiple databases/sources. The facility's TRFID and FRS ID can be used to identify sites that report to TRI, DMR, and NEI.

2. **Assign OESs:** If the facility does not report to other databases, the following information should be used to assign an OES:

    a. 4-digit SIC codes reported by the facility in DMR (*e.g.,* a facility that reported SIC code 2891, Adhesives and Sealants, likely formulates these products; a facility that reported

[14] A list of the industries for which EPA has promulgated effluent guidelines is available at: https://www.epa.gov/eg/industrial-effluent-guidelines#existing (accessed August 11, 2025).

[15] Note that a facility may request to have monitoring requirements reduced or removed from the permit where historical sampling demonstrates that these chemicals are consistently measured below the effluent limits. Thus, it is possible for a facility to cease monitoring for the chemical of interest upon approval by the permitting authority.

SIC code 4952, Sewerage Systems, likely treats wastewater). Note that SIC codes can be crosswalked to NAICS codes, which are often more useful for mapping OES because they are more descriptive than SIC codes.

   b. Internet research of the types of products made at the facility (*e.g.,* if a facility's website indicates the facility manufactures metal parts, the facility is likely to use chemicals for degreasing or in a metalworking fluid) and information from sources cited in the COU table and scoping document, such as public and stakeholder comments (*i.e.,* EPA will review sources cited in the COU table and scoping document to see if there is any information specific to the reporting site that can be used to inform the mapping).

3. **Refine OES:** If the specific OES still cannot be determined using the information in Step 2, the following should be considered.

   a. NPDES permit numbers reported in DMR. The permit number generally indicates if the permit is an individual permit or a general permit.[16] If the permit is a general permit, the permit number can often indicate the type of general permit, which can provide information on the operations at the facility.

      - Individual NPDES permits are numbered in the format of the state abbreviation followed by a seven-digit number (*e.g.,* VA0123456). General permits are usually numbered in the format of state abbreviation followed by one letter then a six-digit number (*e.g.,* VAG112345 or MAG912345).

      - Because each state is slightly different in their general permit numbering, the general permit number should be searched on the internet to determine the type of general permit. For the general permit number examples provided above, a permit number beginning in "VAG11" signifies Virginia's general permit for concrete products facilities and a permit number beginning with "MAG91" signifies Massachusetts' general permit for groundwater remediation. Other common general permit types include those for construction sites, mining operations, sites that only discharge non-contact cooling water, and vehicle washes.

   b. Searching for the permit online. If the specific NPDES permit for the facility can be found online, it may contain some general process information for the facility that can help inform the OES mapping. However, NPDES permits may be difficult to find online and do not generally contain much information on process operations.

   c. An evaluation of the OES that is most likely to result in a water release (*e.g.,* for facilities that report an SIC code for the production of metal products, both Vapor Degreasing and Metalworking Fluid OESs are applicable; in such cases, the Metalworking Fluid OES may be assigned because it is more likely to result in water releases than vapor degreasing).

   d. Grouped OES for similar uses (*e.g.,* multiple facilities that may conduct formulation operations based on the reported SIC code may be assigned a grouped formulation OES that covers all types of formulation [*e.g.,* adhesives, paints, cleaning products]).

4. **Consider Options for DMR Sites that Cannot be Mapped to an OES**: Given the limited information available in DMR, it may not always be feasible to achieve mapping of 100% of the

[16] Information on individual and general NPDES permits can be found at: https://www.epa.gov/npdes/npdes-permit-basics (accessed August 11, 2025).

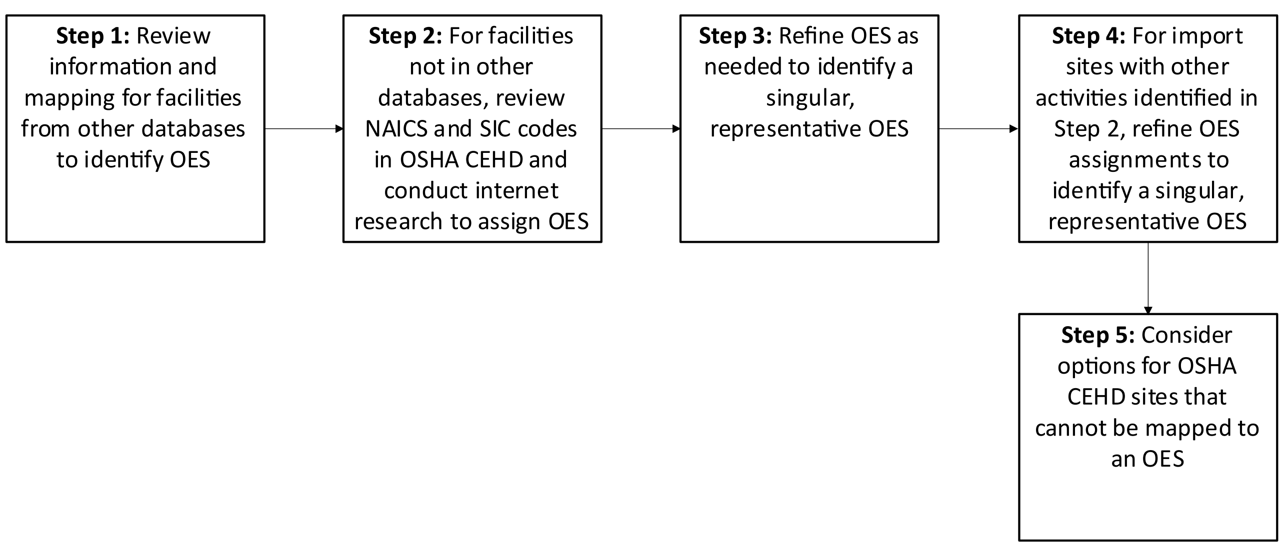
sites reporting to DMR to an OES. In such cases, multiple options may be appropriate depending on assessment needs, such as:

a. Assigning the sites as having an unknown OES with 250 release days/year. This allows for subsequent exposure modeling and the assessment of risk. For sites with identified risk, the OES can then be mapped using the below resources.
b. Contacting the state government for the NPDES permit, permit applications, past inspection reports, and any available information on facility operations. Note that information requests such as these may require an ICR if 10 or more entities are contacted.
c. Contacting the facility for clarification on the use of the chemical. ICR requirements also apply when contacting 10 or more facilities.

B.3.5 Occupational Safety and Health Administration CEHD Data

OSHA CEHD is a compilation of industrial hygiene samples (*i.e.,* occupational exposure data) taken when OSHA monitors worker exposures to chemical hazards. OSHA will conduct monitoring at facilities that fall within targeted industries based on national and regional emphasis programs.[17] OSHA conducts monitoring to compare against occupational health standards. Therefore, unlike CDR, TRI, NEI, and DMR, facilities are not required to report data to OSHA CEHD. Also, because OSHA only visits selected facilities, the amount of OSHA data available for each OES is often limited.

Figure_Apx B-6 depicts the steps that should be followed to map OSHA CEHD sites to OES. Each step is explained in the text below the figure. Additionally, Section B.5.5 shows step-by-step examples for using the mapping procedures to determine the OES for two example OSHA CEHD facilities.



Figure_Apx B-6. OES Mapping Procedures for OSHA CEHD

Within the OSHA CEHD data, there may be sites for which all air sampling data are non-detect (below the limit of detection) for the chemical. In these cases, if there is also no bulk sampling data indicating the presence of the chemical, there is no evidence that the chemical is present at the site. OSHA may have sampled for the chemical based on a suspicion or pre-determined sampling plan, and not because

[17] More information on OSHA CEHD can be found at: https://www.osha.gov/opengov/health-samples (accessed August 11, 2025).

the chemical was actually present at the site. Therefore, these sites do not need to be mapped to OES. To map sites for which there is OSHA CEHD data that are not all non-detect for the chemical, the following procedures should be used:

1. **Review Information from Other Databases:** Given the limited facility information reported in OSHA CEHD, the first step for mapping facilities should be to check other databases/sources (including CDR, TRI, NEI, and TRI). If so, the OES determined from the mapping procedures for those databases (discussed in other sections of this document) should be used. It is important that the same facility is mapped consistently across multiple databases/sources. Because facility identifiers such as TRFID and FRS ID are not available in the CEHD, the name of the facility in the CEHD will need to be compared to the facility names in other databases to identify if the facility is present in multiple databases/sources.
2. **Assign OES:** If the facility does not report to other databases, the following information should be used to assign an OES.
    a. 4-digit SIC and 6-digit NAICS codes reported in the CEHD (*e.g.,* a facility that reported SIC code 2891, Adhesives and Sealants, likely formulates these products; a facility that reported NAICS code 313320, Fabric Coating Mills, likely uses the chemical in fabric coating).
    b. Internet research of the types of products made at the facility (*e.g.,* if a facility's website indicates the facility manufactures metal parts, the facility is likely to use chemicals for degreasing or in a metalworking fluid) and information from sources cited in the COU table and scoping document, such as public and stakeholder comments (*i.e.,* EPA will review sources cited in the COU table and scoping document to see if there is any information specific to the reporting site that can be used to inform the mapping).
3. **Refine OES:** If the specific OES still cannot be determined using the information in Step 2, the following should be considered.
    a. An evaluation of the OES that is most likely to result in occupational exposures (*e.g.,* for facilities that report an SIC code for janitorial services, multiple OES may be applicable, such as cleaning, painting (*e.g.,* touch-ups), other maintenance activities; in such cases, the cleaning OES may be assigned for volatile chemicals because it has the highest exposure potential).
    b. Grouped OES for similar uses (*e.g.,* multiple facilities that may conduct formulation operations based on the reported NAICS or SIC code may be assigned a grouped formulation OES that covers all types of formulation [*e.g.,* adhesives, paints, cleaning products]).
4. **Consider Options for OSHA CEHD Sites that Cannot be Mapped to an OES:** Given the limited information available in OSHA CEHD, it may not always be feasible to achieve mapping of 100% of the sites in the database to an OES. In such cases, multiple options may be appropriate depending on assessment needs, such as:
    a. Assigning the sites as having an unknown OES with 250 exposure days/year. This allows for subsequent health modeling and the assessment of risk. For workers with identified risk, the OES can then be mapped using the below resources.
    b. Contacting OSHA for additional information on the facility from the OSHA inspection/monitoring.
    c. Contacting the facility for clarification on the use of the chemical. Note that information requests such as these may require an ICR if 10 or more entities are contacted.

d. As discussed previously, sites for which all air monitoring data are non-detects for the chemical and for which there are no bulk data indicating the presence of the chemical *do not* need to be mapped to an OES. This is because the data do not provide evidence that the chemical is present at the site.

B.3.6 National Institute of Occupational Safety and Health Hazard Evaluation (HHE)

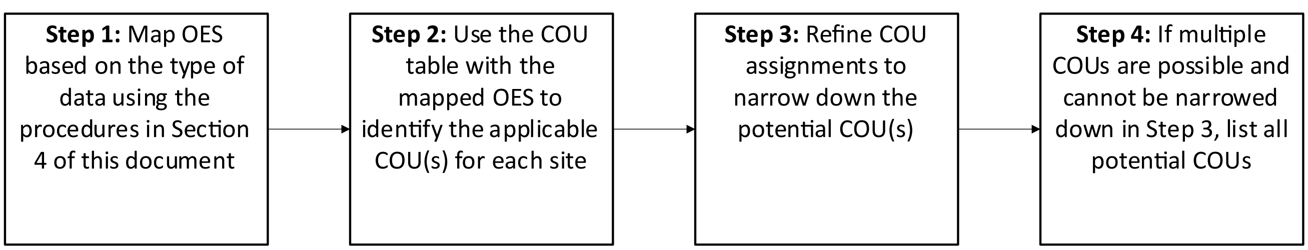
NIOSH conducts HHEs at facilities to evaluate current workplace conditions and to make recommendations to reduce or eliminate the identified hazards.[18] NIOSH conducts HHEs at the request of employers, unions, or employees in workplaces where employee health and wellbeing is affected by the workplace. Therefore, unlike CDR, TRI, NEI, and DMR, facilities are not required to report data to NIOSH under the HHE program. Also, NIOSH only visits selected facilities where an HHE was requested, so the number of NIOSH HHEs available for each OES is often limited.

To map a facility that is the subject of a NIOSH HHE, the information in the HHE report should be used. Specifically, the HHE report typically includes general process information for the facility, information on how the chemical is used, worker activities, and the facility's SIC code. This information should be sufficient to map the facility to a single representative OES. Additionally, given the extent of information available about the subject facilities in NIOSH HHE reports, 100% of these facilities can be mapped to an OES. Additionally, Appendix B.5.6 shows two examples of how to map NIOSH HHE facilities to OES.

B.4 COU Mapping Procedures

As discussed in Section B.1, there is not always a one-to-one mapping between COUs and OESs.

Figure_Apx B-7 depicts the steps that should be followed to map sites from the standard sources discussed in this document to COUs, using the OES mapping completed in Appendix A.1. Each step is explained in the text below the figure. Additionally, Appendix B.5.7 shows step-by-step examples for using the mapping procedures to determine the COU for three example facilities.



Figure_Apx B-7. COU Mapping Procedures for Standard Sources Already Mapped to OESs

To map facilities from standard sources (*i.e.,* CDR, TRI, NEI, DMR, OSHA CEHD, and NIOSH HHE) to COUs, the following procedures should be used:

1. **Map the Facility to an OES:** To map a facility from a standard source to a COU, the facility should first be mapped to an OES following the procedures for the specific source of data (discussed in Section B.3).

[18] More information about NIOSH HHEs is available at: https://www.osha.gov/opengov/health-samples and https://www.cdc.gov/niosh/hhe/about/?CDC_AAref_Val=https://www.cdc.gov/niosh/hhe/about.html (both hyperlinks accessed October 22, 2025).

2. **Use the COU Table with Mapped OES to Assign COUs:** At the point of the risk evaluation process where EPA are mapping data from standard sources to OES and COU, EPA have already mapped OES to each of the COUs from the scope document, like is shown in Table 1-1. This crosswalk between COUs and OES should be used to identify the COU(s) for the facility using the OES mapped per Section B.3.
3. **Refine the COU Assignment:** In some instances, more than one COU may map to the facility. In such cases, the following information should be used to try to narrow down the list of potentially applicable COUs:
    a. Information from the standard sources (*e.g.,* if ERG/EPA assigned a grouped OES like "Industrial Processing Aid" and the facility's NAICS code in TRI or NEI is related to battery manufacturing, the COU can be identified as the "Processing Aid" category and Process solvent used in battery manufacture" subcategory).
    b. Internet research of the types of products made at the facility (*e.g.,* if a facility's website indicates the facility makes adhesives, the COU category of "Processing – Incorporation into formulation, mixture or reaction product" and subcategory of "Adhesives and sealant chemicals" can be assigned and the remaining subcategories [*e.g.,* Solvents for cleaning or degreasing, Solvents which become part of the product formulation or mixture] are not applicable) and information from sources cited in the COU table and scoping document, such as public and stakeholder comments (*i.e.,* EPA will review sources cited in the COU table and scoping document to see if there is any information specific to the reporting site that can be used to inform the mapping).
4. **List all Potential COUs:** Where the above information does not narrow down the list of potentially applicable COUs, EPA will list all the potential COUs and will not attempt to select just one from the list where there is insufficient information to do so.

B.5 Example Case Studies

This section contains step-by-step examples of how to implement the OES and COU mapping procedures listed in Appendices A.1 and B.4 to determine OES for facilities that report to standard engineering sources.

B.5.1 CDR Mapping Examples

This section includes examples of how to implement the OES mapping procedures for sites reporting to CDR, as listed in Section B.3.1. Specifically, this section includes examples for three example sites that reported to 2020 CDR for the round 2 chemical Di-isononyl phthalate (DINP). These example sites are referred to as Facility A, Facility B, and Facility C.

To map Facilities A, B, and C to an OES, the following procedures are used with the non-CBI 2020 CDR database.

1. **Review Manufacturing and Import Activity Information**: The first step in the process is to review the reported activity information to identify if the facility imports or manufactures the chemical. Table_Apx B-3 summarizes the information gathered from 2020 CDR for the three example sites for this step.

Table_Apx B-3. Step 1 for CDR Mapping Facilities

Facility Name	Step 1a: Reported Activity	Step 1b: Byproduct Information	Step 1c: Check Other Activities?	OES Determination
Facility A	Domestically Manufactured/Imported	Not Known or Reasonably Ascertainable	Not needed – per Step 1 in Section B.3.1	Per Step 1a, this site maps to the Manufacturing OES
Facility B	Imported	CBI	Yes	Cannot be determined in Step 1 – Proceed with Step 2
Facility C	Imported	Not Known or Reasonably Ascertainable	Yes	Cannot be determined in Step 1 – Proceed with Step 2

2. **For Importation Sites, Review Fields for "Imported Never at Site," "Volume Exported," and "Volume Used":** The next step is to review these additional fields to determine if the reporting facility conducts more than just importation activities. Table_Apx B-4 summarizes the information gathered from 2020 CDR for the three example sites for this step.

Table_Apx B-4. Step 2 for CDR Mapping Example Facilities

Facility Name	Step 2a: Imported Never at Site	Step 2b: Volume Exported	Step 2c: Volume Used	OES Determination
Facility A	N/A – OES determined in Step 1			
Facility B	CBI	CBI	CBI	Cannot be determined in Step 2 – Proceed with Step 3.
Facility C	Yes	0	0	Because the facility only imports and does not use DINP, this site maps to the Import/Repackaging OES.
CBI = confidential business information; CDR = Chemical Data Reporting; OES = occupational exposure scenario				

3. **Refine OES Assignments:** If multiple OES were identified from the previous steps, a single primary OES must be selected using additional facility information as discussed in Steps 3a to 3f. Table_Apx B-5 summarizes the information gathered from 2020 CDR for the three example sites for this step.

Table_Apx B-5. Step 3 for CDR Mapping Example Facilities

Facility Name	Step 3a: NAICS	Step 3b: Processing/Use Information	Step 3c: Internet Research	Step 3d–e: Other Databases and OES Grouping	OES Determination
Facility A	N/A – OES determined in Step 1				
Facility B	325110, Petrochemical Manufacturing	CBI	Research indicates the facility is a petrochemical plant and does not indicate how DINP is used.	Check other databases per Step 4.	Cannot be determined in Step 2 – Proceed with Step 4.
Facility C	N/A – OES determined in Step 2				
CBI = confidential business information; CDR = Chemical Data Reporting; OES = occupational exposure scenario					

4. **Review Information from Other Databases:** Lastly, other databases/sources (such as TRI, NEI, and DMR) should be checked to see if the facility has reported to these. If the facility does

not report to these databases, but additional OES are possible per Step 2, search available facility information on the internet. Table_Apx B-6 summarizes the information gathered from 2020 CDR for the three example sites for this step.

Table_Apx B-6. Step 4 for CDR Mapping Example Facilities

Facility Name	Step 4: Other Databases	OES Determination
Facility A	N/A – OES determined in Step 1	
Facility B	Using the FRS ID reported in CDR, this facility does not report to TRI, NEI, or DMR. The Agency searched the facility in EPA's ECHO database and found that the facility does not have any listed NAICS codes, SIC codes, or permits, and appears to be a warehouse from aerial imagery. Therefore, this facility is likely just an importer.	Using the information from Step 4, this site maps to the Import/ Repackaging OES.
Facility C	N/A – OES determined in Step 2	
CBI = confidential business information; CDR = Chemical Data Reporting; OES = occupational exposure scenario		

B.5.2 TRI Mapping Examples

This appendix includes examples of how to implement the OES mapping procedures for sites reporting to TRI, as listed in Section B.3.2. Specifically, this appendix includes examples for three example sites that reported to TRI for the round 2 chemical 1,2-dichloroethane (1,2-dichloroethane). These example sites are referred to as Facility D, Facility E, and Facility F.

To map Facilities D, E, and F to an OES, the following procedures are used with information from TRI.

1. **Assign Chemical Data Reporting Codes Using TRI-to-CDR Crosswalk:** The first step in the TRI mapping process is to map the uses and sub-uses reported by each facility to one or more 2016 CDR IFC codes. The uses and sub-uses reported to TRI by each example site are compiled in Table_Apx B-7.

Table_Apx B-7. Step 1 for TRI Mapping Example Facilities

Facility Name	TRI Form Type	TRI Uses (Sub-Uses)	2016 CDR IFC Codes
Facility D	R	Manufacture: produce, import, for onsite use/processing, for sale/distribution, as a byproduct Processing: as a reactant, as a formulation component (P299 Other) Otherwise Used: ancillary or other use (Z399 Other)	PK, U001, U003, U016, U013, U014, U018, U019, U020, U023, U027, U028, or U999
Facility E	R	Otherwise Used: ancillary or other use (Z399 Other)	U001, U013, U014, U018, U020, or U023
Facility F	A	None – not reported in Form A submissions	
CDR = Chemical Data Reporting; TRI = Toxics Release Inventory			

2. **Develop Chemical-Specific Crosswalk to Link CDR Codes to OES:** The next step is to develop a separate CDR IFC code-to-OES crosswalk that links CDR IFC codes to OES for the chemical. To create this crosswalk, match the COU and OES from the COU table in the published scope documents to the list of 2016 CDR IFC codes. The categories and subcategories

of COUs typically match the IFC code category. See Table_Apx B-8 for the completed crosswalk for 1,2-dichloroethane.

Table_Apx B-8. Step 2 for TRI Mapping Example Facilities

COU and OES from Published Scope Document				Mapping		
Life Cycle Stage	**Category**	**Subcategory**	**OES**	**2016 CDR IFC Code**	**2016 CDR IFC Code Name**	**Rationale**
Manufacturing	Domestic manufacturing	Domestic manufacturing	Manufacturing	None	None	Per Section B.5.1, there is no corresponding CDR code for this COU/OES
Repackaging	Repackaging	Repackaging	Repackaging	PK	Processing – repackaging	Category matches CDR code
Processing	Processing – As a reactant	Intermediate in petrochemical manufacturing	Processing as a Reactant	U015; U016; U019; U024	Processing as a reactant	Category matches CDR code
		Plastic material and resin manufacturing				
		All other basic organic chemical manufacturing				
Processing	Processing – Incorporation into formulation, mixture, or reaction product	Fuels and fuel additives: All other petroleum and coal products manufacturing	Incorporated into Formulation, Mixture, or Reaction Product	U012	Fuel and fuel additives	Category matches CDR code
		Formulation of adhesives and sealants		U002	Adhesives and sealant chemicals	Category matches CDR code
		Processing aids: Specific to petroleum production		U025	Processing aids: specific to petroleum production	Category matches CDR code
Distribution in commerce	Distribution in commerce	Distribution in commerce	Distribution in Commerce	None	None	Per Section B.5.1, there is no corresponding CDR code for this COU/OES
Industrial use	Adhesives and sealants	Adhesives and sealants	Adhesives and Sealants	U002	Adhesives and sealant chemicals	Category matches CDR code
	Functional fluids (closed systems)	Engine coolant additive	Functional Fluids (Closed Systems)	U013	Functional Fluids (closed systems)	Category matches CDR code

COU and OES from Published Scope Document				Mapping		
Life Cycle Stage	**Category**	**Subcategory**	**OES**	**2016 CDR IFC Code**	**2016 CDR IFC Code Name**	**Rationale**
Industrial use	Lubricants and greases	Paste lubricants and greases	Lubricants and Greases	U017	Lubricants and Lubricant additives	Category matches CDR code
Industrial use	Oxidizing/ reducing agents	Oxidation inhibitor in controlled oxidative chemical reactions	Oxidizing/Reducing Agents	U019	Oxidizing/reducing agents	Category matches CDR code
Industrial use	Cleaning and degreasing	Industrial and commercial non-aerosol cleaning/degreasing	Solvents (for Cleaning and Degreasing)	U029	Solvents (for cleaning or degreasing)	Category matches CDR code
Commercial use	Cleaning and degreasing	Commercial aerosol products (aerosol degreasing, aerosol lubricants, automotive care products)	Solvents (for Cleaning and Degreasing)	U029	Solvents (for cleaning or degreasing)	Category matches CDR code
Commercial use	Plastic and rubber products	Products such as: Plastic and rubber products	Plastics and Rubber Products	None	None	Per Section B.5.1, there is no corresponding CDR code for this COU/OES.
Commercial use	Fuels and related products	Fuels and related products	Fuels and Related Products	U012	Fuels and Fuel Additives	Category matches CDR code
Commercial use	Other use	Laboratory chemical	Other Use	None	Use-non-incorporative activities	This use does not match any other CDR codes and is non-incorporative
Commercial use	Other use	Embalming agent	Other Use	None	Use-non-incorporative activities	This use does not match any other CDR codes and is non-incorporative
Waste handling, disposal, treatment, and recycling	Waste handling, disposal, treatment, and recycling	Waste handling, disposal, treatment, and recycling	Waste Handling, Disposal, Treatment, and Recycling	None	None	Per Section B.5.1, there is no corresponding CDR code for this COU/OES.
CDR = Chemical Data Reporting; COU = condition of use; OES = occupational exposure scenario						

3. **Assign OES:** Each TRI facility is then mapped to one or more OES using the CDR IFC codes assigned to each facility in Step 1 and the CDR IFC code-to-OES crosswalk developed in Step 2. Table_Apx B-9 includes the potential OES for each example facility per this step.

Table_Apx B-9. Step 3 for TRI Mapping Example Facilities

Facility Name	TRI Form Type	2016 CDR IFC Codes	Crosswalked OES	OES Determination
Facility D	R	PK, U001, U003, U016, U013, U014, U018, U019, U020, U023, U027, U028, or U999	Repackaging, Processing as a Reactant, Functional Fluids (Closed Systems), or Oxidizing/Reducing Agents	Cannot be determined in Step 3 – proceed to Step 4
Facility E	R	U001, U013, U014, U018, U020, or U023	Functional Fluids (Closed Systems)	Since the facility maps to only one OES, the OES is Functional Fluids (Closed Systems)
Facility F	A	None – not reported in Form A submissions		Cannot be determined in Step 3 – proceed to Step 4
CDR = Chemical Data Reporting; OES = occupational exposure scenario				

4. **Refine OES Assignments:** If a facility maps to more than one OES in Step 3, a single primary OES must be selected using additional facility information per Steps 4a to 4e. Table_Apx B-10 summarizes the information gathered for the three example sites for this step.

Table_Apx B-10. Step 4 for TRI Mapping Example Facilities

Facility Name	Step 4a: NAICS Code	Step 4b: Internet Research	Step 4c: Other Databases	Step 4d–e: Most Likely OES or OES Grouping	OES Determination
Facility D	486990, All Other Pipeline Transportation	The facility is a large chemical manufacturing plant	Check databases per Step 5	Based on the type of facility, the Processing as a Reactant OES seems the most likely OES from Step 3	Most likely Processing as a Reactant OES; check other databases in Step 5 to verify
Facility E	N/A – OES determined in Step 3				
Facility F	325199, All Other Basic Organic Chemical Manufacturing	The facility is a chemical supplier that does not appear to produce chemicals	Check databases per Step 5	Based on the NAICS code and type of facility, the Repackaging OES seems the most likely	Most likely Repackaging OES; check other databases in Step 5 to verify
NAICS = North American Industry Classification System; OES = occupational exposure scenario; TRI = Toxics Release Inventory					

5. **Review Information from Other Databases:** Other databases/sources (including CDR, NEI, and DMR) should be checked to see if the facility has reported to these. If so, the OES

determined from the mapping procedures for those databases (discussed in other sections of this document) should also be used. It is important that the same facility is mapped consistently across multiple databases/sources. The facility's TRFID and FRS ID can be used to identify sites that report to TRI, DMR, and NEI. Table_Apx B-11 summarizes the information gathered from other databases for the three example sites for this step.

Table_Apx B-11. Step 5 for TRI Mapping Example Facilities

Facility Name	Step 5: Other Databases	OES Determination
Facility D	The facility did not report to 2016 or 2020 CDR. The facility reported to 2020 NEI, reporting emissions of 1,2-dichloroethane from storage tanks and process equipment from chemical manufacturing processes and storage/transfer operations. The facility reported DMRs for the past few years but reported no releases of 1,2-dichloroethane to DMR.	The NEI information corroborates the most likely OES determined in Step 4d; therefore, this site maps to the Processing as a Reactant OES
Facility E	N/A – OES determined in Step 3	
Facility F	The facility did not report to 2016 or 2020 CDR, 2020 NEI, or the past few years of DMR	Because no additional information was determined in Step 5, the site maps to the Repackaging OES per Step 4d
CDR = Chemical Data Reporting; DMR = Discharge Monitoring Report; NEI = National Emissions Inventory; OES = occupational exposure scenario; TRI = Toxics Release Inventory		

B.5.3 NEI Mapping Examples

This section includes examples of how to implement the OES mapping procedures for sites reporting to NEI, as listed in Section B.3.3. Specifically, this section includes two examples for 1,2-dichloroethane from 2017 NEI: (1) Facility G, which is an industrial site that reported point source emissions under multiple NEI records, and (2) Example H, which is a county that reported nonpoint source emissions under multiple NEI records.

To map Facility G (point source) and Example H (non-point source) NEI records to OES, the following procedures should be used:

1. **Develop Crosswalks to Link NEI-Reported SCC and Sector Combinations to Chemical Data Reporting Codes:** The first step in mapping NEI data to potentially relevant OES is to develop a crosswalk to map each unique combination of NEI-reported SCC Levels 1 to 4 and industry sectors to one or more CDR codes. This crosswalk is developed on a chemical-by-chemical basis rather than an overall crosswalk for all chemicals because SCCs correspond to emission sources rather than chemical uses such that the crosswalk to CDR codes may differ from chemical to chemical. In some cases, it may not be possible to assign all SCC sector combinations to CDR codes, in which case information from Step 5 can be used to help make OES assignments. Separate crosswalks are needed for point and nonpoint source records, as shown in Table_Apx B-12 and Table_Apx B-13. Note that theses tables only present the crosswalk for the SCC and sector codes relevant to Facility G (point source) and Example H (nonpoint source) examples; there are many more SCC and sector codes reported for 1,2-dichloroethane in 2017 NEI.

Table_Apx B-12. Step 1a for NEI Mapping Example Facilities

SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Sector	Assigned CDR Code	Rationale
Chemical Evaporation	Organic Solvent Evaporation	Air Stripping Tower	Solvent	Solvent – Industrial Surface Coating & Solvent Use	U029 – Solvents (for Cleaning and Degreasing)	Based on Sector
Chemical Evaporation	Organic Solvent Evaporation	Cold Solvent Cleaning/ Stripping	Other Not Classified	Solvent – Degreasing	U029 – Solvents (for Cleaning and Degreasing)	Based on Sector
Chemical Evaporation	Organic Solvent Evaporation	Dry Cleaning	Other Not Classified	Solvent – Dry Cleaning	U029 – Solvents (for Cleaning and Degreasing)	Based on Sector
Chemical Evaporation	Organic Solvent Evaporation	Fugitive Emissions	General	Solvent – Degreasing	U029 – Solvents (for Cleaning and Degreasing)	Based on Sector
Chemical Evaporation	Organic Solvent Evaporation	Miscellaneous Volatile Organic Compound Evaporation	Miscellaneous	Solvent – Industrial Surface Coating & Solvent Use	U029 – Solvents (for Cleaning and Degreasing)	Based on Sector
Chemical Evaporation	Organic Solvent Evaporation	Solvent Storage	General Processes: Drum Storage – Pure Organic Chemicals	Industrial Processes – Storage and Transfer	N/A – no matching CDR IFC, likely Distribution in Commerce	Matched SCC and sector code
Chemical Evaporation	Organic Solvent Evaporation	Solvent Storage	General Processes: Spent Solvent Storage	Industrial Processes – Storage and Transfer	N/A – no matching CDR IFC, likely Distribution in Commerce	Matched SCC and sector code
Chemical Evaporation	Organic Solvent Evaporation	Waste Solvent Recovery Operations	Other Not Classified	Solvent – Industrial Surface Coating & Solvent Use	N/A – no matching CDR IFC, likely Waste Handling, Disposal and Treatment	Matched to SCC level 3 code
Chemical Evaporation	Organic Solvent Evaporation	Waste Solvent Recovery Operations	Solvent Loading	Industrial Processes – Storage and Transfer	N/A – no matching CDR IFC, likely Waste Handling, Disposal and Treatment	Matched to SCC level 3 code
Industrial Processes	Photo Equip/Health Care/Labs/Air Condit/ SwimPools	Health Care – Crematoriums	Cremation – Animal	Industrial Processes – NEC	U999 – Other	Does not fit other CDR code

SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Sector	Assigned CDR Code	Rationale
Industrial Processes	Photo Equip/Health Care/Labs/Air Condit/ SwimPools	Health Care – Crematoriums	Cremation – Human	Industrial Processes – NEC	U999 – Other	Does not fit other CDR code
Industrial Processes	Photo Equip/Health Care/Labs/Air Condit/ SwimPools	Health Care – Crematoriums	Crematory Stack – Human and Animal Crematories	Industrial Processes – NEC	U999 – Other	Does not fit other CDR code
Industrial Processes	Photo Equip/Health Care/Labs/Air Condit/ SwimPools	Health Care	Miscellaneous Fugitive Emissions	Industrial Processes – NEC	U999 – Other	Assume use as a laboratory chemical in the healthcare industry
Industrial Processes	Photo Equip/Health Care/Labs/Air Condit/ SwimPools	Laboratories	Bench Scale Reagents: Research	Industrial Processes – NEC	U999 – Other	SCC for laboratories
Industrial Processes	Photo Equip/Health Care/Labs/Air Condit/ SwimPools	Laboratories	Bench Scale Reagents: Testing	Industrial Processes – NEC	U999 – Other	SCC for laboratories
CDR = Chemical Data Reporting; IFC = industrial function category; NEC = not elsewhere classified; NEI = National Emissions Inventory; SCC = source classification codes						

Table_Apx B-13. Step 1b for NEI Mapping Example Facilities

Sector	Assigned CDR Code	Rationale
Commercial Cooking	N/A – no matching CDR IFC	Unknown
Fuel Comb – Comm/Institutional – Biomass	U012 – Fuels and fuel additives	Consistent with sector code
Fuel Comb – Comm/Institutional – Coal	U012 – Fuels and fuel additives	Consistent with sector code
Fuel Comb – Industrial Boilers, ICEs – Biomass	U012 – Fuels and fuel additives	Consistent with sector code
Fuel Comb – Industrial Boilers, ICEs – Coal	U012 – Fuels and fuel additives	Consistent with sector code
Fuel Comb – Residential – Other	U012 – Fuels and fuel additives	Consistent with sector code
Gas Stations	U012 – Fuels and fuel additives	Consistent with sector code

Sector	Assigned CDR Code	Rationale
Solvent – Consumer & Commercial Solvent Use	U029 – Solvents (for cleaning or degreasing)	Consistent with sector code
Waste Disposal	N/A – no matching CDR IFC, likely Waste Handling, Disposal and Treatment	Consistent with sector code
CDR = Chemical Data Reporting; IFC = industrial function category		

2. **Use CDR Crosswalks to Assign CDR Codes:** Next, the chemical-specific CDR crosswalk developed in Step 1 should be used to assign CDR IFC codes to each point source NEI record and CDR IFC codes and/or commercial/consumer use PCs to each nonpoint source NEI record. This is shown in Table_Apx B-14 for Facility G (point source) and Example H (non-point source).

Table_Apx B-14. Step 2 for NEI Mapping Example Facilities

Facility Name	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Sector	Assigned CDR IFC Code
Facility G	Chemical Evaporation	Organic Solvent Evaporation	Air Stripping Tower	Solvent	Solvent – Industrial Surface Coating & Solvent Use	U029 – Solvents (for Cleaning and Degreasing)
	Industrial Processes	Photo Equip/Health Care/Labs/Air Condit/SwimPools	Laboratories	Bench Scale Reagents: Testing	Industrial Processes – NEC	U999 – Other
Example H	N/A – not applicable to nonpoint source				Commercial Cooking	N/A – no matching CDR IFC
	N/A – not applicable to nonpoint source				Fuel Comb – Residential – Other	U012 – Fuels and fuel additives
	N/A – not applicable to nonpoint source				Gas Stations	U012 – Fuels and fuel additives
CDR = Chemical Data Reporting; IFC = industrial function category; NEC = not elsewhere classified; NEI = National Emissions Inventory; SCC = source classification codes						

2. **Update CDR Crosswalks to Link CDR Codes to OES:** The chemical-specific crosswalk developed in Step 1 is then used to link the SCCs, sectors, and CDR codes in the crosswalk to an OES. The OES will be assigned based on the chemical specific COU categories and subcategories and the OES mapped to them. The same crosswalk developed in Table_Apx B-8 (TRI Step 2) links CDR codes to COUs and OES and is used in this example.

3. **Use CDR Crosswalks to Assign OES:** The chemical-specific CDR crosswalks developed in Steps 1 to 3 are then used to assign OES to each point source and nonpoint source NEI data record (*i.e.,* each combination of facility-SCC-sector). Note that the individual facilities in the point source dataset may have multiple emission sources, described by different SCC and sector combinations within NEI, such that multiple OES map to each NEI record. In such cases, a single, representative OES must be selected for each NEI record using the additional information described in Step 5. Similarly, the sectors reported by nonpoint sources may map to multiple

CDR IFC or PC codes, such that multiple OES are applicable and must be refined to a single OES. See Table_Apx B-15 for completed Step 4 for the example facilities.

Table_Apx B-15. Step 4 for NEI Mapping Example Facilities

Facility Name	SCC Level One	SCC Level Two	SCC Level Three	SCC Level Four	Sector	Assigned CDR IFC Code	Mapped OES	OES Determination
Facility G	Chemical Evaporation	Organic Solvent Evaporation	Air Stripping Tower	Solvent	Solvent – Industrial Surface Coating & Solvent Use	U029 – Solvents (for Cleaning and Degreasing)	Solvents (for Cleaning and Degreasing)	Because only one OES maps to this NEI record, the OES is: Solvents (for Cleaning and Degreasing)
	Industrial Processes	Photo Equip/Health Care/Labs/Air Condit/ SwimPools	Laboratories	Bench Scale Reagents: Testing	Industrial Processes – NEC	U999 – Other	Laboratory Chemical Embalming Agent	Cannot be determined in Step 4 – Proceed with Step 5
Example H	N/A – not applicable to nonpoint source				Commercial Cooking	N/A – no matching CDR IFC	None	Cannot be determined in Step 4 – Proceed with Step 5
	N/A – not applicable to nonpoint source				Fuel Comb – Residential – Other	U012 – Fuels and fuel additives	Incorporated into Formulation, Mixture, or Reaction Product Fuels and Related Products	Cannot be determined in Step 4 – Proceed with Step 5
	N/A – not applicable to nonpoint source				Gas Stations	U012 – Fuels and fuel additives	Incorporated into Formulation, Mixture, or Reaction Product Fuels and Related Products	Cannot be determined in Step 4 – Proceed with Step 5

CDR = Chemical Data Reporting; IFC = industrial function category; NEI = National Emissions Inventory; OES = occupational exposure scenario; SCC = source classification codes

4. **Refine OES Assignments:** The initial OES assignments may need to be confirmed and/or refined to identify a single primary OES using the following information described in Steps 5a to 5b. See Table_Apx B-16 for Facility G (point source) and Example H (non-point source).

Table_Apx B-16. Step 5 for NEI Mapping Example Facilities

Facility Name	Sector	Step 5a: Additional Point Source Information	Step 5b: Additional Non-Point Source Information	OES Determination
Facility G	Solvent – Industrial Surface Coating & Solvent Use	N/A – mapped to OES in Step 4		
	Industrial Processes – NEC	NAICS is 336415, Guided Missile and Space Vehicle Propulsion Unit and Propulsion Unit Parts Manufacturing. Emitting process is analytical lab operations	N/A	Information from Step 4 and 5a affirm the OES is: Laboratory Chemical
Example H	Commercial Cooking	N/A	No knowledge is available on the use of 1,2-dichloroethane in commercial cooking	Cannot be determined in Step 5 – Proceed to Step 7
	Fuel Comb – Residential – Other	N/A	1,2-Dichloroethane may be used in fuel additives	Information from Step 4 and 5a affirm the OES is: Fuels and Related Products
	Gas Stations	N/A	1,2-Dichloroethane may be used in fuel additives	Information from Step 4 and 5a affirm the OES is: Fuels and Related Products
NEC = not elsewhere classified; NEI = National Emissions Inventory; NAICS = North American Industry Classification System; OES = occupational exposure scenario				

5. **Review Information from Other Databases for Point Source Facilities:** Other databases/sources (including CDR, TRI, and DMR) should be checked to see if the point source facilities have reported to these. Facility G does not report to other databases. This step is not applicable to non-point source Example H.
6. **Consider Options for NEI Records that Cannot be Mapped to an OES:** Given the number of records in NEI and the information available, it may not always be feasible to achieve mapping of 100% of the sites reporting to NEI to an OES. This is the case for the NEI record Example H – Commercial Cooking. In this case, the OES will be assessed per Step 7a – as "unknown OES" with 250 release days/year. This allows for subsequent exposure modeling and the assessment of risk.

B.5.4 DMR Mapping Examples

This section includes examples of how to implement the OES mapping procedures for sites reporting to DMR, as listed in Section B.3.4. Specifically, this appendix includes examples for two example sites that reported to DMR for 1,2-dichloroethane. These example sites are referred to as Facility I and J.

To map Facilities I and J to an OES, the following procedures are used with information from DMR:

1. **Review Information from Other Databases:** Given the limited facility information reported in DMRs, the first step for mapping facilities reporting to DMR should be to check other

databases/sources (including CDR, TRI, and NEI). For these examples, neither Facility I nor J reported to other databases.

2. **Assign OES:** If the facility does not report to other databases, the reported SIC code from DMR and internet research should be used to map the facility to an OES, per Steps 2a and 2b. See Table_Apx B-17 for completed Step 2 for the example facilities.

Table_Apx B-17. Step 2 for DMR Mapping Example Facilities

Facility Name	Step 2a: SIC Code	Step 2b: Internet Research	OES Determination
Facility I	4613, Refined Petroleum Pipeline	Internet research indicates that the facility is a fuel terminal	Cannot be determined in Step 2 – Proceed with Step 3
Facility J	2821, Plastics Materials and Resins	Internet research indicates the facility makes poly vinyl chloride; 1,2-dichloroethane is known to be used as a reactant in this process	This facility maps to the Processing as a Reactant OES, based on the SIC code (which matches the subcategory of use in the COU table, Table 1-1) and internet research
COU = condition of use; DMR = Discharge Monitoring Report; SIC = standard industrial classification			

3. **Refine OES:** If the specific OES still cannot be determined using the information in Step 2, information in Steps 3a to 3d should be considered. This includes searching for the facility NPDES permit and trying to determine which OES (or group of OES) is the most likely. See Table_Apx B-18 for completed Step 3 for the example facilities.

Table_Apx B-18. Step 3 for DMR Mapping Example Facilities

Facility Name	Step 3a: NPDES Permit Number	Step 3b: Finding the NPDES Permit	Steps 3c–d: Most Likely OES or Grouped OED	OES Determination
Facility I	VAG83#### → A search of VA NPDES permits indicates that permit numbers starting in "VAG0083" are remediation general permits.	The facility's NPDES permit could not be found online	None of COUs or OES for 1,2-dichloroethane in Table 1-1 cover remediation	Because the facility's permit is for remediation, the facility most likely does not use 1,2-dichloroethane but the chemical is present as a contaminant at the site. This does not correspond to an in-scope OES. However, the OES should be designated as "Remediation" for EPA to determine how/if to present the release data.
Facility J	N/A – This facility was mapped to an OES in Step 2.			
DMR = Discharge Monitoring Report; NPDES = National Pollutant Discharge Elimination System; OES = occupational exposure scenario				

B.5.5 OSHA CEHD Mapping Examples

This section includes examples of how to implement the OES mapping procedures for sites in the OSHA CEHD dataset, as listed in Section B.3.5. Specifically, this section includes examples for two example sites in the OSHA CEHD dataset for 1,4-dioxane. These example sites are referred to as Facility K and L.

To map Facilities K and L to an OES, the following procedures are used with information from OSHA CEHD:

1. **Review Information from Other Databases:** Given the limited facility information reported in OSHA CEHD, the first step for mapping facilities should be to check other databases/sources (including CDR, TRI, NEI, and TRI). For these examples neither Facility K nor L reported to other databases.

Assign OES: If the facility does not report to other databases, the reported SIC code from OSHA CEHD and internet research should be used to map the facility to an OES, per Steps 2a and 2b. See Table_Apx B-19 for completed Step 2 for the example facilities.

Table_Apx B-19. Step 2 for OSHA CEHD Mapping Example Facilities

Facility Name	Step 2a: SIC or NAICS Code	Step 2b: Internet Research	OES Determination
Facility K	339112, Surgical and Medical Instrument Manufacturing	Internet research indicates that the facility produces medical equipment for cardiovascular procedures	Based on the OES in Table 1-1, the most applicable OES are likely Processing as a Reactant (for the Production of Plastics Used in Equipment), Solvents (for Cleaning or Degreasing), Plastics and Rubber Products, or Other Use. The specific OES cannot be determined in Step 2 – Proceed with Step 3.
Facility L	5169, Chemicals and Allied Products, Not Elsewhere Classified	Internet research indicates the facility is a waste management company	This facility maps to the *Waste Handling, Disposal, Treatment, and Recycling*, based on information from internet research
CEHD = Chemical Exposure Health Data; NAICS = North American Industry Classification System; OES = occupational exposure scenario; OSHA = Occupational Safety and Health Administration; SIC = Standard Industrial Classification			

2. **Refine OES:** If the specific OES still cannot be determined using the information in Step 2, an evaluation of the OES that is most likely or a group of OES should be considered per Steps 3a and 3b. See Table_Apx B-20 for completed Step 3 for the example facilities.

Table_Apx B-20. Step 3 for OSHA CEHD Mapping Example Facilities

Facility Name	Step 3a: Mostly Likely OES	Step 3b: Grouped OED	OES Determination
Facility K	The scope document for 1,2-dichloroethane indicates that the chemical is used to make polyvinyl chloride that is then used in medical devices. The use of 1,2-dichloroethane to produce polyvinyl chloride falls under the Processing as a Reactant OES (as an intermediate for plastics).	Not needed – the OES was determined as Processing as a Reactant in Step 3a	Per Step 3a, this facility maps to the Processing as a Reactant OES. To further support this determination, EPA may contact OSHA for additional information on the visit to this facility, per Step 4b.
Facility L	N/A – This facility was mapped to an OES in Step 2.		
CEHD = Chemical Exposure Health Data; OES = occupational exposure scenario; OSHA = Occupational Safety and Health Administration			

B.5.6 NIOSH HHE Mapping Examples

This section includes examples of how to implement the OES mapping procedures listed in Section B.3.6, for two example NIOSH HHEs for 1,2-dichloroethane. To map facilities that are the subject of a NIOSH HHE, the process information and other narrative descriptions in the NIOSH HHE should be used.

1. The first example is for the following NIOSH HHE: https://www.cdc.gov/niosh/hhe/reports/pdfs/80-186-1149.pdf (accessed August 11, 2025). The following information is found in the NIOSH HHE:
    a. The facility produces plastic products, primarily plastic tubes for packaging.
    b. 1,2-Dichloroethane was used as a bonding agent for sealing packaging.

OES Determination: Based on the OES for 1,2-dichloroethane (listed in Table_Apx B-8), the use of 1,2-dichloroethane for sealants falls under the Adhesives and Sealants OES.

2. The second example is for the following NIOSH HHE: https://www.cdc.gov/niosh/hhe/reports/pdfs/77-73-610.pdf (accessed August 11, 2025). The following information is found in the NIOSH HHE:
    a. The facility is a chemical manufacturer.
    b. The facility uses 1,2-dichloroethane as a solvent in a reaction to produce another chemical.

OES Determination: Based on the OES for 1,2-dichloroethane (listed in Table_Apx B-8), the use of 1,2-dichloroethane as a reactant falls under the Processing as a Reactant OES.

As discussed in Section B.3.6, NIOSH HHEs typically contain detailed process information and description of how the chemical is used at the facility. Therefore, the mapping of NIOSH HHE facilities to OES is straightforward.

B.5.7 COU Mapping Examples

This appendix includes examples of how to implement the COU mapping procedures for sites from standard sources (*i.e.,* CDR, TRI, NEI, DMR, OSHA CEHD, NIOSH, and HHE, as listed in Section B.4. Specifically, this appendix uses the same example facilities (Facility D, Facility E, and Facility F) for the TRI examples in Section B.5.2.

To map Facilities D, E, and F to an COUs, the following procedures should be used:

1. **Map the Facility to an OES:** To map a facility from a standard source to a COU, the facility should first be mapped to an OES following the procedures for the specific source of data (discussed in Section B.3). This mapping was completed in completed in Section B.5.2 and is summarized in Table_Apx B-21.

Table_Apx B-21. Step 1 for COU Mapping Example Facilities

Facility Name	Step 1: OES Determination from Appendix A.2
Facility D	Processing as a Reactant
Facility E	Functional Fluids (Closed Systems)
Facility F	Repackaging
COU = condition of use; OES = occupational exposure scenario	

2. **Use the COU Table with Mapped OES to Assign COUs:** At the point of the risk evaluation process where EPA are mapping data from standard sources to OES and COU, EPA have already mapped OES to each of the COUs from the scope document. This crosswalk between COUs and OES, which is in Table_Apx B-8, for the example facilities should be used to identify the COU(s). See Table_Apx B-22 for completed Step 2 for the example facilities.

Table_Apx B-22. Step 2 for COU Mapping Example Facilities

<table>
<tr><th>Facility Name</th><th>OES Determination from Appendix A.2</th><th>Step 2: Mapped COUs</th></tr>
<tr><td>Facility D</td><td>Processing as a Reactant</td><td>Using the COU to OES crosswalk previously developed (Table 1-1), the COUs that map to this OES are:
<table>
<tr><th>Life Cycle Stage</th><th>Category</th><th>Subcategory</th></tr>
<tr><td rowspan="3">Processing</td><td rowspan="3">Processing – As a reactant</td><td>Intermediate in petrochemical manufacturing</td></tr>
<tr><td>Plastic material and resin manufacturing</td></tr>
<tr><td>All other basic organic chemical manufacturing</td></tr>
</table></td></tr>
<tr><td>Facility E</td><td>Functional Fluids (Closed Systems)</td><td>Using the COU to OES crosswalk previously developed (Table 1-1), only one COU maps to this OES:
<table>
<tr><th>Life Cycle Stage</th><th>Category</th><th>Subcategory</th></tr>
<tr><td>Industrial use</td><td>Functional fluids (closed systems)</td><td>Engine coolant additive</td></tr>
</table></td></tr>
<tr><td>Facility F</td><td>Repackaging</td><td>Using the COU to OES crosswalk previously developed (Table 1-1), only one COU maps to this OES:
<table>
<tr><th>Life Cycle Stage</th><th>Category</th><th>Subcategory</th></tr>
<tr><td>Repackaging</td><td>Repackaging</td><td>Repackaging</td></tr>
</table></td></tr>
<tr><td colspan="3">COU = condition of use; OES = occupational exposure scenario</td></tr>
</table>

3. **Refine the COU Assignment:** In some instances, more than one COU may map to the facility. In such cases, the reported NAICS code and internet research should be used to try to narrow down the list of potentially applicable COUs, per Steps 3a to 3b. See Table_Apx B-23 for completed Step 3 for the example facilities.

Table_Apx B-23. Step 3 for COU Mapping Example Facilities

Facility Name	Step 3a: NAICS Code	Step 3b: Internet Research	COU Determination
Facility D	486990, All Other Pipeline Transportation	The facility is a large chemical manufacturing plant	The COU subcategory for "Plastic material and resin manufacturing" can be eliminated. However, the COU cannot be narrowed down between the remaining two subcategories of use. Proceed to Step 4.
Facility E	N/A – COU determined in Step 2		
Facility F	N/A – COU determined in Step 2		
COU = condition of use; NAICS = North American Industry Classification System			

4. **List all Potential COUs:** Where the above information does not narrow down the list of potentially applicable COUs, EPA will list all the potential COUs and will not attempt to select just one from the list where there is insufficient information to do so. Because a singular OES was identified for Facility D and F, this step is not applicable to those facilities. For Facility F, there are two possible COUs that are listed in Table_Apx B-24. Although a COU consists of a life cycle stage, category, and subcategory, all three should be presented in this step.

Table_Apx B-24. Step 4 for COU Mapping Example Facilities

Facility Name	Step 4: All Potential COUs		
Facility D	All potential COUs for this facility are as follows:		
	Life Cycle Stage	**Category**	**Subcategory**
	Processing	Processing – As a reactant	Intermediate in petrochemical manufacturing
			All other basic organic chemical manufacturing
COU = condition of use			

B.6 TRI to CDR Use Mapping Crosswalk

Table_Apx B-25 presents the TRI-CDR Crosswalk used to map facilities to the OES for each chemical. "N/A" in the 2016 CDR code column indicates there is no corresponding CDR code that matches the TRI code. 2020 CDR introduced new codes for chemicals designated as high priority for risk evaluation; however, reporters may still use the same 2016 CDR codes listed in Table_Apx B-25 for all other chemicals. For 2020 CDR reporting facilities using the new codes, the crosswalk between 2016 CDR codes and 2020 CDR codes in Table 4-15 of the 2020 CDR reporting instructions (accessed August 11, 2025) should be used with Table_Apx B-25.

Table_Apx B-25. Toxics Release Inventory-Chemical Data Recording (TRI-CDR) Use Code Crosswalk

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.1.a	Manufacture: Produce	N/A	N/A	N/A	N/A	N/A
3.1.b	Manufacture: Import	N/A	N/A	N/A	N/A	N/A
3.1.c	Manufacture: For on-site use/processing	N/A	N/A	N/A	N/A	N/A
3.1.d	Manufacture: For sale/distribution	N/A	N/A	N/A	N/A	N/A
3.1.e	Manufacture: As a byproduct	N/A	N/A	N/A	N/A	N/A
3.1.f	Manufacture: As an impurity	N/A	N/A	N/A	N/A	N/A
3.2.a	Processing: As a reactant	N/A	N/A	PC	Processing as a Reactant	Chemical substance is used in chemical reactions for the manufacturing of another chemical substance or product
3.2.a	Processing: As a reactant	P101	Feedstocks	N/A	N/A	N/A
3.2.a	Processing: As a reactant	P102	Raw Materials	N/A	N/A	N/A
3.2.a	Processing: As a reactant	P103	Intermediates	U015	Intermediates	Chemical substances consumed in a reaction to produce other chemical substances for commercial advantage. A residual of the intermediate chemical substance which has no separate function may remain in the reaction product.
3.2.a	Processing: As a reactant	P104	Initiators	U024	Process Regulators	Chemical substances used to change the rate of a chemical reaction, start or stop the reaction, or otherwise influence the course of the reaction. Process regulators may be consumed or become part of the reaction product.
3.2.a	Processing: As a reactant	P199	Other	U016	Ion Exchange Agents	Chemical substances, usually in the form of a solid matrix, are used to selectively remove targeted ions from a solution. Examples generally consist of an inert hydrophobic matrix such as styrene divinylbenzene or phenol-formaldehyde, cross-linking

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						polymer such as divinylbenzene, and ionic functional groups including sulfonic, carboxylic or phosphonic acids. This code also includes aluminosilicate zeolites.
3.2.a	Processing: As a reactant	P199	Other	U019	Oxidizing/ Reducing Agent	Chemical substances used to alter the valence state of another substance by donating or accepting electrons or by the addition or removal of hydrogen to a substance. Examples of oxidizing agents include nitric acid, perchlorates, hexavalent chromium compounds, and peroxydisulfuric acid salts. Examples of reducing agents include hydrazine, sodium thiosulfate, and coke produced from coal.
3.2.a	Processing: As a reactant	P199	Other	U999	Other (Specify)	Chemical substances used in a way other than those described by other codes.
3.2.b	Processing: As a formulation component	N/A	N/A	PF	Processing – Incorporation into Formulation, Mixture, or Reaction Product	Chemical substance is added to a product (or product mixture) prior to further distribution of the product.
3.2.b	Processing: As a formulation component	P201	Additives	U007	Corrosion Inhibitors and Antiscaling Agents	Chemical substances used to prevent or retard corrosion or the formation of scale. Examples include phenylenediamine, chromates, nitrates, phosphates, and hydrazine.
3.2.b	Processing: As a formulation component	P201	Additives	U009	Fillers	Chemical substances used to provide bulk, increase strength, increase hardness, or improve resistance to impact. Fillers incorporated in a matrix reduce production costs by minimizing the amount of more expensive substances used in the production of articles. Examples include calcium carbonate, barium sulfate, silicates, clays, zinc oxide and aluminum oxide.
3.2.b	Processing: As a formulation component	P201	Additives	U010	Finishing Agents	Chemical substances used to impart such functions as softening, static proofing, wrinkle resistance, and water repellence. Substances may be applied to textiles, paper, and leather. Examples include

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						quaternary ammonium compounds, ethoxylated amines, and silicone compounds.
3.2.b	Processing: As a formulation component	P201	Additives	U017	Lubricants and Lubricant Additives	Chemical substances used to reduce friction, heat, or wear between moving parts or adjacent solid surfaces, or that enhance the lubricity of other substances. Examples of lubricants include mineral oils, silicate and phosphate esters, silicone oil, greases, and solid film lubricants such as graphite and PTFE. Examples of lubricant additives include molybdenum disulphide and tungsten disulphide.
3.2.b	Processing: As a formulation component	P201	Additives	U034	Paint Additives and Coating Additives Not Described by Other Codes	Chemical substances used in a paint or coating formulation to enhance properties such as water repellence, increased gloss, improved fade resistance, ease of application, foam prevention, etc. Examples of paint additives and coating additives include polyols, amines, vinyl acetate ethylene emulsions, and aliphatic polyisocyanates.
3.2.b	Processing: As a formulation component	P202	Dyes	U008	Dyes	Chemical substances used to impart color to other materials or mixtures (*i.e.,* substrates) by penetrating the surface of the substrate. Example types include azo, anthraquinone, amino azo, aniline, eosin, stilbene, acid, basic or cationic, reactive, dispersive, and natural dyes.
3.2.b	Processing: As a formulation component	P202	Dyes	U021	Pigments	Chemical substances used to impart color to other materials or mixtures (*i.e.,* substrates) by attaching themselves to the surface of the substrate through binding or adhesion. This code includes fluorescent agents, luminescent agents, whitening agents, pearlizing agents, and opacifiers. Examples include metallic oxides of iron, titanium, zinc, cobalt, and chromium; metal powder suspensions; lead chromates; vegetable and animal products; and synthetic organic pigments.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.2.b	Processing: As a formulation component	P203	Reaction Diluents	U030	Solvents (which Become Part of Product Formulation or Mixture)	Chemical substances used to dissolve another substance (solute) to form a uniformly dispersed mixture (solution) at the molecular level. Examples include diluents used to reduce the concentration of an active material to achieve a specified effect and low gravity materials added to reduce cost.
3.2.b	Processing: As a formulation component	P203	Reaction Diluents	U032	Viscosity Adjustors	Chemical substances used to alter the viscosity of another substance. Examples include viscosity index (VI) improvers, pour point depressants, and thickeners.
3.2.b	Processing: As a formulation component	P204	Initiators	U024	Process Regulators	Chemical substances used to change the rate of a chemical reaction, start, or stop the reaction, or otherwise influence the course of the reaction. Process regulators may be consumed or become part of the reaction product.
3.2.b	Processing: As a formulation component	P205	Solvents	U030	Solvents (which Become Part of Product Formulation or Mixture)	Chemical substances used to dissolve another substance (solute) to form a uniformly dispersed mixture (solution) at the molecular level. Examples include diluents used to reduce the concentration of an active material to achieve a specified effect and low gravity materials added to reduce cost.
3.2.b	Processing: As a formulation component	P206	Inhibitors	U024	Process Regulators	Chemical substances used to change the rate of a chemical reaction, start, or stop the reaction, or otherwise influence the course of the reaction. Process regulators may be consumed or become part of the reaction product.
3.2.b	Processing: As a formulation component	P207	Emulsifiers	U003	Adsorbents and Absorbents	Chemical substances used to retain other substances by accumulation on their surface or by assimilation. Examples of adsorbents include silica gel, activated alumina, and activated carbon. Examples of absorbents include straw oil, alkaline solutions, and kerosene.
3.2.b	Processing: As a formulation component	P208	Surfactants	U002	Adhesives and Sealant Chemicals	Chemical substances used to promote bonding between other substances, promote adhesion of surfaces, or prevent seepage of moisture or air.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						Examples include epoxides, isocyanates, acrylamides, phenol, urea, melamine, and formaldehyde.
3.2.b	Processing: As a formulation component	P208	Surfactants	U023	Plating Agents and Surface Treating Agents	Chemical substances applied to metal, plastic, or other surfaces to alter physical or chemical properties of the surface. Examples include metal surface treating agents, strippers, etchants, rust and tarnish removers, and descaling agents.
3.2.b	Processing: As a formulation component	P208	Surfactants	U031	Surface Active Agents	Chemical substances used to modify surface tension when dissolved in water or water solutions or reduce interfacial tension between two liquids or between a liquid and a solid or between liquid and air. Examples include carboxylates, sulfonates, phosphates, carboxylic acid, esters, and quaternary ammonium salts.
3.2.b	Processing: As a formulation component	P209	Lubricants	U017	Lubricants and Lubricant Additives	Chemical substances used to reduce friction, heat, or wear between moving parts or adjacent solid surfaces, or that enhance the lubricity of other substances. Examples of lubricants include mineral oils, silicate and phosphate esters, silicone oil, greases, and solid film lubricants such as graphite and PTFE. Examples of lubricant additives include molybdenum disulphide and tungsten disulphide.
3.2.b	Processing: As a formulation component	P210	Flame Retardants	U011	Flame Retardants	Chemical substances used on the surface of or incorporated into combustible materials to reduce or eliminate their tendency to ignite when exposed to heat or a flame for a short period of time. Examples include inorganic salts, chlorinated, or brominated organic compounds, and organic phosphates/phosphonates.
3.2.b	Processing: As a formulation component	P211	Rheological Modifiers	U022	Plasticizers	Chemical substances used in plastics, cement, concrete, wallboard, clay bodies, or other materials to increase their plasticity or fluidity. Examples include phthalates, trimellitates, adipates, maleates, and lignosulphonates.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.2.b	Processing: As a formulation component	P211	Rheological Modifiers	U032	Viscosity Adjustors	Chemical substances used to alter the viscosity of another substance. Examples include viscosity index (VI) improvers, pour point depressants, and thickeners.
3.2.b	Processing: As a formulation component	P299	Other	U003	Adsorbents and Absorbents	Chemical substances used to retain other substances by accumulation on their surface or by assimilation. Examples of adsorbents include silica gel, activated alumina, and activated carbon. Examples of absorbents include straw oil, alkaline solutions, and kerosene.
3.2.b	Processing: As a formulation component	P299	Other	U016	Ion Exchange Agents	Chemical substances, usually in the form of a solid matrix, are used to selectively remove targeted ions from a solution. Examples generally consist of an inert hydrophobic matrix such as styrene divinylbenzene or phenol-formaldehyde, cross-linking polymer such as divinylbenzene, and ionic functional groups including sulfonic, carboxylic or phosphonic acids. This code also includes aluminosilicate zeolites.
3.2.b	Processing: As a formulation component	P299	Other	U018	Odor Agents	Chemical substances used to control odors, remove odors, mask odors, or impart odors. Examples include benzenoids, terpenes and terpenoids, musk chemicals, aliphatic aldehydes, aliphatic cyanides, and mercaptans.
3.2.b	Processing: As a formulation component	P299	Other	U019	Oxidizing/ Reducing Agent	Chemical substances used to alter the valence state of another substance by donating or accepting electrons or by the addition or removal of hydrogen to a substance. Examples of oxidizing agents include nitric acid, perchlorates, hexavalent chromium compounds, and peroxydisulfuric acid salts. Examples of reducing agents include hydrazine, sodium thiosulfate, and coke produced from coal.
3.2.b	Processing: As a formulation component	P299	Other	U020	Photosensitive Chemicals	Chemical substances used for their ability to alter their physical or chemical structure through absorption of light, resulting in the emission of light,

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						dissociation, discoloration, or other chemical reactions. Examples include sensitizers, fluorescents, photovoltaic agents, ultraviolet absorbers, and ultraviolet stabilizers.
3.2.b	Processing: As a formulation component	P299	Other	U027	Propellants and Blowing Agents	Chemical substances used to dissolve or suspend other substances and either to expel those substances from a container in the form of an aerosol or to impart a cellular structure to plastics, rubber, or thermos set resins. Examples include compressed gasses and liquids and substances which release ammonia, carbon dioxide, or nitrogen.
3.2.b	Processing: As a formulation component	P299	Other	U028	Solid Separation Agents	Chemical substances used to promote the separation of suspended solids from a liquid. Examples include flotation aids, flocculants, coagulants, dewatering aids, and drainage aids.
3.2.b	Processing: As a formulation component	P299	Other	U999	Other (Specify)	Chemical substances used in a way other than those described by other codes.
3.2.c	Processing: As an article component	N/A	N/A	PA	Processing – Incorporation into Article	Chemical substance becomes an integral component of an article distributed for industrial, trade, or consumer use.
3.2.c	Processing: As an article component	N/A	N/A	U008	Dyes	Chemical substances used to impart color to other materials or mixtures (*i.e.,* substrates) by penetrating the surface of the substrate. Example types include azo, anthraquinone, amino azo, aniline, eosin, stilbene, acid, basic or cationic, reactive, dispersive, and natural dyes.
3.2.c	Processing: As an article component	N/A	N/A	U009	Fillers	Chemical substances used to provide bulk, increase strength, increase hardness, or improve resistance to impact. Fillers incorporated in a matrix reduce production costs by minimizing the amount of more expensive substances used in the production of articles. Examples include calcium carbonate, barium sulfate, silicates, clays, zinc oxide and aluminum oxide.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.2.c	Processing: As an article component	N/A	N/A	U021	Pigments	Chemical substances used to impart color to other materials or mixtures (*i.e.,* substrates) by attaching themselves to the surface of the substrate through binding or adhesion. This code includes fluorescent agents, luminescent agents, whitening agents, pearlizing agents, and opacifiers. Examples include metallic oxides of iron, titanium, zinc, cobalt, and chromium; metal powder suspensions; lead chromates; vegetable and animal products; and synthetic organic pigments.
3.2.c	Processing: As an article component	N/A	N/A	U034	Paint Additives and Coating Additives Not Described by Other Codes	Chemical substances used in a paint or coating formulation to enhance properties such as water repellence, increased gloss, improved fade resistance, ease of application, foam prevention, etc. Examples of paint additives and coating additives include polyols, amines, vinyl acetate ethylene emulsions, and aliphatic polyisocyanates.
3.2.c	Processing: As an article component	N/A	N/A	U999	Other (Specify)	Chemical substances used in a way other than those described by other codes.
3.2.d	Processing: Repackaging	N/A	N/A	PK	Processing – Repackaging	Preparation of a chemical substance for distribution in commerce in a different form, state, or quantity. This includes transferring the chemical substance from a bulk container into smaller containers. This definition does not apply to sites that only relabel or redistribute the reportable chemical substance without removing the chemical substance from the container in which it is received or purchased.
3.2.e	Processing: As an impurity	N/A	N/A	N/A	N/A	N/A
3.2.f	Processing: Recycling	N/A	N/A	N/A	N/A	N/A
3.3.a	Otherwise Use: As a chemical processing aid	N/A	N/A	U	Use-Non Incorporative Activities	Chemical substance is otherwise used (*e.g.,* as a chemical processing or manufacturing aid).

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.3.a	Otherwise Use: As a chemical processing aid	Z101	Process Solvents	U029	Solvents (for Cleaning or Degreasing)	Chemical substances used to dissolve oils, greases, and similar materials from textiles, glassware, metal surfaces, and other articles. Examples include trichloroethylene, perchloroethylene, methylene chloride, liquid carbon dioxide, and n-propyl bromide.
3.3.a	Otherwise Use: As a chemical processing aid	Z102	Catalysts	U020	Photosensitive Chemicals	Chemical substances used for their ability to alter their physical or chemical structure through absorption of light, resulting in the emission of light, dissociation, discoloration, or other chemical reactions. Examples include sensitizers, fluorescents, photovoltaic agents, ultraviolet absorbers, and ultraviolet stabilizers.
3.3.a	Otherwise Use: As a chemical processing aid	Z102	Catalysts	U025	Processing Aids, Specific to Petroleum Production	Chemical substances added to water-, oil-, or synthetic drilling muds or other petroleum production fluids to control viscosity, foaming, corrosion, alkalinity and pH, microbiological growth, hydrate formation, etc., during the production of oil, gas, and other products from beneath the earth’s surface.
3.3.a	Otherwise Use: As a chemical processing aid	Z102	Catalysts	U026	Processing Aids, Not Otherwise Listed	Chemical substances used to improve the processing characteristics or the operation of process equipment or to alter or buffer the pH of the substance or mixture, when added to a process or to a substance or mixture to be processed. Processing agents do not become a part of the reaction product and are not intended to affect the function of a substance or article created. Examples include buffers, dehumidifiers, dehydrating agents, sequestering agents, and chelators.
3.3.a	Otherwise Use: As a chemical processing aid	Z103	Inhibitors	U024	Process Regulators	Chemical substances used to change the rate of a chemical reaction, start or stop the reaction, or otherwise influence the course of the reaction. Process regulators may be consumed or become part of the reaction product.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.3.a	Otherwise Use: As a chemical processing aid	Z103	Inhibitors	U025	Processing Aids, Specific to Petroleum Production	Chemical substances added to water-, oil-, or synthetic drilling muds or other petroleum production fluids to control viscosity, foaming, corrosion, alkalinity and pH, microbiological growth, hydrate formation, etc., during the production of oil, gas, and other products from beneath the earth's surface.
3.3.a	Otherwise Use: As a chemical processing aid	Z103	Inhibitors	U026	Processing Aids, Not Otherwise Listed	Chemical substances used to improve the processing characteristics or the operation of process equipment or to alter or buffer the pH of the substance or mixture, when added to a process or to a substance or mixture to be processed. Processing agents do not become a part of the reaction product and are not intended to affect the function of a substance or article created. Examples include buffers, dehumidifiers, dehydrating agents, sequestering agents, and chelators.
3.3.a	Otherwise Use: As a chemical processing aid	Z104	Initiators	U024	Process Regulators	Chemical substances used to change the rate of a chemical reaction, start, or stop the reaction, or otherwise influence the course of the reaction. Process regulators may be consumed or become part of the reaction product.
3.3.a	Otherwise Use: As a chemical processing aid	Z104	Initiators	U025	Processing Aids, Specific to Petroleum Production	Chemical substances added to water-, oil-, or synthetic drilling muds or other petroleum production fluids to control viscosity, foaming, corrosion, alkalinity and pH, microbiological growth, hydrate formation, etc., during the production of oil, gas, and other products from beneath the earth's surface.
3.3.a	Otherwise Use: As a chemical processing aid	Z104	Initiators	U026	Processing Aids, Not Otherwise Listed	Chemical substances used to improve the processing characteristics or the operation of process equipment or to alter or buffer the pH of the substance or mixture, when added to a process or to a substance or mixture to be processed. Processing agents do not become a part of the reaction product and are not intended to affect the function of a substance or article created. Examples include buffers, dehumidifiers,

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						dehydrating agents, sequestering agents, and chelators.
3.3.a	Otherwise Use: As a chemical processing aid	Z105	Reaction Terminators	U024	Process Regulators	Chemical substances used to change the rate of a chemical reaction, start, or stop the reaction, or otherwise influence the course of the reaction. Process regulators may be consumed or become part of the reaction product.
3.3.a	Otherwise Use: As a chemical processing aid	Z105	Reaction Terminators	U025	Processing Aids, Specific to Petroleum Production	Chemical substances added to water-, oil-, or synthetic drilling muds or other petroleum production fluids to control viscosity, foaming, corrosion, alkalinity and pH, microbiological growth, hydrate formation, etc., during the production of oil, gas, and other products from beneath the earth's surface.
3.3.a	Otherwise Use: As a chemical processing aid	Z105	Reaction Terminators	U026	Processing Aids, Not Otherwise Listed	Chemical substances used to improve the processing characteristics or the operation of process equipment or to alter or buffer the pH of the substance or mixture, when added to a process or to a substance or mixture to be processed. Processing agents do not become a part of the reaction product and are not intended to affect the function of a substance or article created. Examples include buffers, dehumidifiers, dehydrating agents, sequestering agents, and chelators.
3.3.a	Otherwise Use: As a chemical processing aid	Z106	Solution Buffers	U026	Processing Aids, Not Otherwise Listed	Chemical substances used to improve the processing characteristics or the operation of process equipment or to alter or buffer the pH of the substance or mixture, when added to a process or to a substance or mixture to be processed. Processing agents do not become a part of the reaction product and are not intended to affect the function of a substance or article created. Examples include buffers, dehumidifiers, dehydrating agents, sequestering agents, and chelators.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.3.a	Otherwise Use: As a chemical processing aid	Z199	Other	U002	Adhesives and Sealant Chemicals	Chemical substances used to promote bonding between other substances, promote adhesion of surfaces, or prevent seepage of moisture or air. Examples include epoxides, isocyanates, acrylamides, phenol, urea, melamine, and formaldehyde.
3.3.a	Otherwise Use: As a chemical processing aid	Z199	Other	U006	Bleaching Agents	Chemical substances used to lighten or whiten a substrate through chemical reaction, usually an oxidative process which degrades the color system. Examples generally fall into one of two groups: chlorine containing bleaching agents (*e.g.,* chlorine, hypochlorite, N-chloro compounds and chlorine dioxide); and, peroxygen bleaching agents (*e.g.,* hydrogen peroxide, potassium permanganate, and sodium perborate).
3.3.a	Otherwise Use: As a chemical processing aid	Z199	Other	U018	Odor Agents	Chemical substances used to control odors, remove odors, mask odors, or impart odors. Examples include benzenoids, terpenes and terpenoids, musk chemicals, aliphatic aldehydes, aliphatic cyanides, and mercaptans.
3.3.a	Otherwise Use: As a chemical processing aid	Z199	Other	U023	Plating Agents and Surface Treating Agents	Chemical substances applied to metal, plastic, or other surfaces to alter physical or chemical properties of the surface. Examples include metal surface treating agents, strippers, etchants, rust and tarnish removers, and descaling agents.
3.3.a	Otherwise Use: As a chemical processing aid	Z199	Other	U025	Processing Aids, Specific to Petroleum Production	Chemical substances added to water-, oil-, or synthetic drilling muds or other petroleum production fluids to control viscosity, foaming, corrosion, alkalinity and pH, microbiological growth, hydrate formation, etc., during the production of oil, gas, and other products from beneath the earth’s surface.
3.3.a	Otherwise Use: As a chemical processing aid	Z199	Other	U026	Processing Aids, Not Otherwise Listed	Chemical substances used to improve the processing characteristics or the operation of process equipment or to alter or buffer the pH of the substance or mixture, when added to a process or to a substance or mixture to be processed. Processing agents do not

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						become a part of the reaction product and are not intended to affect the function of a substance or article created. Examples include buffers, dehumidifiers, dehydrating agents, sequestering agents, and chelators.
3.3.a	Otherwise Use: As a chemical processing aid	Z199	Other	U028	Solid Separation Agents	Chemical substances used to promote the separation of suspended solids from a liquid. Examples include flotation aids, flocculants, coagulants, dewatering aids, and drainage aids.
3.3.b	Otherwise Use: As a manufacturing aid	N/A	N/A	U	Use − Non Incorporative Activities	Chemical substance is otherwise used (*e.g.,* as a chemical processing or manufacturing aid).
3.3.b	Otherwise Use: As a manufacturing aid	Z201	Process Lubricants	U017	Lubricants and Lubricant Additives	Chemical substances used to reduce friction, heat, or wear between moving parts or adjacent solid surfaces, or that enhance the lubricity of other substances. Examples of lubricants include mineral oils, silicate and phosphate esters, silicone oil, greases, and solid film lubricants such as graphite and PTFE. Examples of lubricant additives include molybdenum disulphide and tungsten disulphide.
3.3.b	Otherwise Use: As a manufacturing aid	Z202	Metalworking Fluids	U007	Corrosion Inhibitors and Antiscaling Agents	Chemical substances used to prevent or retard corrosion or the formation of scale. Examples include phenylenediamine, chromates, nitrates, phosphates, and hydrazine.
3.3.b	Otherwise Use: As a manufacturing aid	Z202	Metalworking Fluids	U014	Functional Fluids (Open Systems)	Liquid or gaseous chemical substances used for one or more operational properties in an open system. Examples include antifreezes and de−icing fluids such as ethylene and propylene glycol, sodium formate, potassium acetate, and sodium acetate. This code also includes substances incorporated into metal working fluids.
3.3.b	Otherwise Use: As a manufacturing aid	Z203	Coolants	U013	Functional Fluids (Closed Systems)	Liquid or gaseous chemical substances used for one or more operational properties in a closed system. Examples include heat transfer agents (*e.g.,* coolants and refrigerants) such as polyalkylene glycols,

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						silicone oils, liquified propane, and carbon dioxide; hydraulic/transmission fluids such as mineral oils, organophosphate esters, silicone, and propylene glycol; and dielectric fluids such as mineral insulating oil and high flash point kerosene. This code does not include fluids used as lubricants.
3.3.b	Otherwise Use: As a manufacturing aid	Z204	Refrigerants	U013	Functional Fluids (Closed Systems)	Liquid or gaseous chemical substances used for one or more operational properties in a closed system. Examples include heat transfer agents (*e.g.,* coolants and refrigerants) such as polyalkylene glycols, silicone oils, liquified propane, and carbon dioxide; hydraulic/transmission fluids such as mineral oils, organophosphate esters, silicone, and propylene glycol; and dielectric fluids such as mineral insulating oil and high flash point kerosene. This code does not include fluids used as lubricants.
3.3.b	Otherwise Use: As a manufacturing aid	Z205	Hydraulic Fluids	U013	Functional Fluids (Closed Systems)	Liquid or gaseous chemical substances used for one or more operational properties in a closed system. Examples include: heat transfer agents (*e.g.,* coolants and refrigerants) such as polyalkylene glycols, silicone oils, liquified propane, and carbon dioxide; hydraulic/transmission fluids such as mineral oils, organophosphate esters, silicone, and propylene glycol; and dielectric fluids such as mineral insulating oil and high flash point kerosene. This code does not include fluids used as lubricants.
3.3.b	Otherwise Use: As a manufacturing aid	Z299	Other	U013	Functional Fluids (Closed Systems)	Liquid or gaseous chemical substances used for one or more operational properties in a closed system. Examples include: heat transfer agents (*e.g.,* coolants and refrigerants) such as polyalkylene glycols, silicone oils, liquified propane, and carbon dioxide; hydraulic/transmission fluids such as mineral oils, organophosphate esters, silicone, and propylene glycol; and dielectric fluids such as mineral insulating oil and high flash point kerosene. This code does not include fluids used as lubricants.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.3.b	Otherwise Use: As a manufacturing aid	Z299	Other	U023	Plating Agents and Surface Treating Agents	Chemical substances applied to metal, plastic, or other surfaces to alter physical or chemical properties of the surface. Examples include metal surface treating agents, strippers, etchants, rust and tarnish removers, and descaling agents.
3.3.c	Otherwise Use: Ancillary or other use	N/A	N/A	U	Use – Non-Incorporative Activities	Chemical substance is otherwise used (*e.g.,* as a chemical processing or manufacturing aid).
3.3.c	Otherwise Use: Ancillary or other use	Z301	Cleaner	U007	Corrosion Inhibitors and Antiscaling Agents	Chemical substances used to prevent or retard corrosion or the formation of scale. Examples include phenylenediamine, chromates, nitrates, phosphates, and hydrazine.
3.3.c	Otherwise Use: Ancillary or other use	Z301	Cleaner	U029	Solvents (for Cleaning or Degreasing)	Chemical substances used to dissolve oils, greases, and similar materials from textiles, glassware, metal surfaces, and other articles. Examples include trichloroethylene, perchloroethylene, methylene chloride, liquid carbon dioxide, and n-propyl bromide.
3.3.c	Otherwise Use: Ancillary or other use	Z302	Degreaser	U003	Adsorbents and Absorbents	Chemical substances used to retain other substances by accumulation on their surface or by assimilation. Examples of adsorbents include silica gel, activated alumina, and activated carbon. Examples of absorbents include straw oil, alkaline solutions, and kerosene.
3.3.c	Otherwise Use: Ancillary or other use	Z302	Degreaser	U029	Solvents (for Cleaning or Degreasing)	Chemical substances used to dissolve oils, greases, and similar materials from textiles, glassware, metal surfaces, and other articles. Examples include trichloroethylene, perchloroethylene, methylene chloride, liquid carbon dioxide, and n-propyl bromide.
3.3.c	Otherwise Use: Ancillary or other use	Z303	Lubricant	U017	Lubricants and Lubricant Additives	Chemical substances used to reduce friction, heat, or wear between moving parts or adjacent solid surfaces, or that enhance the lubricity of other substances. Examples of lubricants include mineral oils, silicate and phosphate esters, silicone oil, greases, and solid film lubricants such as graphite and PTFE. Examples

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						of lubricant additives include molybdenum disulphide and tungsten disulphide.
3.3.c	Otherwise Use: Ancillary or other use	Z304	Fuel	U012	Fuels and Fuel Additives	Chemical substances used to create mechanical or thermal energy through chemical reactions, or which are added to a fuel for the purpose of controlling the rate of reaction or limiting the production of undesirable combustion products, or which provide other benefits such as corrosion inhibition, lubrication, or detergency. Examples of fuels include coal, oil, gasoline, and various grades of diesel fuel. Examples of fuel additives include oxygenated compound such as ethers and alcohols, antioxidants such as phenylenediamines and hindered phenols, corrosion inhibitors such as carboxylic acids, amines, and amine salts, and blending agents such as ethanol.
3.3.c	Otherwise Use: Ancillary or other use	Z305	Flame Retardant	U011	Flame Retardants	Chemical substances used on the surface of or incorporated into combustible materials to reduce or eliminate their tendency to ignite when exposed to heat or a flame for a short period of time. Examples include inorganic salts, chlorinated, or brominated organic compounds, and organic phosphates/phosphonates.
3.3.c	Otherwise Use: Ancillary or other use	Z306	Waste Treatment	U006	Bleaching Agents	Chemical substances used to lighten or whiten a substrate through chemical reaction, usually an oxidative process which degrades the color system. Examples generally fall into one of two groups: chlorine containing bleaching agents (*e.g.,* chlorine, hypochlorites, N-chloro compounds and chlorine dioxide); and peroxygen bleaching agents (*e.g.,* hydrogen peroxide, potassium permanganate, and sodium perborate).
3.3.c	Otherwise Use: Ancillary or other use	Z306	Waste Treatment	U018	Odor Agents	Chemical substances used to control odors, remove odors, mask odors, or impart odors. Examples include benzenoids, terpenes and terpenoids, musk chemicals, aliphatic aldehydes, aliphatic cyanides, and mercaptans.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.3.c	Otherwise Use: Ancillary or other use	Z306	Waste Treatment	U019	Oxidizing/Reducing Agent	Chemical substances used to alter the valence state of another substance by donating or accepting electrons or by the addition or removal of hydrogen to a substance. Examples of oxidizing agents include nitric acid, perchlorates, hexavalent chromium compounds, and peroxydisulfuric acid salts. Examples of reducing agents include hydrazine, sodium thiosulfate, and coke produced from coal.
3.3.c	Otherwise Use: Ancillary or other use	Z306	Waste Treatment	U028	Solid Separation Agents	Chemical substances used to promote the separation of suspended solids from a liquid. Examples include flotation aids, flocculants, coagulants, dewatering aids, and drainage aids.
3.3.c	Otherwise Use: Ancillary or other use	Z307	Water Treatment	U006	Bleaching Agents	Chemical substances used to lighten or whiten a substrate through chemical reaction, usually an oxidative process which degrades the color system. Examples generally fall into one of two groups: chlorine containing bleaching agents (*e.g.,* chlorine, hypochlorites, N-chloro compounds and chlorine dioxide); and peroxygen bleaching agents (*e.g.,* hydrogen peroxide, potassium permanganate, and sodium perborate).
3.3.c	Otherwise Use: Ancillary or other use	Z307	Water Treatment	U018	Odor Agents	Chemical substances used to control odors, remove odors, mask odors, or impart odors. Examples include benzenoids, terpenes and terpenoids, musk chemicals, aliphatic aldehydes, aliphatic cyanides, and mercaptans.
3.3.c	Otherwise Use: Ancillary or other use	Z307	Water Treatment	U019	Oxidizing/Reducing Agent	Chemical substances used to alter the valence state of another substance by donating or accepting electrons or by the addition or removal of hydrogen to a substance. Examples of oxidizing agents include nitric acid, perchlorates, hexavalent chromium compounds, and peroxydisulfuric acid salts. Examples of reducing agents include hydrazine, sodium thiosulfate, and coke produced from coal.

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
3.3.c	Otherwise Use: Ancillary or other use	Z307	Water Treatment	U028	Solid Separation Agents	Chemical substances used to promote the separation of suspended solids from a liquid. Examples include flotation aids, flocculants, coagulants, dewatering aids, and drainage aids.
3.3.c	Otherwise Use: Ancillary or other use	Z308	Construction Materials	N/A	N/A	N/A
3.3.c	Otherwise Use: Ancillary or other use	Z399	Other	U001	Abrasives	Chemical substances used to wear down or polish surfaces by rubbing against the surface. Examples include sandstones, pumice, silex, quartz, silicates, aluminum oxides, and glass.
3.3.c	Otherwise Use: Ancillary or other use	Z399	Other	U013	Functional Fluids (Closed Systems)	Liquid or gaseous chemical substances used for one or more operational properties in a closed system. Examples include heat transfer agents (*e.g.,* coolants and refrigerants) such as polyalkylene glycols, silicone oils, liquified propane, and carbon dioxide; hydraulic/transmission fluids such as mineral oils, organophosphate esters, silicone, and propylene glycol; and dielectric fluids such as mineral insulating oil and high flash point kerosene. This code does not include fluids used as lubricants.
3.3.c	Otherwise Use: Ancillary or other use	Z399	Other	U014	Functional Fluids (Open Systems)	Liquid or gaseous chemical substances used for one or more operational properties in an open system. Examples include antifreezes and de-icing fluids such as ethylene and propylene glycol, sodium formate, potassium acetate, and sodium acetate. This code also includes substances incorporated into metal working fluids.
3.3.c	Otherwise Use: Ancillary or other use	Z399	Other	U018	Odor Agents	Chemical substances used to control odors, remove odors, mask odors, or impart odors. Examples include benzenoids, terpenes and terpenoids, musk chemicals, aliphatic aldehydes, aliphatic cyanides, and mercaptans.
3.3.c	Otherwise Use: Ancillary or other use	Z399	Other	U020	Photosensitive Chemicals	Chemical substances used for their ability to alter their physical or chemical structure through absorption of light, resulting in the emission of light,

TRI Section	TRI Description	TRI Sub-Use Code	TRI Sub-Use Code Name	2016 CDR Code	2016 CDR Code Name	2016 CDR Functional Use Definition
						dissociation, discoloration, or other chemical reactions. Examples include sensitizers, fluorescents, photovoltaic agents, ultraviolet absorbers, and ultraviolet stabilizers.
3.3.c	Otherwise Use: Ancillary or other use	Z399	Other	U023	Plating Agents and Surface Treating Agents	Chemical substances applied to metal, plastic, or other surfaces to alter physical or chemical properties of the surface. Examples include metal surface treating agents, strippers, etchants, rust and tarnish removers, and descaling agents.
CDR = Chemical Data Reporting; TRI = Toxics Release Inventory						

Appendix C ESTIMATING DAILY WASTEWATER DISCHARGES FROM DISCHARGE MONITORING REPORTS AND TOXICS RELEASE INVENTORY DATA

This appendix provides steps and examples for estimating daily wastewater discharges from industrial and commercial facilities manufacturing, processing, or using chemicals undergoing risk evaluation under the TSCA. Wastewater discharges are reported either via DMRs under the NPDES or TRI.

The following estimation methods are provided:

- average daily wastewater discharge rate (kg/site-day);
- high-end daily wastewater discharge rate (kg/site-day);
- 1-day maximum wastewater discharge rate (kg/site-day); and
- trends over 5 years for a facility including the minimum, maximum, and median wastewater discharge rate that has occurred for a facility within the past 5 years.

These estimates will be used in modeling to estimate surface water concentrations in receiving waters for the assessment of risks to aquatic species and to the general population from drinking water.

C.1 Collecting and Mapping Wastewater Discharge Data to COUs and OESs

The first step in estimating daily releases is obtaining and mapping the relevant data to the COUs for the chemical that were identified in the scoping document. Some COUs may be broad categories of use and additional steps may be taken in the risk evaluation to further define the COUs into more specific OESs. A methodology for how to do this mapping step has been developed and the key steps are described below.

1. Query the Loading Tool and TRI for each of the past 5 years, starting with the most recent calendar year for which TRI data are available. In general, when a facility reports under both the NPDES program and TRI, EPA will perform comparisons of the data to determine if any discrepancies exist and, if so, which data are more appropriate to use in the risk evaluation. However, the two datasets are not updated concurrently. The Loading Tool automatically and continuously checks ICIS-NPDES for newly submitted DMRs. The Loading Tool processes the data weekly and calculates pollutant loading estimates; therefore, water discharge data (DMR data) are available on a continual basis. While the Loading Tool process data weekly, each permitted discharging facility is only required to report their monitoring results for each pollutant at a frequency specified in the permit (*e.g.,* monthly, every 2 months, quarterly). TRI data is only reported annually for the previous calendar year and is typically released in July (*i.e.,* 2020 TRI data is released in July 2021). To ensure EPA is making an appropriate comparison between the two datasets, EPA should only use data for years where data from both datasets are available.
2. Remove the following DMR facility types from further analysis:
    a. Facilities reporting zero discharges for the chemical of interest for each of the 5 years queried as EPA cannot confirm if the pollutant is present at the facility.
3. Map each remaining facility to a COU and OES; the OES will inform estimates of average operating days per year for the facility.

C.2 Estimating the Number of Facility Operating Days per Year

The number of operating days per year (days/year) for each facility that reports wastewater discharges may be available but will most likely be unknown. An approach has been developed for use in TSCA risk evaluations for estimating the number of facility operating days before and is described below.

1. **Facility-Specific Data:** Use facility-specific data if available. If facility-specific data is not available, estimate the days/year using one of the following approaches:
    a. If facilities have known or estimated average daily use rates, calculate the days/year (days/year = estimated annual use rate for the site [kg/year] / average daily use rate from sites with available data [kg/day]).
    b. If sites with days/year data do not have known or estimate average daily use rates, use the average number of days/year from the sites with such data.
2. **Industry-Specific Data:** Industry-specific data may be available in the form of GSs, ESDs, trade publications, or other relevant literature. In such cases, these estimates should take precedent over other approaches, unless facility-specific data are available.
3. **Manufacture of Large-Production Volume (PV) Commodity Chemicals:** For the manufacture of the large-PV commodity chemicals, a value of 350 days/year should be used. This assumes the plant runs 7 day/week and 50 week/year (with 2 weeks down for turnaround) and assumes that the plant is always producing the chemical.
4. **Manufacture of Lower-PV Specialty Chemicals:** For the manufacture of lower-PV specialty chemicals, it is unlikely the chemical is being manufactured continuously throughout the year. Therefore, a value of 250 days/year should be used. This assumes the plant manufactures the chemical 5 days/week and 50 weeks/year (with 2 weeks down for turnaround).
5. **Processing as Reactant (Intermediate Use) in the Manufacture of Commodity Chemicals:** Similar to #3, the manufacture of commodity chemicals is assumed to occur 350 days/year such that the use of a chemical as a reactant to manufacture a commodity chemical will also occur 350 days/year.
6. **Processing as Reactant (Intermediate Use) in the Manufacture of Specialty Chemicals:** Similar to #4, the manufacture of specialty chemicals is not likely to occur continuously throughout the year. Therefore, a value of 250 days/year can be used.
7. **Other Chemical Plant OESs** (*e.g.,* Processing into Formulation and Use of Industrial Processing Aids): For these OES, it is reasonable to assume that the chemical of interest is not always in use at the facility, even if the facility operates 24/7. Therefore, in general, a value of 300 days/year can be used based on the "SpERC fact sheet – Formulation & (re)packing of substances and mixtures – Industrial (Solvent-borne)" which uses a default of 300 days/year for the chemical industry. However, in instances where the OES uses a low volume of the chemical of interest, 250 days/year can be used as a lower estimate for the days/year.
8. **POTWs:** Although POTWs are expected to operate continuously over 365 days/year, the discharge frequency of the chemical of interest from a POTW will be dependent on the discharge patterns of the chemical from the upstream facilities discharging to the POTW. The upstream discharge patterns will be addressed in a second-tier analysis. However, there can be multiple upstream facilities (possibly with different OES) discharging to the same POTW and information to determine when the discharges from each facility occur on the same day or separate days is typically not available. Therefore, an exact number of days/year the chemical of interest is discharged from the POTW cannot be determined and a value of 365 days/year should be used.
9. **All Other OESs:** Regardless of what the facility operating schedule is, other OES are unlikely to use the chemical of interest every day. Therefore, a value of 250 days/year should be used for these OESs.

C.3 Approach for Estimating Daily Discharges

After the initial steps of selecting and mapping of the water discharge data and estimating the number of facility operating days/year have been completed, the next steps in the analysis are to make estimates of daily wastewater discharges. This guidance presents approaches for making the following estimates:

- average daily wastewater discharges – this approach averages out the yearly discharges into an average daily discharge rate for the entire year for the facility;
- high-end daily wastewater discharges – this approach estimates a high-end daily discharge rate that may take place for a period of time during the year for the facility; and
- 1-day maximum discharge rate – this approach estimates a discharge rate that may represent a 1-day maximum rate for the facility.

C.3.1 Average Daily Wastewater Discharges

The following steps should be used to estimate the average daily wastewater discharge for each facility for each year:

1. Obtain total annual loads calculated from the Loading Tool and reported annual surface water discharges in TRI.
2. For facilities with both TRI and DMR data, compare the annual surface water discharges reported to each to see if they agree. If not, select the data representing the highest annual discharge.
3. Divide the annual discharge over the number of estimated operating days for the OES to which the facility has been mapped. The number of operating days will differ for each OES and chemical but typically ranges from 200 to 350 days/year (see Section 2.3.2 for approach to estimating operating days/year).

This approach can be used for both direct discharges to surface water and indirect discharges to POTW or non-POTW WWT. However, special care should be given to facilities reporting transfers to POTW or non-POTW WWT plants in TRI as the subsequent discharge to surface water from these transfers may already be accounted for in the receiving facilities DMRs.

C.3.2 High-End Daily Direct Discharge for Facilities with DMR Data

The following steps should be used to estimate the high-end daily direct discharge for each facility with DMR data for each year:

1. Use the Loading Tool to obtain the reporting periods (*e.g.,* monthly, bimonthly, quarterly, biannually, annually) and required reporting statistics (*e.g.,* average monthly concentration, max daily concentration) for each external outfall at each facility. When there is one outfall reported in the Loading Tool, assume it is an external outfall. If multiple outfalls are reported in the Loading Tool, further investigation to determine the external outfall would be required, such as a review of facility's permits.

2. For each external outfall at each facility, calculate the average daily load for each reporting period by multiplying the period average concentration by the period average wastewater flowrate. If there is one outfall reported in the Loading Tool, assume it is an external outfall. Further investigation is needed if multiple outfalls are reported in the Loading Tool to determine the external outfall, such as a review of the facility's permit.

3. Sum the average daily loads from each external outfall for each period.

4. Select the period with the highest average daily load across all external outfalls as an estimate of the high-end daily discharge assessed over the number of days in the period. The number of days

in the reporting period does not necessarily equate to the number of operating days in the reporting period. For example, for a plant that operates 200 days/year, use 200 rather than 365 days/year for average daily discharge. Therefore, discharges will not occur every day of the reporting period, but only for a fraction (200 ÷ 365 = 68%). The number of days of the reporting period should be multiplied by this factor to maintain consistency between operating days/year and operating days/reporting period.

C.3.3 High-End Daily Direct Consecutive Discharge for Facilities Without DMRs

Some facilities may report surface water discharges to TRI but are not required to monitor or report those discharges under the NPDES. In such cases, EPA will only have the annual discharge value and not discharge values from multiple periods throughout the year. To estimate the high-end daily direct discharges for these facilities the following steps should be used:

1. Identify facilities that report under the NPDES program for the same chemical, same year, and same OES as the TRI facility and report DMRs monthly. Note that if no monthly reporters exist, reporters with less frequent reporting can be substituted provided the number of release days per year are adjusted in subsequent steps.
2. For each facility identified in #1, calculate the percentage of the total annual discharge that occurred in the highest one-month period.
3. Calculate a generic factor for the OES as the average of the percentages calculated in #2.
4. Estimate the high-end daily discharge for each facility without DMRs by multiplying the annual discharge by the generic factor from #3. For example, a facility reports 500 lb released per year and has a generic factor of 15% for the OES from #3. The estimated high-end chronic daily discharge for the facility would be (500 lb × 15% = 75 lb/month).
5. Use the value calculated in #4 as an estimate of the high-end daily discharge assessed over 30 days per year. For example, the high-end daily discharge assessed over 30 days per year for the facility with the estimated high-end chronic daily discharge of 75 lb/month (from #4 above) is (75 lb/month ÷ 30 days = 2.5 lb/day for 30 days).

This approach can also be applied to facilities that have less frequent reporting periods under the NPDES program (*e.g.,* facilities that report quarterly or biannually). Use the facility-specific permit data for less frequent reporting periods. Refer to Section C.5 for additional details.

C.3.4 High-End Daily Indirect Discharges

In general, EPA is unlikely to have detailed information to estimate high-end daily indirect discharges to POTWs or non-POTW WWT plants and will only be able to calculate average daily discharges. However, in some cases, EPA may have site-specific information that allows for the estimation of a range for the release days per year (*e.g.,* such information can be find in ECHO). In such instances, EPA can calculate the high-end daily discharge as the annual discharge divided by the minimum number of release days per year.

C.3.5 1-Day Discharges

Facilities required to report under the NPDES may sometimes be required to report a daily maximum discharge concentration for the period. These values can be used to estimate 1-day discharges by multiplying the maximum daily concentration by the corresponding month's maximum daily wastewater flow rate.

C.4 Trends in Wastewater Discharge Data: 5 Year Data Characterization

Wastewater discharge data may vary from year to year for a facility due to factors including the economy. A trend of the releases from each facility can be used to characterize results and develop a range of potential discharges from each site. A 5-year period will be used for this analysis. Prior to calculating the 5-year statistics, it is recommended that an evaluation be done of whether the 5-year range includes any outlier years and remove them from the analysis to ensure no atypical years are being included in the statistics. The interquartile rule for outliers can be used for this analysis.

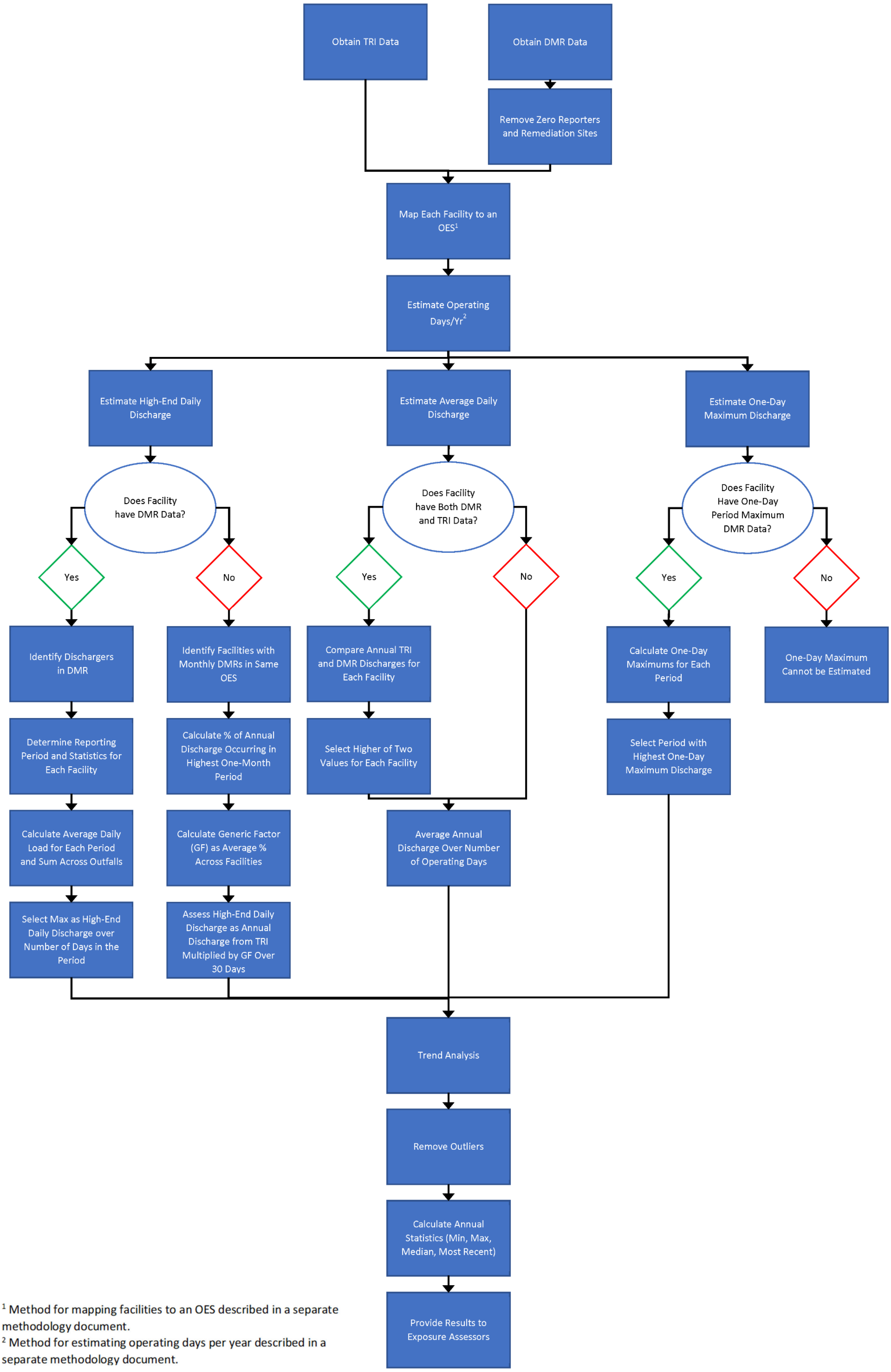
The interquartile rule for outliers states that if the distance between a data point and the first or third quartile is greater than 1.5 times the interquartile range (IQR), the data point is an outlier. The IQR is the difference between the third quartile (*i.e.,* 75th percentile) and first quartile (*i.e.,* 25th percentile) of a dataset. Therefore, any values less than 25th percentile minus 1.5 IQR or values exceeding the 75th percentile plus 1.5 IQR would be considered outliers.

After any outliers are removed, the following 5-year statistics should be determined for each facility:

1. minimum, maximum, median, and most recent (if different than the maximum) annual discharge;
2. minimum, maximum, median, and most recent (if different than the maximum) average chronic daily discharge;
3. minimum, maximum, median, and most recent (if different than the maximum) high-end chronic daily discharge; and
4. minimum, maximum, median, and most recent (if different than the maximum) acute 1-day discharge.

C.4.1 Decision Tree for DMR and TRI Wastewater Discharge Estimates

A *Decision Tree for Wastewater Discharge Estimates Using TRI and/or DMR Data*, provided as Figure_Apx C-1 below, helps visualize the process for estimating daily discharges.



[1] Method for mapping facilities to an OES described in a separate methodology document.
[2] Method for estimating operating days per year described in a separate methodology document.

Figure_Apx C-1. Decision Tree for Wastewater Discharge Estimates Using TRI and DMR Data

C.5 Example Facilities

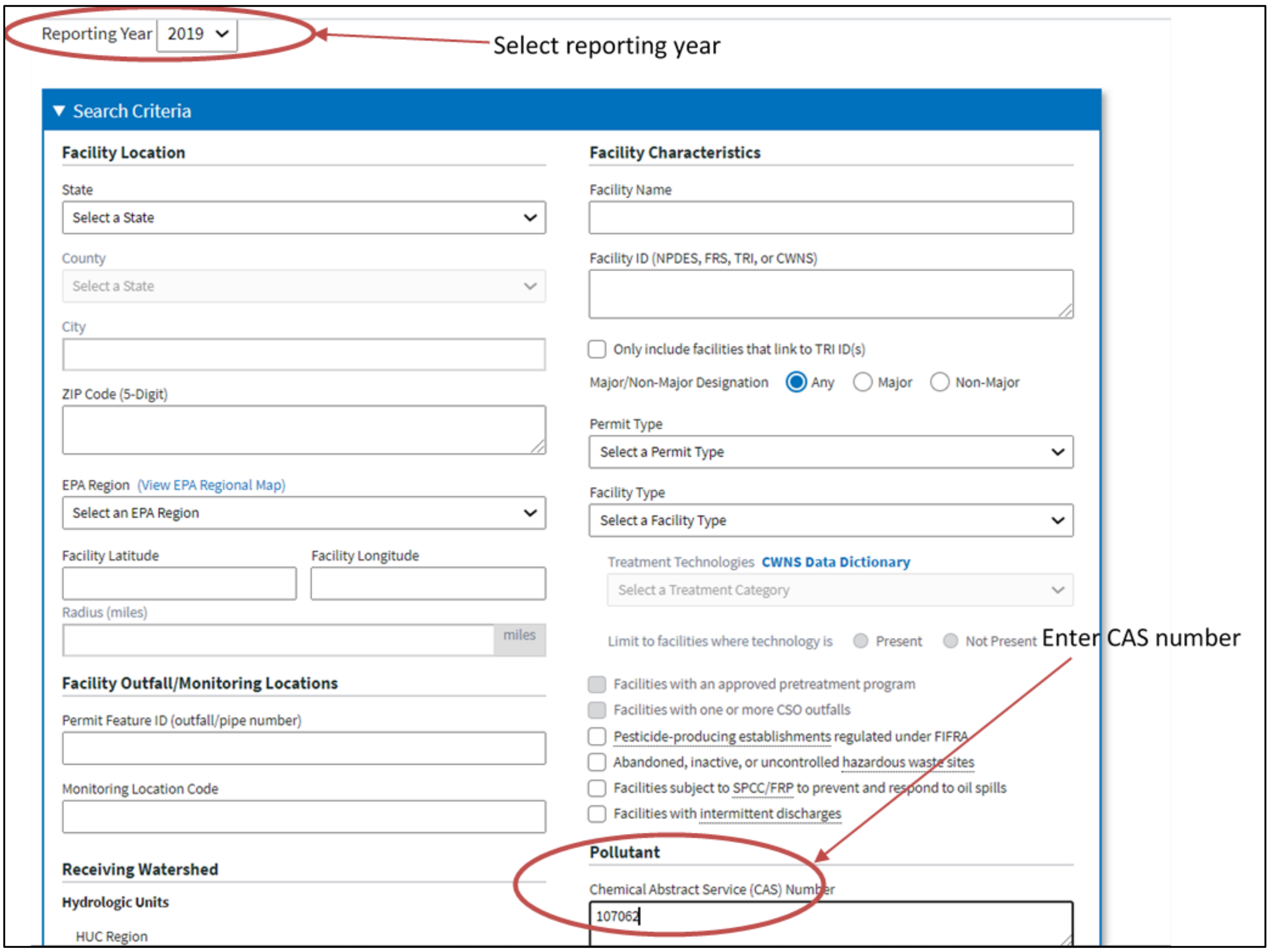
This section illustrates how to calculate both high-end and average daily discharges for situations where a facility has both TRI and DMR data and where a facility only has TRI data. It also includes calculations for 1-day daily discharges from DMR data. The examples provided are for two facilities reporting for the pollutant 1,2-dichloroethane ("1,2-DCA"):

1. Westlake Vinyls in Calvert City, Kentucky – reports both DMR and TRI; and
2. Axiall LLC in Plaquemine, Louisiana – reports to TRI only.

For purposes of this example, only a single year for each database is presented.

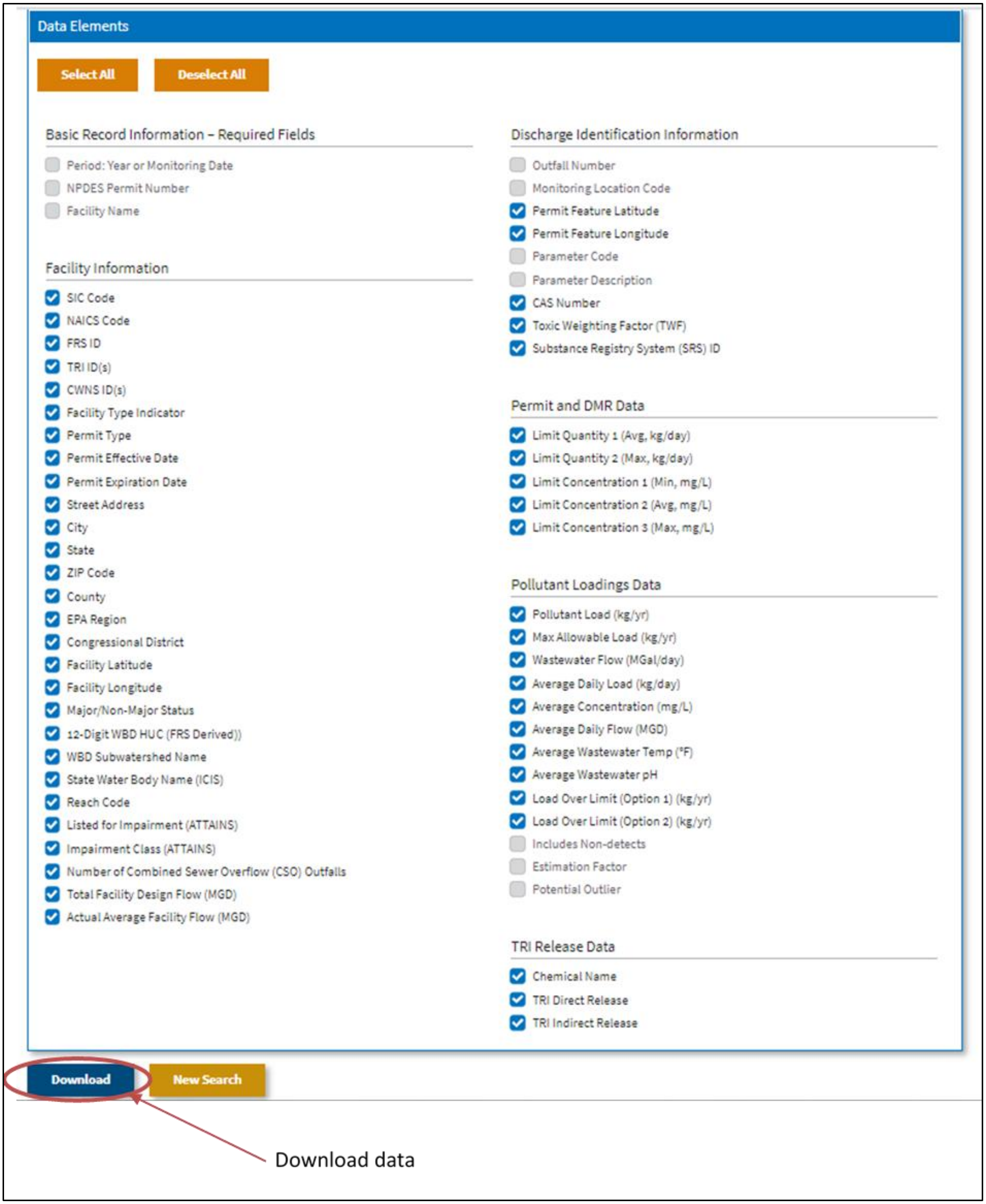
Obtaining DMR Data

DMR data can be obtained through multiple methods; however, this method focuses on a single approach for simplicity. To query the loading tool for all pollutant data, the user should go to the following webpage: https://echo.epa.gov/trends/loading-tool/get-data/custom-search (accessed August 11, 2025), select the reporting year of interest and then enter a chemical CAS number as shown in Figure_Apx C-2.



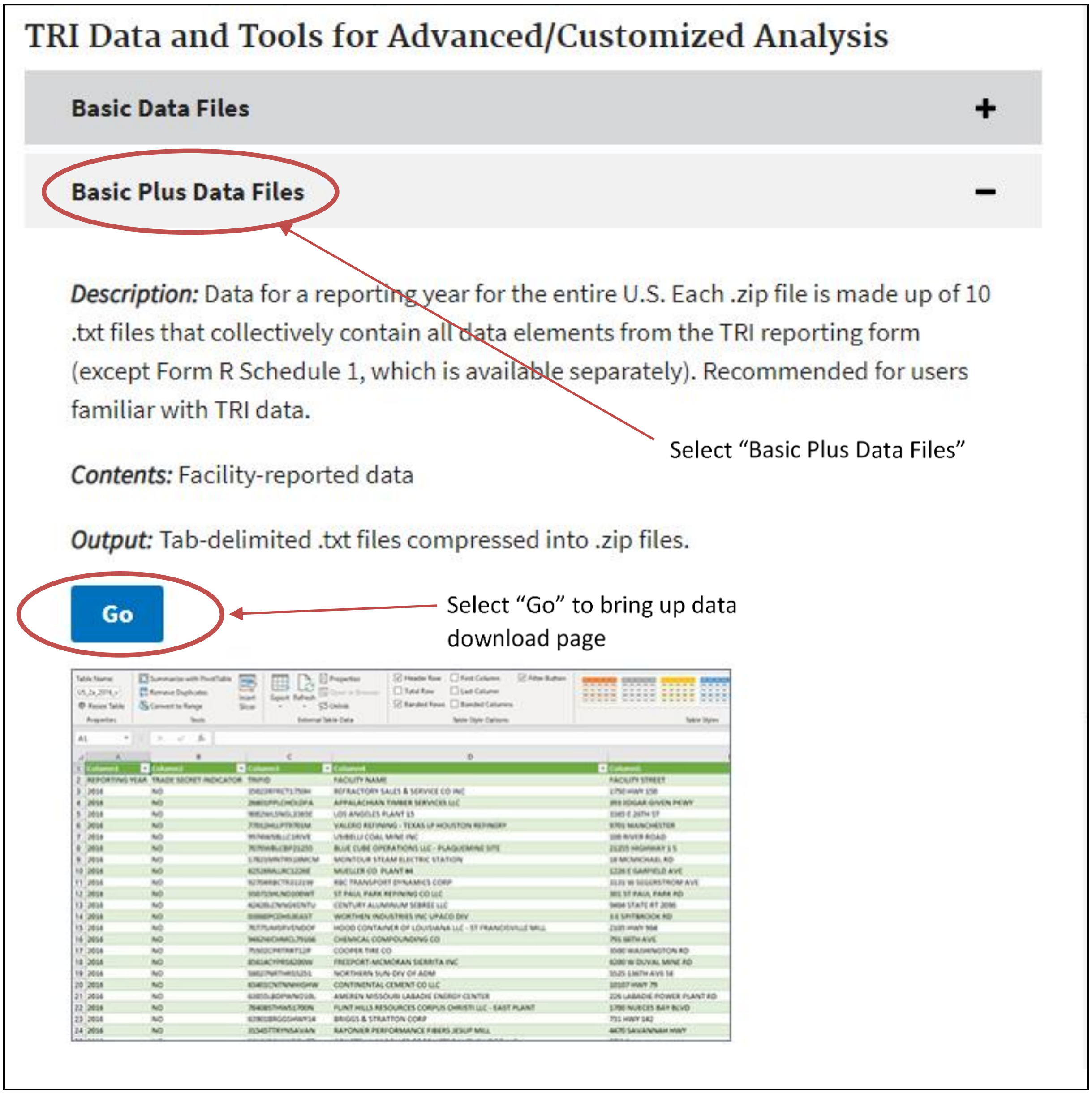
Figure_Apx C-2. Loading Tool – Data Query

After clicking submit, the Loading Tool will present a list of data elements that can be selected or deselected for the query. By default, all data elements will be selected and for this methodology, it is suggested to leave that unchanged to ensure all relevant data fields are downloaded. The user should then click “download,” as shown in Figure_Apx C-3. This will provide an Excel spreadsheet with all the facilities that are required to monitor for the pollutant for the selected year and their annual discharge calculated by the Loading Tool.



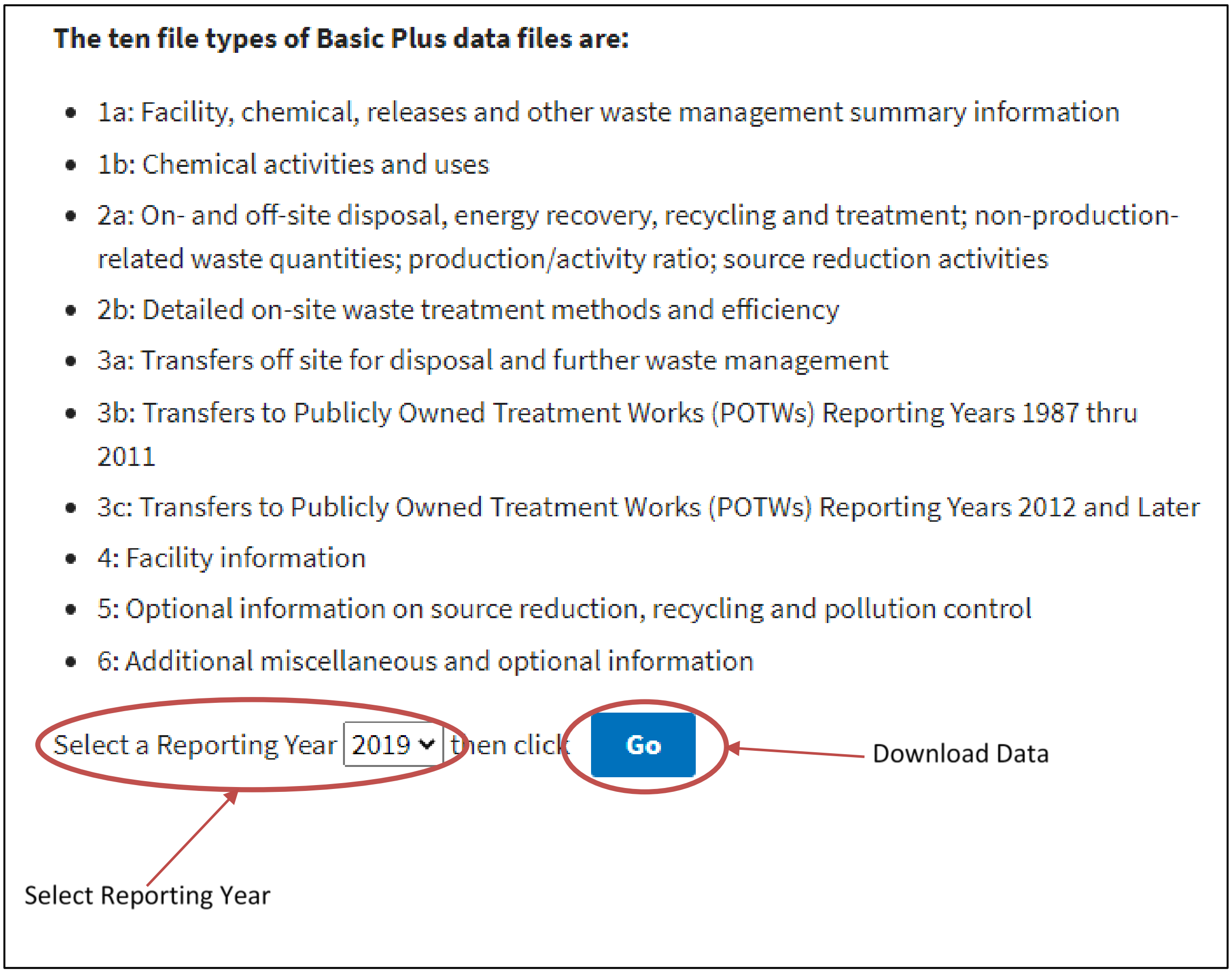
Figure_Apx C-3. Loading Tool – Download Facility Discharges from Query Results

Obtaining TRI Data
TRI data is available in several formats with various levels of detail depending on the type of information a user intends to use. For this analysis, the "Basic Plus Data Files" were used. This data can be obtained by going to the following website: https://www.epa.gov/toxics-release-inventory-tri-program/tri-data-and-tools (accessed August 11, 2025), selecting "Basic Plus Data Files," then "Go" as shown in Figure_Apx C-4.



Figure_Apx C-4. Accessing Basic Plus Data Files[a]
[a] See Guides for accessing, downloading, and importing the Basic Plus Data files (accessed August 7, 2025) for further information.

The subsequent webpage can then be used to select the reporting year of interest and download the data files as shown in Figure_Apx C-5. This will provide a zip file containing multiple tab-delimited.txt files, which can be imported into Excel Spreadsheets and contain all the 2019 TRI data for all chemicals, including annual direct and indirect wastewater discharges. The files can then be filtered for the chemical of interest and facilities with non-zero discharges.[19] Table_Apx C-1 provides a list of key data fields and from which Basic Plus data file they can be obtained.



Figure_Apx C-5. TRI – Downloading Basic Data Plus Files

[19] Facilities using a Form A rather than a Form R to report to TRI do not report any release information; therefore, the wastewater discharges for these facilities will be shown as "0" in the TRI data files. However, these may not be true zero discharges. Discharges from these facilities may need to be estimated separately and is outside the scope of this TSD.

Table_Apx C-1. List of Key Data Fields from TRI Basic Plus Data

TRI Basic Plus Data File	Field Name
US_1a_[Year]	1. FORM TYPE
US_1a_[Year]	2. REPORTING YEAR
US_1a_[Year]	9. TRIFD
US_1a_[Year]	10. FACILITY NAME
US_1a_[Year]	11. FACILITY STREET
US_1a_[Year]	12. FACILITY CITY
US_1a_[Year]	13. FACILITY COUNTY
US_1a_[Year]	14. FACILITY STATE
US_1a_[Year]	15. FACILITY ZIP CODE
US_1a_[Year]	41. PRIMARY NAICS CODE
US_1a_[Year]	47. LATITUDE
US_1a_[Year]	48. LONGITUDE
US_1a_[Year]	74. FRS FACILITY ID
US_1a_[Year]	76. CAS NUMBER
US_1a_[Year]	77. CHEMICAL NAME
US_1a_[Year]	81. UNIT OF MEASURE
US_1a_[Year]	112. DISCHARGES TO STREAM A – STREAM NAME
US_1a_[Year]	113. DISCHARGES TO STREAM A – RELEASE POUNDS
US_1a_[Year]	114. DISCHARGES TO STREAM A – RELEASE RANGE CODE
US_1a_[Year]	115. TOTAL DISCHARGES TO STREAM A
US_1a_[Year]	116. DISCHARGES TO STREAM A – BASIS OF ESTIMATE
US_1a_[Year]	117. DISCHARGES TO STREAM A – % FROM STORMWATER
US_1a_[Year]	118. DISCHARGES TO STREAM B – STREAM NAME
US_1a_[Year]	119. DISCHARGES TO STREAM B – RELEASE POUNDS
US_1a_[Year]	120. DISCHARGES TO STREAM B – RELEASE RANGE CODE
US_1a_[Year]	121. TOTAL DISCHARGES TO STREAM B
US_1a_[Year]	122. DISCHARGES TO STREAM B – BASIS OF ESTIMATE
US_1a_[Year]	123. DISCHARGES TO STREAM B – % FROM STORMWATER
US_1a_[Year]	124. DISCHARGES TO STREAM C – STREAM NAME
US_1a_[Year]	125. DISCHARGES TO STREAM C – RELEASE POUNDS
US_1a_[Year]	126. DISCHARGES TO STREAM C – RELEASE RANGE CODE
US_1a_[Year]	127. TOTAL DISCHARGES TO STREAM C
US_1a_[Year]	128. DISCHARGES TO STREAM C – BASIS OF ESTIMATE
US_1a_[Year]	129. DISCHARGES TO STREAM C – % FROM STORMWATER
US_1a_[Year]	130. DISCHARGES TO STREAM D – STREAM NAME
US_1a_[Year]	131. DISCHARGES TO STREAM D – RELEASE POUNDS
US_1a_[Year]	132. DISCHARGES TO STREAM D – RELEASE RANGE CODE
US_1a_[Year]	133. TOTAL DISCHARGES TO STREAM D
US_1a_[Year]	134. DISCHARGES TO STREAM D – BASIS OF ESTIMATE
US_1a_[Year]	135. DISCHARGES TO STREAM D – % FROM STORMWATER
US_1a_[Year]	136. DISCHARGES TO STREAM E – STREAM NAME
US_1a_[Year]	137. DISCHARGES TO STREAM E – RELEASE POUNDS

TRI Basic Plus Data File	Field Name
US_1a_[Year]	138. DISCHARGES TO STREAM E – RELEASE RANGE CODE
US_1a_[Year]	139. TOTAL DISCHARGES TO STREAM E
US_1a_[Year]	140. DISCHARGES TO STREAM E – BASIS OF ESTIMATE
US_1a_[Year]	141. DISCHARGES TO STREAM E – % FROM STORMWATER
US_1a_[Year]	142. DISCHARGES TO STREAM F – STREAM NAME
US_1a_[Year]	143. DISCHARGES TO STREAM F – RELEASE POUNDS
US_1a_[Year]	144. DISCHARGES TO STREAM F – RELEASE RANGE CODE
US_1a_[Year]	145 TOTAL DISCHARGES TO STREAM F
US_1a_[Year]	146 DISCHARGES TO STREAM F – BASIS FOR ESTIMATE
US_1a_[Year]	147. DISCHARGES TO STREAM F – % FROM STORMWATER
US_1a_[Year]	148. DISCHARGES TO STREAM G – STREAM NAME
US_1a_[Year]	149. DISCHARGES TO STREAM G – RELEASE POUNDS
US_1a_[Year]	150. DISCHARGES TO STREAM G – RELEASE RANGE CODE
US_1a_[Year]	151. TOTAL DISCHARGES TO STREAM G
US_1a_[Year]	152. DISCHARGES TO STREAM G – BASIS FOR ESTIMATE
US_1a_[Year]	153. DISCHARGES TO STREAM G – % FROM STORMWATER
US_1a_[Year]	154. DISCHARGES TO STREAM H – STREAM NAME
US_1a_[Year]	155. DISCHARGES TO STREAM H – RELEASE POUNDS
US_1a_[Year]	156. DISCHARGES TO STREAM H – RELEASE RANGE CODE
US_1a_[Year]	157. TOTAL DISCHARGES TO STREAM H
US_1a_[Year]	158. DISCHARGES TO STREAM H – BASIS FOR ESTIMATE
US_1a_[Year]	159. DISCHARGES TO STREAM H – % FROM STORMWATER
US_1a_[Year]	160. DISCHARGES TO STREAM I – STREAM NAME
US_1a_[Year]	161. DISCHARGES TO STREAM I – RELEASE POUNDS
US_1a_[Year]	162. DISCHARGES TO STREAM I – RELEASE RANGE CODE
US_1a_[Year]	163. TOTAL DISCHARGES TO STREAM I
US_1a_[Year]	164. DISCHARGES TO STREAM I – BASIS FOR ESTIMATE
US_1a_[Year]	165. DISCHARGES TO STREAM I – % FROM STORMWATER
US_1a_[Year]	166. TOTAL NUMBER OF RECEIVING STREAMS
US_1a_[Year]	167. TOTAL SURFACE WATER DISCHARGE
US_1a_[Year]	217. OFF-SITE – POTW RELEASES 81C
US_1a_[Year]	218. OFF-SITE – POTW RELEASES 81D
US_1a_[Year]	219. OFF-SITE – POTW RELEASES
US_1a_[Year]	222. OFF-SITE – WASTEWATER TREATMENT RELEASE (EXCLUDING POTWs) – METALS AND METAL COMPOUNDS ONLY
US_1a_[Year]	224. OFF-SITE – WASTEWATER TREATMENT (EXCLUDING POTWS) METALS AND METAL COMPOUNDS ONLY
US_1a_[Year]	249. OFF-SITE – POTW TREATMENT
US_1a_[Year]	253. OFF-SITE – WASTEWATER TREATMENT (EXCLUDING POTWs) – NON-METALS ONLY
US_1a_[Year]	259. TOTAL POTW TRANSFER
US_1b_[Year]	1. FORM TYPE
US_1b_[Year]	2. REPORTING YEAR

TRI Basic Plus Data File	Field Name
US_1b_[Year]	3. TRADE SECRET INDICATOR
US_1b_[Year]	4. SANITIZED INDICATOR
US_1b_[Year]	5. TITLE OF CERTIFYING OFFICIAL
US_1b_[Year]	6. NAME OF CERTIFYING OFFICIAL
US_1b_[Year]	7. CERTIFYING OFFICIAL'S SIGNATURE INDICATOR
US_1b_[Year]	8. DATE SIGNED
US_1b_[Year]	9. TRIFD
US_1b_[Year]	10. FACILITY NAME
US_1b_[Year]	11. FACILITY STREET
US_1b_[Year]	12. FACILITY CITY
US_1b_[Year]	13. FACILITY COUNTY
US_1b_[Year]	14. FACILITY STATE
US_1b_[Year]	15. FACILITY ZIP CODE
US_1b_[Year]	16. BIA CODE
US_1b_[Year]	17. TRIBE NAME
US_1b_[Year]	18. MAILING NAME
US_1b_[Year]	19. MAILING STREET
US_1b_[Year]	20. MAILING CITY
US_1b_[Year]	21. MAILING STATE
US_1b_[Year]	22. MAILING PROVINCE
US_1b_[Year]	23. MAILING ZIP CODE
US_1b_[Year]	24. ENTIRE FACILITY IND
US_1b_[Year]	25. PARTIAL FACILITY IND
US_1b_[Year]	26. FEDERAL FACILITY IND
US_1b_[Year]	27. GOCO FACILITY IND
US_1b_[Year]	28. ASSIGNED FED FACILITY FLAG
US_1b_[Year]	29. ASSIGNED PARTIAL FACILITY FLAG
US_1b_[Year]	30. PUBLIC CONTACT NAME
US_1b_[Year]	31. PUBLIC CONTACT PHONE
US_1b_[Year]	32. PUBLIC CONTACT PHONE EXT
US_1b_[Year]	33. PUBLIC CONTACT EMAIL
US_1b_[Year]	34. PRIMARY SIC CODE
US_1b_[Year]	35. SIC CODE 2
US_1b_[Year]	36. SIC CODE 3
US_1b_[Year]	37. SIC CODE 4
US_1b_[Year]	38. SIC CODE 5
US_1b_[Year]	39. SIC CODE 6
US_1b_[Year]	40. NAICS ORIGIN
US_1b_[Year]	41. PRIMARY NAICS CODE
US_1b_[Year]	42. NAICS CODE 2
US_1b_[Year]	43. NAICS CODE 3
US_1b_[Year]	44. NAICS CODE 4
US_1b_[Year]	45. NAICS CODE 5

TRI Basic Plus Data File	Field Name
US_1b_[Year]	46. NAICS CODE 6
US_1b_[Year]	47. LATITUDE
US_1b_[Year]	48. LONGITUDE
US_1b_[Year]	49. D and B NR A
US_1b_[Year]	50. D and B NR B
US_1b_[Year]	51. RCRA NR A
US_1b_[Year]	52. RCRA NR B
US_1b_[Year]	53. RCRA NR C
US_1b_[Year]	54. RCRA NR D
US_1b_[Year]	55. RCRA NR E
US_1b_[Year]	56. RCRA NR F
US_1b_[Year]	57. RCRA NR G
US_1b_[Year]	58. RCRA NR H
US_1b_[Year]	59. RCRA NR I
US_1b_[Year]	60. RCRA NR J
US_1b_[Year]	61. NPDES NR A
US_1b_[Year]	62. NPDES NR B
US_1b_[Year]	63. NPDES NR C
US_1b_[Year]	64. NPDES NR D
US_1b_[Year]	65. NPDES NR E
US_1b_[Year]	66. NPDES NR F
US_1b_[Year]	67. NPDES NR G
US_1b_[Year]	68. NPDES NR H
US_1b_[Year]	69. NPDES NR I
US_1b_[Year]	70. NPDES NR J
US_1b_[Year]	71. PARENT COMPANY NAME
US_1b_[Year]	72. PARENT COMPANY D and B NR
US_1b_[Year]	73. STANDARDIZED PARENT COMPANY NAME
US_1b_[Year]	74. FRS FACILITY ID
US_1b_[Year]	75. DOCUMENT CONTROL NUMBER
US_1b_[Year]	76. CAS NUMBER
US_1b_[Year]	77. CHEMICAL NAME
US_1b_[Year]	78. MIXTURE NAME
US_1b_[Year]	79. ELEMENTAL METAL INCLUDED
US_1b_[Year]	80. CLASSIFICATION
US_1b_[Year]	81. UNIT OF MEASURE
US_1b_[Year]	82. METAL IND
US_1b_[Year]	83. REVISION CODE 1
US_1b_[Year]	84. REVISION CODE 2
US_1b_[Year]	85. PRODUCE THE CHEMICAL
US_1b_[Year]	86. IMPORT THE CHEMICAL
US_1b_[Year]	87. ON-SITE USE OF THE CHEMICAL
US_1b_[Year]	88. SALE OR DISTRIBUTION OF THE CHEMICAL

TRI Basic Plus Data File	Field Name
US_1b_[Year]	89. AS A BYPRODUCT
US_1b_[Year]	90. AS A MANUFACTURED IMPURITY
US_1b_[Year]	91. USED AS A REACTANT
US_1b_[Year]	92. P101 FEEDSTOCKS
US_1b_[Year]	93. P102 RAW MATERIALS
US_1b_[Year]	94. P103 INTERMEDIATES
US_1b_[Year]	95. P104 INITIATORS
US_1b_[Year]	96. P199 OTHER
US_1b_[Year]	97. ADDED AS A FORMULATION COMPONENT
US_1b_[Year]	98. P201 ADDITIVES
US_1b_[Year]	99. P202 DYES
US_1b_[Year]	100. P203 REACTION DILUENTS
US_1b_[Year]	101. P204 INITIATORS
US_1b_[Year]	102. P205 SOLVENTS
US_1b_[Year]	103. P206 INHIBITORS
US_1b_[Year]	104. P207 EMULSIFIERS
US_1b_[Year]	105. P208 SURFACTANTS
US_1b_[Year]	106. P209 LUBRICANTS
US_1b_[Year]	107. P210 FLAME RETARDANTS
US_1b_[Year]	108. P211 RHEOLOGICAL MODIFIERS
US_1b_[Year]	109. P299 OTHER
US_1b_[Year]	110. USED AS AN ARTICLE COMPONENT
US_1b_[Year]	111. REPACKAGING
US_1b_[Year]	112. AS A PROCESS IMPURITY
US_1b_[Year]	113. PROCESSED / RECYCLING
US_1b_[Year]	114. USED AS A CHEMICAL PROCESSING AID
US_1b_[Year]	115. Z101 PROCESS SOLVENTS
US_1b_[Year]	116. Z102 CATALYSTS
US_1b_[Year]	117. Z103 INHIBITORS
US_1b_[Year]	118. Z104 INITIATORS
US_1b_[Year]	119. Z105 REACTION TERMINATORS
US_1b_[Year]	120. Z106 SOLUTION BUFFERS
US_1b_[Year]	121. Z199 OTHER
US_1b_[Year]	122. USED AS A MANUFACTURING AID
US_1b_[Year]	123. Z201 PROCESS LUBRICANTS
US_1b_[Year]	124. Z202 METALWORKING FLUIDS
US_1b_[Year]	125. Z203 COOLANTS
US_1b_[Year]	126. Z204 REFRIGERANTS
US_1b_[Year]	127. Z205 HYDRAULIC FLUIDS
US_1b_[Year]	128. Z299 OTHER
US_1b_[Year]	129. ANCILLARY OR OTHER USE
US_1b_[Year]	130. Z301 CLEANER
US_1b_[Year]	131. Z302 DEGREASER

TRI Basic Plus Data File	Field Name
US_1b_[Year]	132. Z303 LUBRICANT
US_1b_[Year]	133. Z304 FUEL
US_1b_[Year]	134. Z305 FLAME RETARDANT
US_1b_[Year]	135. Z306 WASTE TREATMENT
US_1b_[Year]	136. Z307 WATER TREATMENT
US_1b_[Year]	137. Z308 CONSTRUCTION MATERIALS
US_1b_[Year]	138. Z399 OTHER
US_3c_[Year]	1. FORM TYPE
US_3c_[Year]	2. TRIFID
US_3c_[Year]	3. DOCUMENT CONTROL NUMBER
US_3c_[Year]	4. CAS NUMBER
US_3c_[Year]	5. CHEMICAL NAME
US_3c_[Year]	7. MIXTURE NAME
US_3c_[Year]	6. ELEMENTAL METAL INCLUDED
US_3c_[Year]	8. CLASSIFICATION
US_3c_[Year]	9. UNIT OF MEASURE
US_3c_[Year]	10. METAL INDICATOR
US_3c_[Year]	11. REVISION CODE 1
US_3c_[Year]	12. REVISION CODE 2
US_3c_[Year]	13. REPORTING YEAR
US_3c_[Year]	14. TRADE SECRET INDICATOR
US_3c_[Year]	15. FACILITY NAME
US_3c_[Year]	16. FACILITY STREET
US_3c_[Year]	17. FACILITY CITY
US_3c_[Year]	18. FACILITY COUNTY
US_3c_[Year]	19. FACILITY STATE
US_3c_[Year]	20. FACILITY ZIP CODE
US_3c_[Year]	21. ASSIGNED FED FACILITY FLAG
US_3c_[Year]	22. ASSIGNED PARTIAL FACILITY FLAG
US_3c_[Year]	23. BIA CODE
US_3c_[Year]	24. TRIBE NAME
US_3c_[Year]	25. ENTIRE FACILITY IND
US_3c_[Year]	26. PARTIAL FACILITY IND
US_3c_[Year]	27. FEDERAL FACILITY IND
US_3c_[Year]	28. GOCO FACILITY IND
US_3c_[Year]	29. PUBLIC CONTACT NAME
US_3c_[Year]	30. PUBLIC CONTACT PHONE
US_3c_[Year]	31. PUBLIC CONTACT PHONE EXT
US_3c_[Year]	32. PUBLIC CONTACT EMAIL
US_3c_[Year]	33. PRIMARY SIC CODE
US_3c_[Year]	34. SIC CODE 2
US_3c_[Year]	35. SIC CODE 3
US_3c_[Year]	36. SIC CODE 4

TRI Basic Plus Data File	Field Name
US_3c_[Year]	37. SIC CODE 5
US_3c_[Year]	38. SIC CODE 6
US_3c_[Year]	39. NAICS ORIGIN
US_3c_[Year]	40. PRIMARY NAICS CODE
US_3c_[Year]	41. NAICS CODE 2
US_3c_[Year]	42. NAICS CODE 3
US_3c_[Year]	43. NAICS CODE 4
US_3c_[Year]	44. NAICS CODE 5
US_3c_[Year]	45. NAICS CODE 6
US_3c_[Year]	46. LATITUDE
US_3c_[Year]	47. LONGITUDE
US_3c_[Year]	48. DB NR A
US_3c_[Year]	49. DB NR B
US_3c_[Year]	50. RCRA NR A
US_3c_[Year]	51. RCRA NR B
US_3c_[Year]	52. RCRA NR C
US_3c_[Year]	53. RCRA NR D
US_3c_[Year]	54. RCRA NR E
US_3c_[Year]	55. RCRA NR F
US_3c_[Year]	56. RCRA NR G
US_3c_[Year]	57. RCRA NR H
US_3c_[Year]	58. RCRA NR I
US_3c_[Year]	59. RCRA NR J
US_3c_[Year]	60. NPDES NR A
US_3c_[Year]	61. NPDES NR B
US_3c_[Year]	62. NPDES NR C
US_3c_[Year]	63. NPDES NR D
US_3c_[Year]	64. NPDES NR E
US_3c_[Year]	65. NPDES NR F
US_3c_[Year]	66. NPDES NR G
US_3c_[Year]	67. NPDES NR H
US_3c_[Year]	68. NPDES NR I
US_3c_[Year]	69. NPDES NR J
US_3c_[Year]	70. PARENT COMPANY NAME
US_3c_[Year]	71. PARENT COMPANY DB NR
US_3c_[Year]	72. STANDARDIZED PARENT COMPANY NAME
US_3c_[Year]	73. FRS FACILITY ID
US_3c_[Year]	74. POTW NAME
US_3c_[Year]	75. POTW ADDRESS
US_3c_[Year]	76. POTW CITY
US_3c_[Year]	77. POTW STATE
US_3c_[Year]	78. POTW COUNTY
US_3c_[Year]	79. POTW ZIP

TRI Basic Plus Data File	Field Name
US_3c_[Year]	80. POTW REGISTRY ID
US_3c_[Year]	81. QUANTITY TRANSFERRED
US_3c_[Year]	82. BASIS OF ESTIMATE
US_3c_[Year]	83. DISCHARGES TO WATER STREAMS
US_3c_[Year]	84. DISCHARGES TO WATER STREAMS – BASIS OF ESTIMATE
US_3c_[Year]	85. DISCHARGES TO OTHER ACTIVITIES
US_3c_[Year]	86. DISCHARGES TO OTHER ACTIVITIES – BASIS OF ESTIMATE
US_3c_[Year]	87. RELEASED TO AIR
US_3c_[Year]	88. RELEASED TO AIR – BASIS OF ESTIMATE
US_3c_[Year]	89. SLUDGE TO DISPOSAL
US_3c_[Year]	90. SLUDGE TO DISPOSAL – BASIS OF ESTIMATE
US_3c_[Year]	91. SLUDGE TO INCINERATION – METALS
US_3c_[Year]	92. SLUDGE TO INCINERATION – METALS – BASIS OF ESTIMATE
US_3c_[Year]	93. SLUDGE TO AGRICULTURAL APPLICATIONS
US_3c_[Year]	94. SLUDGE TO AGRICULTURAL APPLICATIONS – BASIS OF ESTIMATE
US_3c_[Year]	95. OTHER OR UNKNOWN DISPOSAL
US_3c_[Year]	96. OTHER OR UNKNOWN DISPOSAL – BASIS OF ESTIMATE
US_3c_[Year]	97. OFF-SITE POTW RELEASES – 8.1C
US_3c_[Year]	98. OFF-SITE POTW RELEASES – 8.1D
US_3c_[Year]	99. OFF-SITE – POTW RELEASES
US_3c_[Year]	100. OTHER OR UNKNOWN TREATMENT
US_3c_[Year]	101. OTHER OR UNKNOWN TREATMENT – BASIS OF ESTIMATE
US_3c_[Year]	102. SLUDGE TO INCINERATION – NONMETALS
US_3c_[Year]	103. SLUDGE TO INCINERATION – NONMETALS – BASIS OF ESTIMATE
US_3c_[Year]	104. EXPERIMENTTAL AND ESTIMATED TREATMENT
US_3c_[Year]	105. EXPERIMENTTAL AND ESTIMATED TREATMENT – BASIS OF ESTIMATE
US_3c_[Year]	106. TOTAL TREATED
NAICS = North American Industry Classification System; NPDES = National Pollutant Discharge Elimination System; POTW = publicly owned treatment works; RCRA = Resource Conservation and Recovery Act; SIC = Standard Industrial Classification; TRI = Toxics Release Inventory	

Mapping Facilities to an OES and Selecting the Number of Operating Days per Year

Both facilities used in this example reported to the 2016 CDR as domestic manufacturers of 1,2-dichloroethane. Therefore, they are mapped to the Manufacturing OES. Because 1,2-dichloroethane is a commodity chemical, each facility is assumed to operate 350 days/year.

Annual Facility Discharges

Annual facility discharges can be obtained directly from the Loading Tool and TRI data file downloads for each facility. The 2019 annual discharges for the two facilities in this example are provided in Table_Apx C-2.

Table_Apx C-2. Example Facilities' 2019 Annual Discharges

Facility	Annual Surface Water Discharge from Loading Tool (kg)	Annual Reported Discharge from TRI (kg)
Westlake Vinyls in Calvert City, KY	209 kg[a]	212 kg to surface water 0 kg to POTW and non-POTW WWT
Axiall LLC in Plaquemine, LA	N/A – No DMR data for this facility	10 kg to surface water 0 kg to POTW and non-POTW WWT

POTW = publicly owned treatment works; TRI = Toxics Release Inventory; WWT = wastewater treatment
[a] The Loading Tool estimates this discharge a 495 lb (or 224 kg) as the sum of outfalls 001, 002, and 009. However, the NPDES permit for this facility indicates that 002 and 009 are internal outfalls that discharge into 001. Therefore, discharges from 001 includes those from 002 and 009 and the total annual discharge shown in the table is equal to the Loading Tool's estimate for outfall 001 only (461 lb or 209 kg). Review of NPDES permits is generally outside the scope of this methodology document; however, permit information for Westlake Vinyls can be obtained at https://dep.gateway.ky.gov/eSearch/agencydetails?agencyid=2967 (accessed April 25, 2026).

Average Daily Discharges

To calculate average daily discharges at each facility, the annual discharge is averaged over the number of operating as shown in the calculations below:

Equation_Apx C-1.

$$ADR = \frac{YR}{OD}$$

Where:

ADR	=	Average daily discharge (kg/day)
YR	=	Annual discharge (kg/year)
OD	=	Operating days (days/year)

For Westlake Vinyls the annual discharge of 209 kg/year is averaged over 350 days/year (operating days for manufacturers) to calculate the daily discharge using DMR as:

Equation_Apx C-2.

$$ADR = \frac{YR}{OD} = \frac{209\ kg/yr}{350\ days/yr} = 0.6\ kg/day$$

Similarly, for Westlake Vinyls the average daily discharge using TRI is calculated as the 212 kg/year annual discharge over 350 days/year, as shown below:

Equation_Apx C-3.

$$ADR = \frac{YR}{OD} = \frac{212\ kg/yr}{350\ days/yr} = 0.6\ kg/day$$

For Axiall LLC, the average daily discharge is calculated as the annual discharge of 10 kg/year over 350 days/year:

Equation_Apx C-4.

$$ADR = \frac{YR}{OD} = \frac{10\ kg/yr}{350\ days/yr} = 0.03\ kg/day$$

High-End Daily Discharges for Facilities with DMRs

To estimate high-end daily discharge for sites with DMRs, the reporting frequency and pollutant load for each reporting period throughout the year must be determined. This information can be obtained from the Loading Tool by going to the "Top Facility Discharges" table in the query results and clicking on the desired facility name as shown in Figure_Apx C-6.[20] This will open the details of the facility's DMR.

Select facility of interest

Top Facility Discharges (2019)

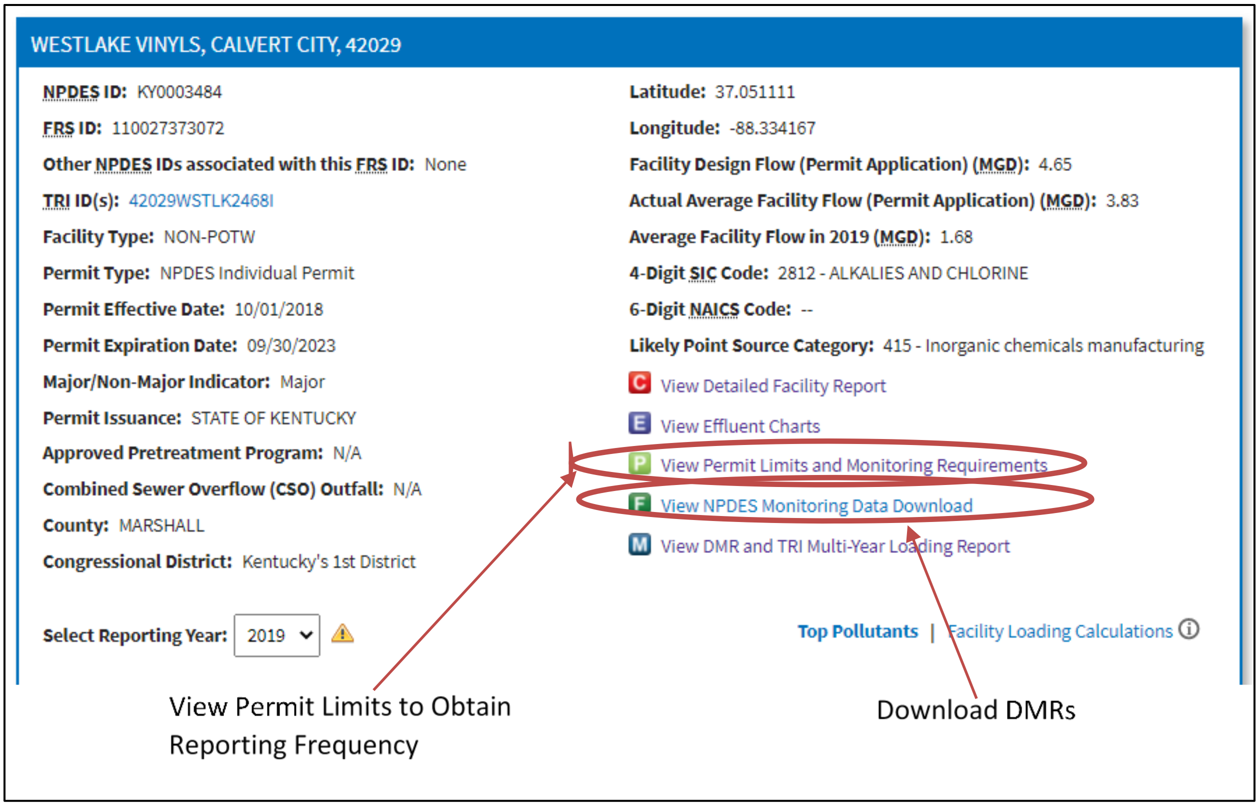
NPDES ID	Facility Name	City, State	Report	SIC Code	HUC-12 Code	Avg Conc (mg/L)	Max Conc (mg/L)	Total Pounds (lb/yr)	Total TWPE (lb-eq/yr)	Avg Flow (MGD)
KY0003484	WESTLAKE VINYLS	CALVERT CITY, KY	L E C P	2812	060400060502	0.0191	0.2320	495	4.95	1.68
MI0000868	DOW CHEMICAL-MIDLAND	MIDLAND, MI	L E C P	2869	040802010604	0.0019	0.0167	415	4.15	5.52
TX0085570	FORMOSA PLASTICS CORPORATION, TEXAS	POINT COMFORT, TX	L E C P	2821	121004010100	0.0008	0.0445	244	2.44	19.92
LA0002933	OCCIDENTAL CHEMICAL CORP GEISMAR PLANT	GEISMAR, LA	L E C P	2869	080702040101	0.0029	0.0351	164	1.64	0.9016
TX0007412	OXY VINYLS LP - DEER PARK PVC	DEER PARK, TX	L E C P	2812	120401040703	0.0076	0.0320	143	1.43	4.27
KY0003603	ARKEMA INC	CALVERT CITY, KY	L E C P	2819	060400060502	0.0083	0.0192	137	1.37	0.9300
LA0000761	EAGLE US 2 LLC - LAKE CHARLES COMPLEX	LAKE CHARLES, LA	L E C P	2869	080802060301	0.1138	0.3830	78.97	0.7897	40.72
LA0000281	WESTLAKE VINYLS CO	GEISMAR, LA	L E C P	2869	080702040103	0.0020	0.0097	25.74	0.2574	0.8815
KY0023540	CENTRAL CITY STP	CENTRAL CITY, KY	L E C P	4952	051100030505	0.0050	0.0050	25.01	0.2501	1.28
NJ0005100	CHEMOURS CHAMBERS WORKS	DEEPWATER, NJ	L E C P	2869	020402060103	0.0017	0.0066	22.87	0.2287	3.67

Download All Data | Browse All Facilities

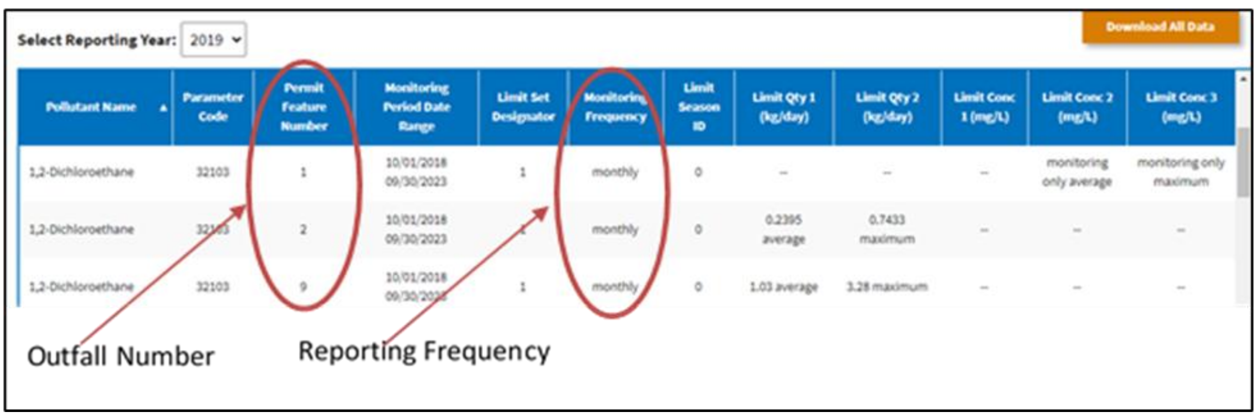
Figure_Apx C-6. Loading Tool – Accessing Facility-Specific Data

From the facility's DMR, the user can select the "View Permit Limits and Monitoring Requirements" to determine the reporting frequency and the "View NPDES Monitoring Data Download" to obtain the facility's DMRs for each pollutant at each outfall for each reporting period and the reporting period's corresponding wastewater flowrate in an Excel Spreadsheet, as shown in Figure_Apx C-7 and Figure_Apx C-8.

[20] If the facility of interest is not listed in this table, the user can select "browse all facilities" to bring up a list of all facilities monitoring for the chemical of interest.



Figure_Apx C-7. Loading Tool – Accessing Monitoring Requirements and Reporting Period Discharge Data



Figure_Apx C-8. Loading Tool – Reviewing Facility Reporting Frequency for Each Outfall

Westlake Vinyls is required to report 1,2-dichloroethane monthly for three outfalls; however, review of their NPDES permit indicates outfalls 002 and 009 are internal outfalls that discharge into outfall 001, and, therefore, are not included for further analysis.[21] For 1,2-dichloroethane, Westlake Vinyls reports a monthly average concentration and a maximum daily concentration. They must also report a monthly average wastewater flow rate and a maximum daily wastewater flow rate. The reporting period load is then calculated by multiplying the monthly average concentration by the monthly average wastewater

[21] Review of NPDES permits is generally outside the scope of this methodology document; however, searchable at https://dep.gateway.ky.gov/eSearch/agencydetails?agencyid=2967 (accessed April 25, 2026).

flow and multiplying by the number of days in the period as shown in the equation below.

Equation_Apx C-5.

$$PR = C \times FR \times 3.785\frac{L}{gal} \times 1 \times 10^{-6}\frac{kg}{mg} \times PD$$

Where:

PR	=	Period discharge (kg/period)
C	=	Pollutant concentration (mg/L)
FR	=	Wastewater flowrate (gal/day)
PD	=	Number of days in the period (days/period)

The results from these calculations for Westlake Vinyl for 1,2-dichloroethane in 2019 are presented in Table_Apx C-3.

Table_Apx C-3. Westlake Vinyl Total Period Discharge Results

Reporting Period End Date	Monthly Average Concentration (mg/L)	Monthly Average Wastewater Flow (MGD)	Days per Period	Period Discharge (kg/period)
01/31/2019	0.014	3.3756	31	5.5
02/28/2019	0.004	3.6760	28	1.6
03/31/2019	0.232	3.6855	31	100
04/30/2019	0.015	3.5123	30	6.0
05/31/2019	0.007	3.3281	31	2.7
06/30/2019	0.122	3.2704	30	45
07/31/2019	0.060	3.0358	31	21
08/31/2019	0.013	3.0535	31	4.7
09/30/2019	0.027	3.1075	30	9.5
10/31/2019	0.012	2.5449	31	3.6
11/30/2019	0.012	3.1966	30	4.3
12/31/2019	0.010	3.6309	31	4.3
MGD = million gallons per day				

As shown in Table_Apx C-3 the period ending March 31, 2019, has the highest total discharge for Westlake Vinyls. Using the highest period discharge, the high-end daily discharge can be calculated using the following equation:

Equation_Apx C-6.

$$HDR = \frac{MPR}{PD} = \frac{100\ kg/period}{31\ day/period} = 3.2\ kg/day$$

Equation_Apx C-7.

$$HDR = \frac{MPR}{PD} = \frac{100\ kg/period}{31\ day/period} = 3.2\ kg/day$$

Where:

HDR	=	High-end daily discharge (kg/day)
MPR	=	Maximum period discharge (kg/period)
PD	=	Number of days in the period (days/period)

High-End Daily Discharges for Facilities Without DMRs

To estimate the high-end daily discharge for TRI facilities without DMRs, a generic factor developed using data from facilities mapped to the same OES with DMRs should be applied to the discharge from facilities without DMRs. The first step is to identify facilities with DMRs for the same chemical, same year, and same OES as the TRI facility and report DMRs monthly. For purposes of this example, only the Westlake Vinyl's facility will be considered; however, in many instances data from multiple facilities will be considered.

After identifying the relevant facility, the percentage of the total annual discharge that occurred in the highest 1-month period should be calculated using the equation below and values from Westlake Vinyls:

Equation_Apx C-8.

$$GF = \frac{MPR}{YR} = \frac{100\ kg/period}{209\ kg/yr} \times 100 = 48\%$$

Where:

GF	=	Generic factor (year/period)
MPR	=	Maximum period discharge (kg/period)
YR	=	Annual discharge (kg/year)

If multiple facilities are included in the analysis, the GF used in the next steps should be the average of the factors calculated for each facility. For this example, the factor of 48% will be used.

To calculate the high-end daily discharge from TRI sites without DMRs, the reported annual discharge should be multiplied by the generic factor and divide by the number of days in a month (30 days) as shown in the equation below using values for Axiall LLC:

Equation_Apx C-9.

$$HDR = \frac{GF \times YR}{30\ days} = 48\% \times 10\ kg = \ 0.2\ kg/day$$

Where:

HDR	=	High-end daily discharge (kg/day)
GF	=	Generic factor (unitless)
YR	=	Annual discharge (kg/year)

This value is assessed over 30 days/period to approximate the high-end period of 1 month the results are based on. Note, the GF calculated in this example is based on a facility with monthly reporting periods which is the preferred method for estimating the GF and hence assesses over 30 days. In situations where the generic factor is calculated using data from facilities with longer reporting periods, the number of days should be adjusted accordingly.

1-Day Discharges

Data to estimate 1-day discharges can be obtained using a similar method as the high-end daily discharges from DMR except concentration and flowrate values reported for the daily maximum for each period should be used. The daily discharge is simply the daily maximum concentration multiplied by the daily maximum flowrate (with proper unit conversions) as shown in the equation below.

Equation_Apx C-10.

$$ODR = C \times FR \times 3.785\,\frac{L}{gal} \times 1 \times 10^{-6}\,\frac{kg}{mg}$$

Where:

ODR	=	1-Day discharge (kg/day)
C	=	Pollutant concentration (mg/L)
FR	=	Wastewater flowrate (gal/day)

The daily maximum for each period for Westlake Vinyls is provided in Table_Apx C-4.

Table_Apx C-4. Westlake Vinyl 1-Day Discharges

Reporting Period End Date	Daily Maximum Concentration (mg/L)	Daily Maximum Wastewater Flow (MGD)	Period Discharge (kg/day)
01/31/2019	0.014	4.0153	0.2
02/28/2019	0.004	5.6582	0.1
03/31/2019	0.232	3.9410	3.5
04/30/2019	0.015	3.7962	0.2
05/31/2019	0.007	3.6638	0.1
06/30/2019	0.122	3.5840	1.7
07/31/2019	0.060	3.4168	0.8
08/31/2019	0.013	3.9349	0.2
09/30/2019	0.027	3.6647	0.4
10/31/2019	0.012	2.7171	0.1
11/30/2019	0.012	3.9522	0.2
12/31/2019	0.010	3.7360	0.1
MGD = million gallons per day			

Summary of Results

The detailed results from each facility are provided in the accompanying spreadsheet; however, an overview of the results for each facility are provided in Table_Apx C-5.

Table_Apx C-5. Summary of Discharge Estimates for 2019 Example Facilities

Facility	Annual Surface Water Discharge from Loading Tool (kg)	Annual Reported Discharge from TRI (kg)	Average Daily Discharge (kg/day)	Release Days for Average Daily Discharge (days/yr)	High-End Daily Discharge (kg/day)	Release Days for High-End Daily Discharge (days/period)	Maximum 1-Day Discharge (kg/day)
Westlake Vinyls in Calvert City, KY	209 kg	212 kg to surface water 0 kg to POTW and non-POTW WWT	0.6 (DMR) 0.6 (TRI)	350	3.2	31	3.5
Axiall LLC in Plaquemine, LA	N/A – No DMR data for this facility	10 kg to surface water 0 kg to POTW and non-POTW WWT	0.03	350	0.2	30	N/A – data not available to estimate 1-day discharge
DMR = Discharge Monitoring Report; POTW= publicly owned treatment works; TRI = Toxics Release Inventory; WWT = wastewater treatment							

Appendix D GUIDANCE FOR USING THE NATIONAL EMISSIONS INVENTORY AND TOXIC RELEASE INVENTORY FOR ESTIMATING AIR RELEASES

This appendix provides guidance for using EPA's NEI and TRI data to estimate air releases for certain chemicals undergoing risk evaluation under TSCA. These estimates will be used as inputs to air modeling for the purposes of estimating ambient air concentrations.

D.1 Background

EPA's NEI and TRI programs require individual facilities, as well as SLT air agencies, to report information on airborne chemical releases to the Agency. Although the chemicals reported under each program differ, both inventories include data for some of the chemicals undergoing TSCA risk evaluation. When available, the NEI and TRI data include information on the sources, magnitude, and nature (*e.g.,* stack vs. fugitive, stack height, stack gas velocity/temperature) of airborne releases from industrial/commercial facilities and other smaller emissions sources. Thus, these databases may provide useful information for estimating air releases of TRI- and/or NEI-covered chemicals, for certain OESs.

As the NEI and TRI programs operate under separate regulatory frameworks, the data reported under these programs do not always overlap. For example, in 2017, approximately 745,000 lb of perchloroethylene (PERC) air emissions were reported to TRI, whereas approximately 16.6 million lb of PERC air emissions were reported to NEI. This appendix describes an approach for using NEI data, in combination with TRI data, to estimate air emissions.

D.2 Obtaining Air Emissions Data

D.2.1 Obtaining NEI Data

NEI emissions data is categorized into (1) point source data, (2) area or nonpoint source data, (3) onroad mobile source data, and (4) nonroad mobile source data. EPA included only point source data categories in the assessment of environmental releases in this risk evaluation. Point sources are stationary sources of air emissions from facilities with operating permits under Title V of the CAA, also called "major sources." Major sources are defined as having actual or potential emissions at or above the major source thresholds. Although thresholds can vary for certain chemicals in NAAQS non-attainment areas, the default threshold is 100 tons/year for non-HAPs, 10 tons per year for a single HAP, or 25 tons per year for any combination of HAPs. Point source facilities include large energy and industrial sites and are reported at the emission unit- and release point-level.

Area or nonpoint sources are stationary sources that do not qualify as major sources. The nonpoint data are aggregated and reported at the county-level and include emissions from smaller facilities as well as agricultural emissions, construction dust, and open burning. Industrial and commercial/institutional fuel combustion, gasoline distribution, oil and gas production and extraction, publicly owned treatment works, and solvent emissions may be reported in the point or nonpoint source categories depending upon source size. EPA targeted its review of environmental releases to point sources and did not review the road, nonroad, and other automotive exhaust information identified.

Onroad mobile sources include emissions from onroad vehicles that combust liquid fuels during operation, including passenger cars, motorcycles, trucks, and buses. The nonroad mobiles sources data include emissions from other mobile sources that are not typically operated on public roadways, such as locomotives, aircraft, commercial marine vessels, recreational equipment, and landscaping equipment.

Onroad and nonroad mobile data is reported in the same format as nonpoint data; however, it is not available for every chemical. EPA did not include area or nonpoint sources in the assessment of environmental releases in this risk evaluation. Further details on EPA's approach to using NEI data for estimating releases are described in Section 2.3.3.2 and Appendix A.

The first step in using NEI data to estimate air releases is to obtain the NEI data in a workable format that provides the requisite data for release estimation and modeling. NEI data are available on EPA's public website as downloadable zip files, divided into onroad, nonroad, nonpoint, and point source data files.[22] The zipped point source data files are extremely large and require specialized database experience to query and manipulate. As an alternative, EPA's EIS Gateway allows registered EPA users, registered SLT users, and approved contractors to query and download NEI data and associated reporting code descriptions. As a result, this methodology uses the EIS Gateway to query point source data. Following download, the point and nonpoint emissions data for the chemical of interest will be imported into an Excel spreadsheet (or using an alternative tool, if the data exceeds Excel's size threshold), to be filtered and manipulated. At this point, EPA will use the EIS lookup tables to populate field descriptions for data fields reported as numerical codes (*e.g.,* NAICS code).

D.2.2 Obtaining TRI Data

TRI data may be downloaded from EPA's public TRI Program, TRI Data and Tools website.[23] Once the .csv file(s) has/have been downloaded, the data are filtered by the chemical of interest using the CASRN and/or chemical name. Relevant NEI data fields include reporting year, facility identifying information (*e.g.,* name, address, FRS ID, and TRIFID), chemical information (chemical name, CASRN), primary NAICS codes, fugitive air releases, and stack air releases.

D.3 Mapping NEI and TRI DATA to Occupational Exposure Scenarios

After TRI and NEI data have been obtained, the next step is to map the data to OESs. For procedures for mapping facilities from TRI and NEI to occupational exposure scenarios, refer to Appendix A.

D.4 Estimating Air Releases Using NEI and TRI Data

EPA will use the mapped NEI and TRI data to develop facility- and/or release-point-specific emissions estimates for chemicals undergoing TSCA risk evaluation. The data summary will include pertinent information for risk evaluation and emission modeling, such as facility location, annual releases, daily releases, operating information, release type (*i.e.,* stack vs. fugitive), and stack parameters.

D.4.1 Linking NEI and TRI Data

Although NEI and TRI have different reporting requirements, some major sources are expected to report to both databases. The most reliable way to link the datasets is with a common identifier. NEI reports EIS Facility Identifier and Facility Registry Identifier (FRSID), though the latter is not reliably populated for all NEI records. TRI reports TRI Facility ID and FRSID. EPA will use its database of EIS Alternate Facility Identifiers ("EISAltFacilityIdentifiers_20211221.accdb") to link TRIFID to an EIS Facility Identifier. Linkages may be confirmed and/or refined using facility names and addresses, if necessary.

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[22] See https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data#datas (accessed August 11, 2025).
[23] See https://www.epa.gov/toxics-release-inventory-tri-program/tri-toolbox (accessed April 25, 2026).

Following linkage, EPA will review the linked NEI/TRI data to ensure that facilities with records in both databases are assigned to a consistent OES. When discrepancies arise, EPA will resolve these discrepancies using the dataset with the greatest level of detail. In general, NEI provides more detailed air emissions data than TRI. For example, NEI reports SCC levels 1 to 4, which provide insight into the specific operations and/or process units associated with NEI-reported air emissions. For example, "Chemical Evaporation Organic Solvent Evaporation Degreasing Entire Unit: Open-top Vapor Degreasing" is a SCC description used in the NEI. This SCC description identifies the emission unit, not only as a degreaser, but as a specific type of degreaser. NEI also includes free text fields where reporters can include additional information about a particular facility and/or emission unit. TRI does not provide this level of detail.

Following a review of OES assignments, the TRI and NEI data are divided into separate tables by OES code(s), which may be linked using the EIS Facility Identifier.

D.4.2 Evaluation of Sub-Annual Emissions

As air emissions data in TRI and NEI are reported as annual values, sub-annual (*e.g.,* daily) emissions must be calculated from information on release duration, release days, and release pattern. Although TRI does not report information on release duration or pattern, this information may be estimated from operating data reported to the NEI.[24] Other sources of release duration and pattern information include GSs and ESDs, literature sources, process information, and standard engineering methodology for estimating number of release days. These sources are described in further detail below, in order of preference.

Sources for Estimating Release Duration

1. *NEI Data:* The NEI dataset includes facility-specific air emissions estimates for major sources and often includes data on the number of hours of operation per day for these facilities. The number of operating hours from NEI can be used to inform release duration for the specific facilities being assessed. Hours of operation for one facility in NEI are typically not used for a different facility; however, engineers may consider conducting an analysis of operating hours for multiple facilities in NEI that are a part of the same OES to develop a broader estimate of release duration at the OES-level. EPA has previously used this approach to inform development of GSs/ESDs, but it is dependent on the amount of data and time available and should be discussed on a chemical-specific basis.
2. *Models:* Models used to estimate air emissions and associated inhalation exposures (*e.g.,* Tank Truck and Railcar Loading and Unloading Release and Inhalation Exposure Model, Open-Top Vapor Degreasing Near-Field/Far-Field Inhalation Exposure Model, Spot Cleaning Near-Field/Far-Field Inhalation Exposure Model, models from GSs/ESDs) sometimes include data on release duration—which are usually either cited from literature or based on generic assumptions about the activity being modeled. Release duration information from models may be presented with non-modeled air emission data from NEI or TRI, if the model is applicable and expected to represent the primary release source for the OES (*e.g.,* release duration from the Tank Truck and Railcar Loading and Unloading Release and Inhalation Exposure Model may be used with estimates of air emissions for a facility in the Repackaging OES). For models that calculate release duration as a distribution, such as from Monte Carlo simulations, the mean and range of release durations from the model should be presented with the air emission estimate.

[24] Note that the NEI operating hours fields are not populated for all entries.

3. *Literature:* Literature sources from systematic review, including GSs/ESDs, are another source of information for release duration. Often, release duration information from literature sources may be broad, such as a range of durations for a given operation. Alternatively, literature sources may describe release duration qualitatively, such as "on and off throughout the day" or "over half the day." Therefore, literature sources may inform release duration at the OES-level, as opposed to at the facility-level. All details from literature sources on release duration, including qualitative descriptions, should be presented with air emission estimates if they are available and there is no other source of this data.
4. *List as "Unknown":* Often, no information on release duration is available at either the facility or OES-level from the above sources. In these cases, engineers should list that the release duration is unknown.

Sources for Estimating Release Pattern

1. *NEI Data:* The NEI dataset includes facility-specific air emissions estimates for major sources and often includes data on the number of days of operation per week and number of weeks of operation per year for these facilities. NEI does not indicate if the number of days per week or weeks per year of operation are consecutive or intermittent throughout the week/year; however, these data are still useful and should be provided by engineers with air emission estimates to help inform release patterns. Data on operational days per week and weeks per year for one facility in NEI is typically not used for a different facility; however, engineers may consider conducting an analysis of these data for multiple facilities in NEI that are a part of the same OES to develop a broader estimate of release pattern at the OES-level. EPA has previously used this approach to inform development of GSs/ESDs, but it is dependent on the amount of data and time available and should be discussed on a chemical-specific basis.
2. *Models:* Models used to estimate air emissions (*e.g.,* Tank Truck and Railcar Loading and Unloading Release and Inhalation Exposure Model, Open-Top Vapor Degreasing Near-Field/Far-Field Inhalation Exposure Model, Spot Cleaning Near-Field/Far-Field Inhalation Exposure Model, models from GSs/ESDs) sometimes, albeit rarely, include data on release pattern from the underlying data sources. Release pattern information from models may be presented with non-modeled air emission data (*e.g.,* NEI, TRI) if the model is applicable and expected to represent the primary release source for the OES (*e.g.,* release pattern from the Tank Truck and Railcar Loading and Unloading Release and Inhalation Exposure Model may be used with estimates of air emissions for a facility in the Repackaging OES).
3. *Literature:* Literature sources from systematic review, including GSs/ESDs, are another source of information for release pattern. Often, literature sources provide general release pattern information for a given operation. Therefore, literature sources may inform release pattern at the OES-level, as opposed to at the facility-level. All details from literature sources on release pattern, even if general and/or limited, should be presented with air emission estimates, if they are available and there is no other source of this information.
4. *List as "Unknown" and Provide Operating Days:* Often, no information on release pattern is available at either the facility- or OES-level from the above sources. In these cases, engineers should do the following:
    a. List that the release pattern is unknown.
    b. Provide the number of operating days for the facility based on project-level engineering methodology, which is summarized below.
    c. Provide any information based on process knowledge (*e.g.,* commercial aerosol degreasing using cans may occur on/off throughout a day and year).

Estimating Number of Operating Days for Point Sources

For major sources that report operating data to NEI, EPA will use these data to calculate operating hours on a days per year basis. For major sources that do not report operating data in NEI (including facilities that only report to TRI), the Agency will estimate operating hours using the other data sources described above. A hierarchical approach for estimating the number of facility operating days per year is described below.

1. *Facility-Specific Data:* Use facility-specific data, if available. NEI reports operating data as hours per year, hours per day, days per week, and weeks per year.
   a. If possible, calculate operating days per years (days/year = hours per year ÷ hours per day).
   b. If hours per year and/or hours per day are not reported, calculate days per year (days/year = days per week × weeks per year).
2. *Facility-Specific Use Rates:* If information on facility-specific use rates is available, estimate days/year using one of the following approaches:
   a. If facilities have known or estimated average daily use rates, calculate the days/year (days/year = estimated annual use rate for the site [kg/year] ÷ average daily use rate from sites with available data [kg/day].
   b. If sites without days/year data do not have known or estimated average daily use rates, use the average number of days/year from the sites with such data.
3. *Industry-Specific Data:* Industry-specific data may be available in the form of GSs, ESDs, trade publications, or other relevant literature. In such cases, these estimates should take precedent over other approaches, unless facility-specific data are available.
4. *Manufacture of Large-Production Volume (PV) Commodity Chemicals:* For the manufacture of the large-PV commodity chemicals, a value of 350 days/year should be used. This assumes the plant runs 7 day/week and 50 week/year (with 2 weeks down for turnaround) and assumes that the plant is always producing the chemical.
5. *Manufacture of Lower-PV Specialty Chemicals:* For the manufacture of lower-PV specialty chemicals, it is unlikely the chemical is being manufactured continuously throughout the year. Therefore, a value of 250 days/year should be used. This assumes the plant manufactures the chemical 5 days/week and 50 weeks/year (with 2 weeks down for turnaround).
6. *Processing as Reactant (Intermediate Use) in the Manufacture of Commodity Chemicals:* As noted above, the manufacture of commodity chemicals is assumed to occur 350 days/year such that the use of a chemical as a reactant to manufacture a commodity chemical will also occur 350 days/year.
7. *Processing as Reactant (Intermediate Use) in the Manufacture of Specialty Chemicals:* As noted above, the manufacture of specialty chemicals is not likely to occur continuously throughout the year. Therefore, a value of 250 days/year can be used.
8. *Other Chemical Plant OES (e.g., Processing into Formulation and Use of Industrial Processing Aids):* For these OES, it is reasonable to assume that the chemical of interest is not always in use at the facility, even if the facility operates 24/7. Therefore, a value of 300 days/year can be used, based on the European Solvent Industry Group's "SpERC fact sheet – Formulation & (re)packing of substances and mixtures – Industrial (Solvent-borne)" default of 300 days/year for the chemical industry. However, in instances where the OES uses a low volume of the chemical of interest, 250 days/year can be used as a lower estimate for the days/year.

9. *All Other OESs:* Regardless of facility operating schedule, other OES are unlikely to use the chemical of interest every day. Therefore, a value of 250 days/year should be used for these OES.

Estimating Number of Operating Days for Area Sources

For area sources, EPA will also estimate operating days per year using information such as NEI operating data for major source facilities within the same OES, general information about the OES, and values from literature.

Facility operating days per year will be used to calculate daily emissions from the NEI and TRI annual emissions data, as follows:

Daily emissions (kg/day) = Annual emissions (kg/year) ÷ Operating days per year (days/year)