OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION
WASHINGTON, D.C. 20460

July 24, 2025

MEMORANDUM

SUBJECT: Diethylhexylphthalate (DEHP) Occupational Exposure Data on Numbers of Workers and ONUs in Each Occupational Exposure Scenario (OES) and the Number of Non-Detects (ND) in Inhalation Monitoring Data and their Incorporation into Exposure Estimates

FROM: Collin Beachum, Branch Supervisor
Risk Assessment Branch 6
Existing Chemicals Risk Assessment Division

TO: Jeff Morris, Director
Existing Chemicals Risk Assessment Division

PURPOSE: Provide additional information on the occupational exposure assessment not included in the draft DEHP Risk Evaluation published on May 30, 2025. This memorandum presents estimates for the number of workers and occupational non-users, as well as further information on the number of non-detects (ND) in the inhalation monitoring data and their incorporation into the exposure estimates for each OES. After public comment, the information in this memorandum will be incorporated into the final risk evaluation and technical support documents, as appropriate.

Estimates for the Number of Potentially Exposed Workers and Occupational Non-Users (ONUs)

An assessment objective is to estimate the number of potentially exposed workers and ONUs. Normally, a primary difference between workers and ONUs is that workers may handle DEHP and have direct contact with the chemical, while ONUs do not directly handle DEHP but may be indirectly exposed to it as part of their employment. The size of the area in which ONUs may work can vary across each OES and across facilities within the same OES. Additional considerations are the facility configuration, building and room sizes, presence of vapor barrier, and worker activity pattern. Where possible, for each OES, EPA identified job types and categories for workers and ONUs. The Agency evaluated inhalation exposures to workers and ONUs, and dermal exposures to workers, in addition to dermal exposure to ONUs for OES where there is potential exposure to mist and dust on deposited surfaces.

Methodology

To estimate the number sites, EPA utilized North American Industry Classification System (NAICS) and Standard Industrial Classification (SIC) code data from the Toxics Release Inventory (TRI), Discharge Monitoring Report (DMR), and National Emissions Inventory (NEI) sites identified for each

condition of use as well as U.S. Bureau of Labor Statistics (BLS) and U.S. Census data {BLS, 2023, 11138808; U.S. Census Bureau, 2015, 5097881}. Where market penetration data and site-specific NAICS/SIC codes from TRI/DMR/NEI were not available, EPA estimated the number of workers using data from EPA Generic Scenarios and OECD Emission Scenario Documents.

RESULTS:

The table below summarizes the number of facilities and total number of exposed workers for all OESs. For some OESs, the estimated number of facilities is based on the number of reporting sites to the 2020 CDR {U.S. EPA, 2020, 10366189}, NEI {U.S. EPA, 2023, 11347319}, DMR {U.S. EPA, 2024, 12212774}, and TRI databases {U.S. EPA, 2024, 12212773}.

Summary of Total Number of Workers and ONUs Potentially Exposed to DEHP for Each OES

Occupational Exposure Scenario (OES)	Total Exposed Workers[1]	Total Exposed ONUs[1]	Number of Facilities	Notes
Manufacturing	99	45	3	Number of facilities estimate based on identified sites from NEI, DMR, TRI, and CDR.
Repackaging	517	235	47	Number of facilities estimate based on identified sites from NEI, DMR, TRI, and CDR.
Incorporation into Formulation, Mixture, or Reaction Product	3,048	1,270	127	Number of facilities estimate based on identified sites from NEI, DMR, and TRI.
Use in Hydraulic Fracturing	396	88	44	Number of facilities estimate based on FracFocus {FracFocus, 2022, 10291772}.
Application of Paints, Coatings, Adhesives, and Sealants	5,600	1,820	140	Number of facilities estimate based on identified sites from NEI, DMR, and TRI.
Use of Laboratory Chemicals - Liquid	3,992 (central tendency); 73,746 (high-end)	27,944 (central tendency); 516,222 (high-end)	1,996 (central tendency); 36,873 (high-end)	Number of facilities estimate based on results from Monte Carlo modeling.
Use of Laboratory Chemicals - Solid	73,746	516,222	36,873	Number of facilities estimate based on results from Monte Carlo modeling.
Plastics Compounding	2,170	1,178	62	Number of facilities estimate based on identified sites from NEI, DMR, and TRI.
Plastics Converting	2,414	1,491	71	Number of facilities estimate based on identified sites from NEI, DMR, and TRI.
Recycling	13	7	1	Number of facilities estimate based on identified sites from TRI.
Rubber Manufacturing	2,890	765	85	Number of facilities estimate based on identified sites from NEI, DMR, and TRI.

Occupational Exposure Scenario (OES)	Total Exposed Workers[1]	Total Exposed ONUs[1]	Number of Facilities	Notes
Formulations for Diffusion Bonding	406	308	14	Number of facilities estimate based on identified sites from NEI and DMR.
Use of Dyes and Pigments, and Fixing Agents	10	5	5	Number of facilities estimate based on identified sites from DMR.
Textile Finishing	77	33	11	Number of facilities estimate based on identified sites from NEI, DMR, and TRI.
Fabrication of Final Product from Articles	224	80	16	Number of facilities estimate based on identified sites from NEI, DMR, and TRI.
Use of Automotive Care Products	176,190 (central tendency); 1,030,064 (high-end)	25,170 (central tendency); 147,152 (high-end)	25,170 (central tendency); 147,152 (high-end)	Number of facilities estimate based on results from Monte Carlo modeling.
Disposal	6,201	3,339	477	Number of facilities estimate based on identified sites from NEI, DMR, and TRI.

[1] Number of workers and ONU estimates based on the 2021 Bureau of Labor Statistics (BLS) and 2015 U.S. Census Bureau data {BLS, 2023, 11138808; U.S. Census Bureau, 2015, 5097881}.

Numbers of personal breathing zone (PBZ) samples and non-detects (ND) in the inhalation monitoring data and their incorporation into the inhalation exposure estimates for each OES

Inhalation monitoring data

For the 17 OES evaluated for inhalation exposure to DEHP, four different methods were used, dependent on data availability.

1) For six OES, EPA identified discrete personal breathing zone (PBZ) inhalation monitoring samples for workers specific to the OES, as indicated in the table below.

2) For five OES, PBZ inhalation monitoring data from a different OES with similar exposure scenarios were used as a surrogate, as indicated in the table below.

3) For two OES, EPA did not identify any references with discrete, full-shift samples through systematic review, and no OES with PBZ data were deemed to be appropriate surrogates. Therefore, EPA relied on references which only reported summary statistics (e.g., minimum, maximum) for time-weighted average (TWA) PBZ and/or area full-shift samples, although these inhalation monitoring data did provide industry-specific data relevant to each OES:

- For the Rubber product manufacturing OES, the European Union Risk Assessment Report for DEHP provided maximum concentrations based on a TWA of 25 data points (personal and area samples) from a plant performing rubber calendaring (ECB, 2008). EPA assessed high-end worker inhalation exposures using the 95th percentile of the maximum concentrations, and central tendency using the 50th percentile of the maximum concentrations.

- For the Use of automotive care products OES, the European Union Risk Assessment Report on DEHP provided a minimum (below limit of detection) concentration and maximum concentration based on their collected full-shift samples during the application of car sealants and under-coatings (ECB, 2008). EPA assessed the high-end worker inhalation exposure using the maximum concentration and central tendency worker inhalation exposure using the midpoint between zero and the maximum concentration.

4) For four OES (Spray application of adhesives, sealants, paints, and coatings; Formulations for diffusion bonding; Textile finishing; and Waste handling): PBZ inhalation monitoring data were not available; no OES with PBZ data were deemed to be appropriate surrogates; and EPA did not identify any references with discrete, full-shift samples through systematic review. For these OES, EPA estimated inhalation exposures through empirically informed models but did not include information on these OES in the table below.

The table below presents the number of PBZ samples and non-detects (ND) from the inhalation monitoring data for each OES that included discrete PBZ samples. In the absence of such data for a given OES, EPA included the number of data points from summary statistics. More information on the inhalation monitoring and modeling data (Section 3) and the resulting occupational exposures (Section 4.2) are detailed in the *Draft Environmental Release and Occupational Exposure Assessment for DEHP* {U.S. EPA, 2025, 11799650}. EPA intends to include the additional information presented here in the final risk evaluation for DEHP (Section 4.1.1).

DEHP Inhalation Monitoring Data

OES	Sample Type	Sample Types		Worker Inhalation Exposure Estimates from Monitoring Data (8-hour TWA; mg/m^3 [a])	
		Total # Samples[b]	#ND [c]	Central Tendency	High-End
Manufacturing of DEHP	Worker PBZ	45	37	1.20E-02	2.2E-02
Use in Hydraulic Fracturing	Manufacturing used as surrogate	0	N/A	1.20E-02	2.2E-02
Incorporation into Formulation, Mixture, or Reaction Product	Manufacturing used as surrogate	0	N/A	1.20E-02	2.2E-02
Plastic Converting	Worker PBZ	35	4 [d]	0.33	0.54
Recycling	Plastic Converting used as surrogate	0	N/A	0.33	0.54
Plastic Compounding	Worker PBZ	21	0	0.30	2.8
Repackaging	Worker PBZ	1	0	0.14	0.52
Use of Laboratory Chemicals	Worker PBZ	1	0	1.00E-02	0.10
Fabrication of Final Product from Articles	Worker PBZ	7	0	6.0E-02	0.13
Rubber Product Manufacturing	Unknown if PBZ or area	7 (Summary statistics only were available)	Unknown	1.7	10
Non-spray Application of Adhesives, Sealants, Paints, and Coatings	Rubber Product Manufacturing used as surrogate	1	0	1.7	10

Use of Dyes, Pigments, and Fixing Agents	Rubber Product Manufacturing used as surrogate	0	N/A	1.7	10
Use of Automotive Care Products	Unknown if PBZ or area	3 (Summary statistics only were available)	Unknown	5.5E-02	0.11

[a] TWA = Time Weighted Average
[b] Number of data points were comprised of discrete samples (i.e., excluding data presented as ranges, arithmetic means, blanks, etc.).
[c] For calculations involving samples below the LOD, EPA's Guidelines for Statistical Analysis of Occupational Exposure Data[1] (U.S. EPA, 1994) recommend using the LOD/√2 if the geometric standard deviation (GSD) is less than 3.0 and LOD/2 if the GSD is 3.0 or greater. Manufacturing and Plastics Converting exposure scenarios included ND as LOD/2. All other OES with discrete PBZ samples had zero ND.
[d] For the OSHA CEHD data, the Detection Limit for the Overall Procedure (DLOP) was 9.3 µg/sample; therefore, the detection limit (in mg/m^3) varied according to the sample volume (liters air).
N/A = Not applicable