United States
Environmental Protection Agency

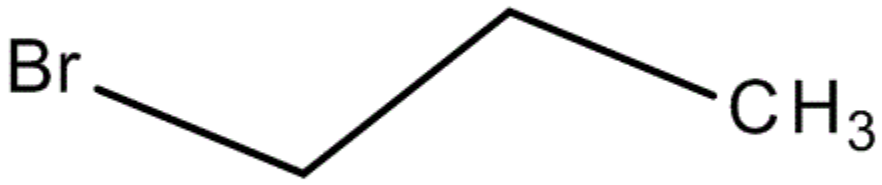
Office of Chemical Safety and
Pollution Prevention

Final Risk Evaluation for 1-Bromopropane (*n*-Propyl Bromide)

Systematic Review Supplemental File:

Data Quality Evaluation for Consumer Exposure

CASRN: 106-94-5



August 2020

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Refer to Appendix E of '*Application of Systematic Review in TSCA Risk Evaluations*' at https://www.epa.gov for more information of evaluation procedures and parameters.

Study Citation:	Batterman, S.,Jia, C.,Hatzivasilis, G.. 2007. Migration of volatile organic compounds from attached garages to residences: A major exposure source. Environmental Research.
Data Type	Monitoring
Hero ID	1065558

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Sampling Methodology	High	1	passive samplers. tenax absorbant. samples stored 1-3 days before analysis.
	Metric 2:	Analytical Methodology	High	1	analytical details reported in another paper, but recoveries, blanks, methods, etc. discussed.
	Metric 3:	Biomarker Selection	N/A	N/A	indoor air
Domain 2: Representativeness					
	Metric 4:	Geographic Area	High	1	
	Metric 5:	Currency	Medium	2	around 2007
	Metric 6:	Spatial and Temporal Variability	Medium	2	15 samples, but sample is not random or necessarily representative, although it may capture much of the variation in the sampled communities.
	Metric 7:	Exposure Scenario	Medium	2	indoor air, but directly related to consumer products.
Domain 3: Accessibility/Clarity					
	Metric 8:	Reporting of Results	Medium	2	No raw data. Mean, SD. Max, DF
	Metric 9:	Quality Assurance	Medium	2	recoveries, blanks discussed, although not specific to chemical.
Domain 4: Variability and Uncertainty					
	Metric 10:	Variability and Uncertainty	High	1	SD provided. Investigated various variables.
Overall Quality Determination[*]			High	1.6	
Extracted			No		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Jain, R. B.. 2015. Levels of selected urinary metabolites of volatile organic compounds among children aged 6-11 years. Environmental Research.
Data Type	Monitoring
Hero ID	3042164

Domain		Metric	Rating†	Score	Comments‡
Domain 1: Reliability					
	Metric 1:	Sampling Methodology	High	1	NHANES sampling. Detailed description at https://wwwn.cdc.gov/nchs/nhanes/ContinuousNhanes/Default.aspx?BeginYear=2011
	Metric 2:	Analytical Methodology	High	1	The laboratory methods used to measure VOCs in urine, as previously mentioned are provided in Alwis et al. (2012) and at https://wwwn.cdc.gov/nchs/nhanes/ContinuousNhanes/Default.aspx?BeginYear=2011.
	Metric 3:	Biomarker Selection	Medium	2	According to the ATSDR Toxicological Profile for 1-Bromopropane, dated August 2017, "Biological exposure to the general population and workers can be assessed by measurement of bromide ion, 1-bromopropane, and its metabolite, N-acetyl-S-(n-propyl)-L-cysteine (AcPrCys) in urine or blood (NTP 2013). N-Acetyl-S-(n-propyl)-L-cysteine is expected to be more specific to 1-bromopropane than bromide due to the presence of the bromide ion in foods; however, there have also been concerns regarding the specificity of N-acetyl-S-(n-propyl)-L-cysteine. The ubiquitous nature of N-acetylS-(n-propyl)-L-cysteine in the urine of the general population suggests that it may not be a specific biomarker for 1-bromopropane, as general population exposure is expected to be limited. It is unknown if other chemicals and/or endogenous metabolism contributed to the observed urinary levels of N-acetylS-(n-propyl)-L-cysteine in biomonitoring studies". The document is available at: https://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=1471&tid=285. NTP. 2013. Report on carcinogens. Monograph on 1-bromopropane. National Toxicology Program, U.S. Department of Health and Human Services.
Domain 2: Representativeness					
	Metric 4:	Geographic Area	High	1	
	Metric 5:	Currency	Medium	2	2011-2012 samples
	Metric 6:	Spatial and Temporal Variability	Medium	2	Large sample size, but appears to be spot samples collected (vs 24 hr or first morning voids)
	Metric 7:	Exposure Scenario	Medium	2	

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Study Citation:	Jain, R. B.. 2015. Levels of selected urinary metabolites of volatile organic compounds among children aged 6-11 years. Environmental Research.
Data Type	Monitoring
Hero ID	3042164

Domain	Metric	Rating[†]	Score	Comments[‡]
Domain 3: Accessibility/Clarity				
	Metric 8: Reporting of Results	Medium	2	No raw data, but raw data are available from NHANES. Mean and 95 percent Confidence Interval (CI) provided. No Standard Deviation (SD).
	Metric 9: Quality Assurance	Medium	2	Study provided creatinine levels to assess completeness of urine samples.
Domain 4: Variability and Uncertainty				
	Metric 10: Variability and Uncertainty	Medium	2	No SD, but discussed age,gender,race/ethnicity,and exposure-toenvironmentaltobaccosmoke.
Overall Quality Determination[*]		Medium	1.7	
Extracted		Yes		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Boyle, E. B.,Viet, S. M.,Wright, D. J.,Merrill, L. S.,Alwis, K. U.,Blount, B. C.,Mortensen, M. E.,Moye, J.,Dellarco, M.. 2016. Assessment of Exposure to VOCs among Pregnant Women in the National Children's Study. International Journal of Environmental Research and Public Health.
Data Type	Monitoring
Hero ID	3158732

Domain		Metric	Rating†	Score	Comments‡
Domain 1: Reliability					
	Metric 1:	Sampling Methodology	High	1	Described equipment and storage. Conducted as a part of large study with protocols.
	Metric 2:	Analytical Methodology	Medium	2	They used a standard method (in reference section) and provided some info, but not recoveries reported. LOD is reported.
	Metric 3:	Biomarker Selection	High	1	biomarker on CDC list https://www.cdc.gov/Nchs/Data/Nhanes/Nhanes_11_12/UVOC_G_MET_VOC_Metabolites.pdf
Domain 2: Representativeness					
	Metric 4:	Geographic Area	High	1	
	Metric 5:	Currency	Medium	2	2009-2010
	Metric 6:	Spatial and Temporal Variability	Medium	2	Medium- Had very large sample size (high), but only spot samples collected (low)
	Metric 7:	Exposure Scenario	High	1	The study analyzes urine from the general population, and therefore the concentrations are not specific to consumer scenarios of interest to OPPT. The study does, however, have provide descriptive statistics that provide the frequency of activity patterns (paint use, air freshener use, etc.) which may be useful in characterizing the data.
Domain 3: Accessibility/Clarity					
	Metric 8:	Reporting of Results	Medium	2	No Coefficient of Variation (CV). No raw data, but raw data are available from NHANES
	Metric 9:	Quality Assurance	Medium	2	Some QA information is missing from the article, however laboratory QA procedures are provided in Alwis 2012, the procedure that was also used for NHANES. Alwis, K.U.; Blount, B.C.; Britt, A.S.; Patel, D.; Ashley, D.L. Simultaneous Analysis of 28 Urinary VOC Metabolites Using Ultra High Performance Liquid Chromatography Coupled with Electrospray Ionization Tandem Mass Spectrometry (UPLC-ESI/MSMS). Anal. Chim. Acta 2012, 750, 152"160.
Domain 4: Variability and Uncertainty					

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Study Citation:	Boyle, E. B.,Viet, S. M.,Wright, D. J.,Merrill, L. S.,Alwis, K. U.,Blount, B. C.,Mortensen, M. E.,Moye, J.,Dellarco, M.. 2016. Assessment of Exposure to VOCs among Pregnant Women in the National Children's Study. International Journal of Environmental Research and Public Health.
Data Type	Monitoring
Hero ID	3158732

Domain	Metric	Rating[†]	Score	Comments[‡]
	Metric 10: Variability and Uncertainty	High	1	
Overall Quality Determination[*]		High	1.5	
Extracted		Yes		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
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[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Emmerich, S. J., Gorfain, J. E., Howard-Reed, C.. 2003. Air and pollutant transport from attached garages to residential living spaces - literature review and field tests. International Journal of Ventilation.
Data Type	Experimental
Hero ID	1060837

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Sampling Methodology and Conditions	High	1	The pressurization tests were generally conducted according to ASTM Standard E 779-99 (ASTM 1999) using blower doors
	Metric 2:	Analytical Methodology	Medium	2	Error analysis and confidence intervals calculated according to ASTM standard 799-99 but no detection limits reported
	Metric 3:	Biomarker Selection	N/A	N/A	
Domain 2: Representative					
	Metric 4:	Testing Scenario	Medium	2	Testing scenario appropriate but specific to DC and results aligned with results from other studies
	Metric 5:	Sample Size and Variability	Medium	2	Sample size = 5 houses
	Metric 6:	Temporality	Low	3	Study from 2003, >15 years ago
Domain 3: Accessibility/Clarity					
	Metric 7:	Reporting of Results	Medium	2	Effective leakage area (ELA) and air change rate (ACH) data reported for all houses; average and standard deviations reported
	Metric 8:	Quality Assurance	N/A	N/A	QA/QC not discussed but implied through adherence to ASTM standards
Domain 4: Variability and Uncertainty					
	Metric 9:	Variability and Uncertainty	Medium	2	Variations in houses tested and respective results are characterized; results compared to other studies to identify data gaps or uncertainties
Overall Quality Determination[*]			Medium	2.1	
Extracted			Yes		

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Study Citation:	Emmerich, S. J., Gorfain, J. E., Howard-Reed, C.. 2003. Air and pollutant transport from attached garages to residential living spaces - literature review and field tests. International Journal of Ventilation.
Data Type	Experimental
Hero ID	1060837

Domain	Metric	Rating†	Score	Comments‡

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
* If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Batterman, S.,Jia, C.,Hatzivasilis, G.. 2007. Migration of volatile organic compounds from attached garages to residences: A major exposure source. Environmental Research.
Data Type	Experimental
Hero ID	1065558

Domain	Metric		Rating†	Score	Comments‡
Domain 1: Reliability					
	Metric 1:	Sampling Methodology and Conditions	High	1	Sampling methodology discussed in detail following methodology in previously published study; sampling equipment, storage, and conditions described
	Metric 2:	Analytical Methodology	High	1	AER measured using constant injection of PFT emitters and passive samplers; samples analyzed by GC/MS; MDLs reported
	Metric 3:	Biomarker Selection	N/A	N/A	
Domain 2: Representative					
	Metric 4:	Testing Scenario	Medium	2	Testing scenarios likely normal but selection of homes and participants not necessarily random or representative; range of testing conditions exists across selected homes
	Metric 5:	Sample Size and Variability	High	1	Sample size = 15 homes; replicate samples taken
	Metric 6:	Temporality	Medium	2	Study from 2007, 13 years ago
Domain 3: Accessibility/Clarity					
	Metric 7:	Reporting of Results	High	1	Raw concentration data provided for each house/garage and VOC; summary statistics provided for each VOC for all houses
	Metric 8:	Quality Assurance	N/A	N/A	At least one field blank collected for each house (25 total blanks); sampling performance evaluated; recoveries 75-128 percent
Domain 4: Variability and Uncertainty					
	Metric 9:	Variability and Uncertainty	High	1	Spatial and temporal variability evaluated; uncertainties and gaps identified
Overall Quality Determination*			High	1.2	
Extracted			Yes		

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Study Citation:	Batterman, S.,Jia, C.,Hatzivasilis, G.. 2007. Migration of volatile organic compounds from attached garages to residences: A major exposure source. Environmental Research.
Data Type	Experimental
Hero ID	1065558

Domain	Metric	Rating†	Score	Comments‡

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
* If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	H. F. Frasch, G. S. Dotson, A. M. Barbero. 2011. In vitro human epidermal penetration of 1-bromopropane. Journal of Toxicology and Environmental Health, Part A: Current Issues.
Data Type	Experimental
Hero ID	1247930

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Sampling Methodology and Conditions	High	1	
	Metric 2:	Analytical Methodology	High	1	
	Metric 3:	Biomarker Selection	N/A	N/A	Biomarkers are not used.
Domain 2: Representative					
	Metric 4:	Testing Scenario	Medium	2	Testing scenarios can be used as surrogate for three types of human dermal exposures.
	Metric 5:	Sample Size and Variability	Medium	2	<10 samples (n=9)
	Metric 6:	Temporality	Medium	2	>5 to 15 years (2011)
Domain 3: Accessibility/Clarity					
	Metric 7:	Reporting of Results	Medium	2	Supplementary or raw data (i.e., individual data points) are not reported, and therefore summary statistics cannot be reproduced.
	Metric 8:	Quality Assurance	N/A	N/A	QA/QC techniques and results were not directly discussed, but can be implied through the study"s use of standard field and laboratory protocols
Domain 4: Variability and Uncertainty					
	Metric 9:	Variability and Uncertainty	Medium	2	The study characterizes a variety of dermal exposure scenarios; however, it has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination[*]			Medium	1.9	
Extracted			Yes		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Knoppel, H.,Schauenburg, H.. 1989. Screening of household products for the emission of volatile organic compounds. Environment International.
Data Type	Experimental
Hero ID	1579753

Domain		Metric	Rating†	Score	Comments‡
Domain 1: Reliability					
	Metric 1:	Sampling Methodology and Conditions	Low	3	Few details, older crude method.
	Metric 2:	Analytical Methodology	Low	3	Few details, no standard method mentioned.
	Metric 3:	Biomarker Selection	N/A	N/A	
Domain 2: Representative					
	Metric 4:	Testing Scenario	Low	3	Testing was conducted on 10 different consumer products (wood and floor waxes and detergents), but testing was not conducted over a broad range of conditions. Additionally, products are not a direct match to the OPPT scenarios of interest.
	Metric 5:	Sample Size and Variability	Medium	2	Although 10 similar types of products were tested, there was no replicate testing per product.
	Metric 6:	Temporality	Low	3	>15 yrs old
Domain 3: Accessibility/Clarity					
	Metric 7:	Reporting of Results	Low	3	No summary of data across product types. No raw data.
	Metric 8:	Quality Assurance	Unacceptable	4	QA not mentioned. and no standard methodologies used to assume QA was done.,
Domain 4: Variability and Uncertainty					
	Metric 9:	Variability and Uncertainty	Low	3	Limited discussion; no replicates.
Overall Quality Determination*			Unacceptable	4.0	Metric mean score**: 3.0.
Extracted			No		

** Consistent with our *Application of Systematic Review in TSCARisk Evaluations* document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, one of the metrics were rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

* If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Turk, B.,. & Hughes, J.,.. 2008. Exploratory Study of Basement Moisture During Operation of ASD Radon Control Systems.
Data Type	Experimental
Hero ID	6558191

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Sampling Methodology and Conditions	Medium	2	Sampling protocol not publicly available but all sampling equipment described for each parameter measured
	Metric 2:	Analytical Methodology	Medium	2	Instrumentation and analysis methodologies provided for various parameters as applicable; ranges of values provided but not detection limits; air flow analyzed by GC
	Metric 3:	Biomarker Selection	N/A	N/A	
Domain 2: Representative					
	Metric 4:	Testing Scenario	Medium	2	Testing scenarios likely represent the relevant exposure scenario in basements if certain criteria met (e.g. unfinished basement)
	Metric 5:	Sample Size and Variability	Medium	2	Many samples but number not explicitly stated; Continuous samples collected for two, three-hour periods over three days each season (4) in each home (3)
	Metric 6:	Temporality	Medium	2	Study from 2008, 12 years ago
Domain 3: Accessibility/Clarity					
	Metric 7:	Reporting of Results	Low	3	Data are provided but primarily in figures and images not tables; simple summary statistics are tabulated for some parameters
	Metric 8:	Quality Assurance	N/A	N/A	QA/QC not directly discussed but can be implied through study's use of equipment and procedures
Domain 4: Variability and Uncertainty					
	Metric 9:	Variability and Uncertainty	Medium	2	Variability and limitations of the study are discussed
Overall Quality Determination[*]			Medium	2.2	
Extracted			Yes		

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Study Citation:	Turk, B.,. & Hughes, J.,.. 2008. Exploratory Study of Basement Moisture During Operation of ASD Radon Control Systems.
Data Type	Experimental
Hero ID	6558191

Domain	Metric	Rating†	Score	Comments‡

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
* If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	U.S, E. P. A.. 2017. Chemical and product categories: 1-Bromopropane.
Data Type	Databases Not Unique to a Chemical
Hero ID	3970089

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Sampling Methodology	High	1	Brief methods described on home page of database, https://actor.epa.gov/cpcat/faces/home.xhtml. Further methods described in the article "Development of a consumer product ingredient database for chemical exposure screening and prioritization". Goldsmith M-R, Grulke CM, Brooks RD, et al. (2013). "Development of a consumer product ingredient database for chemical exposure screening and prioritization." Food and Chemical Toxicology 65: 269-279.
	Metric 2:	Analytical Methodology	N/A	N/A	
Domain 2: Representative					
	Metric 3:	Geographic Area	High	1	US database.
	Metric 4:	Temporal	High	1	Recent products
	Metric 5:	Exposure Scenario	High	1	
Domain 3: Accessibility/Clarity					
	Metric 6:	Availability of DB and Supporting Documents	High	1	Widely accepted. Users Guide.
	Metric 7:	Reporting Results	High	1	Data is organized. No summary provided, so summary stats not applicable
Domain 4: Variability and Uncertainty					
	Metric 8:	Variability and Uncertainty	N/A	N/A	The study has limited discussion of key uncertainties, limitations, and data gaps. For example, interpreting CPCat cassettes. More uncertainties may be available in Goldsmith et al. 2013. or in Dionisio KL, Frame AM, Goldsmith M-R, et al. (2015). "Exploring Consumer Exposure Pathways and Patterns of Use for Chemicals in the Environment." Toxicology Reports 2: 228-237.
Overall Quality Determination[*]			High	1.0	
Extracted			No		

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Study Citation:	U.S, E. P. A.. 2017. Chemical and product categories: 1-Bromopropane.
Data Type	Databases Not Unique to a Chemical
Hero ID	3970089

Domain	Metric	Rating†	Score	Comments‡

† High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
‡ The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
* If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Ntp, Cerhr. 2003. NTP-CERHR monograph on the potential human reproductive and developmental effects of 1-bromopropane.
Data Type	Completed Exposure Assessment
Hero ID	1519109

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Methodology	High	1	
Domain 2: Representative					
	Metric 2:	Exposure Scenario	Low	3	Secondary quantitative data for workers only.
Domain 3: Accessibility/Clarity					
	Metric 3:	Documentation of References	High	1	
Domain 4: Variability and Uncertainty					
	Metric 4:	Variability and Uncertainty	High	1	
Overall Quality Determination[*]			High	1.5	
Extracted			No		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	U.S, E. P. A.. 2006. Significant new alternatives policy (SNAP) - Risk screen on substitutes for ozone depleting substances for adhesive, aerosol solvent, and solvent cleaning applications. Proposed substitute: n-Propyl bromide.
Data Type	Completed Exposure Assessment
Hero ID	2991016

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Methodology	High	1	
Domain 2: Representative					
	Metric 2:	Exposure Scenario	High	1	general pop inhalation
Domain 3: Accessibility/Clarity					
	Metric 3:	Documentation of References	High	1	
Domain 4: Variability and Uncertainty					
	Metric 4:	Variability and Uncertainty	High	1	
Overall Quality Determination[*]			High	1.0	
Extracted			No		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Atsdr,. 2016. Draft toxicological profile for1-bromopropane.
Data Type	Completed Exposure Assessment
Hero ID	3827325

Domain	Metric	Rating[†]	Score	Comments[‡]
Domain 1: Reliability				
	Metric 1: Methodology	High	1	Govt study, clearly written.
Domain 2: Representative				
	Metric 2: Exposure Scenario	High	1	Describes consumer and gen pop.
Domain 3: Accessibility/Clarity				
	Metric 3: Documentation of References	High	1	References provided.
Domain 4: Variability and Uncertainty				
	Metric 4: Variability and Uncertainty	High	1	
Overall Quality Determination[*]		High	1.0	
Extracted		No		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Japanese Ministry of, Environment. 2017. 1-Bromopropane.
Data Type	Completed Exposure Assessment
Hero ID	3980936

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Methodology	Low	3	Assumptions minimally described.
Domain 2: Representative					
	Metric 2:	Exposure Scenario	Low	3	Does not describe metadata regarded ambient air concentration reported.
Domain 3: Accessibility/Clarity					
	Metric 3:	Documentation of References	Unacceptable	4	No reference provided for the ambient air concentration. Possibly modeled, but not clear.
Domain 4: Variability and Uncertainty					
	Metric 4:	Variability and Uncertainty	Low	3	Not discussed.
Overall Quality Determination[*]			Unacceptable	4.0	Metric mean score[**]: 3.2.
Extracted			No		

[**] Consistent with our *Application of Systematic Review in TSCARisk Evaluations* document, if a metric for a data source receives a score of Unacceptable (score = 4), EPA will determine the study to be unacceptable. In this case, one of the metrics were rated as unacceptable. As such, the study is considered unacceptable and the score is presented solely to increase transparency.

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.

[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.

[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Atsdr,. 2016. Toxicological profile for 1-bromopropane.
Data Type	Completed Exposure Assessment
Hero ID	3982334

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Methodology	Medium	2	Govt report of secondary exposure data. Giving medium since does not describe lit serch method.
Domain 2: Representative					
	Metric 2:	Exposure Scenario	High	1	
Domain 3: Accessibility/Clarity					
	Metric 3:	Documentation of References	High	1	
Domain 4: Variability and Uncertainty					
	Metric 4:	Variability and Uncertainty	Medium	2	
Overall Quality Determination[*]			High	1.5	
Extracted			No		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Delmaar, J. E.. Emission of chemical substances from solid matrices: a method for consumer exposure assessment.
Data Type	Completed Exposure Assessment
Hero ID	4663189

Domain	Metric	Rating[†]	Score	Comments[‡]
Domain 1: Reliability				
	Metric 1: Methodology	Low	3	The report discusses the literature review, assumptions, and limitations of the model. The discussion on data and extrapolations from the model are limited due to data availability and lack of tested data.
Domain 2: Representative				
	Metric 2: Exposure Scenario	Low	3	The study models volatile substances using summarized data and does not specifically model 1-BP. Sample and surrogate data used may be similar, but the emphasis on building materials is not in alignment with 1BP uses.
Domain 3: Accessibility/Clarity				
	Metric 3: Documentation of References	Low	3	Numerous studies are referenced, but their use is not always clear or directly related to the text and/or data.
Domain 4: Variability and Uncertainty				
	Metric 4: Variability and Uncertainty	Low	3	Variabilities and uncertainties are addressed, but not as they apply to 1-BP or its specific exposure environments. Models are built on surrogate paramater values which introduces large degrees of uncertainty.
Overall Quality Determination[*]		Low	3.0	
Extracted		No		

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[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	U.S, E. P. A.. 1987. Household solvent products: A national usage survey.
Data Type	Survey
Hero ID	1005969

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Data Collection Methodology	High	1	
	Metric 2:	Data Analysis Methodology	High	1	
Domain 2: Representative					
	Metric 3:	Geographic Area	High	1	Nationwide (U.S.A.) survey with outreach via random dialing and willingness to provide address and respond to survey.
	Metric 4:	Sampling / Sampling Size	High	1	
	Metric 5:	Response Rate	Medium	2	
Domain 3: Accessibility/Clarity					
	Metric 6:	Reporting of Results	High	1	
	Metric 7:	Quality Assurance	Medium	2	
Domain 4: Variability and Uncertainty					
	Metric 8:	Variability and Uncertainty	N/A	N/A	
Overall Quality Determination[*]			High	1.3	
Extracted			Yes		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Chang, J. C. S., Krebs, K. A.. 1992. Evaluation of para-dichlorobenzene emissions from solid moth repellant as a source of indoor air pollution. Journal of the Air and Waste Management Association.
Data Type	Modeling
Hero ID	28421

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	mathematical Equations	High	1	Scientifically sound and from a reputable source
	Metric 2:	Model Evaluation	High	1	Agreement between dynamic chamber, static chamber, and literature data
Domain 2: Representative					
	Metric 3:	Exposure Scenario	Medium	2	While this article was published over 15 years ago, the model was developed looking at the emission rate in conditions that are still relevant.
Domain 3: Accessibility/Clarity					
	Metric 4:	Model and Model Documentation Availability	High	1	Sufficient documentation on model
	Metric 5:	Model Inputs and Defaults	Medium	2	Model inputs are identified but descriptions are not detailed.
Domain 4: Variability and Uncertainty					
	Metric 6:	Variability and Uncertainty	Medium	2	Limited discussion on variability and uncertainty
Overall Quality Determination[*]			High	1.5	
Extracted			Yes		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Guo, Z.. 2002. Review of indoor emission source models Part 1 Overview. Environmental Pollution.
Data Type	Modeling
Hero ID	37431

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Mathematical Equations	Medium	2	Sources generally use sound methods but models are not described in detail; equations are provided
	Metric 2:	Model Evaluation	Medium	2	The models have undergone limited evaluation; cited models have been used in the scientific community but not validated in this study
Domain 2: Representative					
	Metric 3:	Exposure Scenario	Low	3	Paper was published over 15 years ago and may be inconsistent with current exposures.
Domain 3: Accessibility/Clarity					
	Metric 4:	Model and Model Documentation Availability	Low	3	It is uncertain if the models are available with documentation or clear instructions for use without pulling up each of the references cited. This article does not provide enough information for each of the models to make this determination.
	Metric 5:	Model Inputs and Defaults	Low	3	Model inputs were not described in detail.
Domain 4: Variability and Uncertainty					
	Metric 6:	Variability and Uncertainty	High	1	The study included discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination[*]			Low	2.3	
Extracted			No		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	U.S, E. P. A.. 2006. Significant new alternatives policy (SNAP) - Risk screen on substitutes for ozone depleting substances for adhesive, aerosol solvent, and solvent cleaning applications. Proposed substitute: n-Propyl bromide.
Data Type	Modeling
Hero ID	2991016

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Mathematical Equations	High	1	
	Metric 2:	Model Evaluation	Low	3	Would assume so, but cant find documentation.
Domain 2: Representative					
	Metric 3:	Exposure Scenario	High	1	
Domain 3: Accessibility/Clarity					
	Metric 4:	Model and Model Documentation Availability	High	1	https://www3.epa.gov/scram001/userg/screen/screen3d.pdf
	Metric 5:	Model Inputs and Defaults	High	1	
Domain 4: Variability and Uncertainty					
	Metric 6:	Variability and Uncertainty	Low	3	
Overall Quality Determination[*]			Medium	1.7	
Extracted			Yes		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Jayjock, M. A.. 1994. Back Pressure Modeling of Indoor Air Concentrations from Volatilizing Sources. American Industrial Hygiene Association Journal.
Data Type	Modeling
Hero ID	3041749

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Mathematical Equations	High	1	Model is scientifically sound and conceptual model is described in detail; equations are provided.
	Metric 2:	Model Evaluation	Low	3	Model evaluation was conducted according to the author; there is no information provided regarding model peer review, corroboration, or quality assurance checks.
Domain 2: Representative					
	Metric 3:	Exposure Scenario	Medium	2	While this article was published over 15 years ago, the model was developed looking at the emission rate in conditions that are still relevant.
Domain 3: Accessibility/Clarity					
	Metric 4:	Model and Model Documentation Availability	Low	3	The accompanying source code (BASIC) and executable program is "available on a disk"and...from the writer on request"; outdated and not readily available.
	Metric 5:	Model Inputs and Defaults	Medium	2	Model inputs are identified but not all descriptions are detailed.
Domain 4: Variability and Uncertainty					
	Metric 6:	Variability and Uncertainty	Medium	2	The study has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination[*]			Medium	2.2	
Extracted			Yes		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	H. F. Frasch, A. L. Bunge. 2015. The transient dermal exposure II: post-exposure absorption and evaporation of volatile compounds. Journal of Pharmaceutical Sciences.
Data Type	Modeling
Hero ID	3230538

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Mathematical Equations	High	1	Key mathematical equations to calculate fractional absorption & evaporation are clearly defined.
	Metric 2:	Model Evaluation	Medium	2	It is not certain if this model has undergone extensive evaluation. The authors state that the theory should be tested by controlled in vitro experiments using skin or artificial membranes.
Domain 2: Representative					
	Metric 3:	Exposure Scenario	High	1	
Domain 3: Accessibility/Clarity					
	Metric 4:	Model and Model Documentation Availability	High	1	
	Metric 5:	Model Inputs and Defaults	Medium	2	Data quality acceptance criteria specified by the author are not discussed, but inputs appear appropriate.
Domain 4: Variability and Uncertainty					
	Metric 6:	Variability and Uncertainty	Low	3	Key uncertainties, limitations, and data gaps are not discussed.
Overall Quality Determination[*]			Medium	1.7	
Extracted			No		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Sebroski, J. Mason M.. 2017. Developing consensus standards for measuring chemical emissions from spray polyurethane foam (SPF) insulation.
Data Type	Modeling
Hero ID	4663208

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Mathematical Equations	High	1	The models are scientifically sound, from a reputable source, and equations are provided.
	Metric 2:	Model Evaluation	Medium	2	The models have undergone limited evaluation. The selected technical papers were reviewed prior to being accepted, but all methods have not been validated for applications with SPF emissions.
Domain 2: Representative					
	Metric 3:	Exposure Scenario	High	1	The modeled scenario closely represents current exposures (within 5 years) and relevant conditions. Symposium was held in 2015 with the selected technical papers being published in 2017.
Domain 3: Accessibility/Clarity					
	Metric 4:	Model and Model Documentation Availability	High	1	There is sufficient documentation in the data source for each model included.
	Metric 5:	Model Inputs and Defaults	High	1	Key model inputs and defaults are identified, referenced, and clearly described for each model included.
Domain 4: Variability and Uncertainty					
	Metric 6:	Variability and Uncertainty	Medium	2	An overview of research needs identifying limitations and data gaps was included, but each included paper did not discuss uncertainties, limitations, and data gaps in detail.
Overall Quality Determination[*]			High	1.3	
Extracted			No		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.

Study Citation:	Begley, T.,., Castle, L.,., Feigenbaum, A.,., Franz, R.,., Hinrichs, K.,., Lickly, T.,., Mercea, P.,., Milana, M.,., O'Brien, A.,., Rebre, S.,., Rijk, R.,., Piringer, O.. 2005. Evaluation of migration models that might be used in support of regulations for food-contact plastics. Food Additives and Contaminants.
Data Type	Modeling
Hero ID	6558190

Domain	Metric		Rating[†]	Score	Comments[‡]
Domain 1: Reliability					
	Metric 1:	Mathematical Equations	High	1	The model is scientifically sound and from a reputable source.
	Metric 2:	Model Evaluation	High	1	Model has been accepted and is used by the FDA; purpose of the paper to verify compliance with EU regulation standards.
Domain 2: Representative					
	Metric 3:	Exposure Scenario	Medium	2	While this article was published over 15 years ago, the model was developed looking at the emission rate in conditions that are still relevant.
Domain 3: Accessibility/Clarity					
	Metric 4:	Model and Model Documentation Availability	High	1	There is sufficient documentation in the data source.
	Metric 5:	Model Inputs and Defaults	High	1	Model inputs are described in detail.
Domain 4: Variability and Uncertainty					
	Metric 6:	Variability and Uncertainty	Medium	2	There was limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination[*]			High	1.3	
Extracted			Yes		

[†] High = 1; Medium = 2; Low = 3; Unacceptable = 4; N/A has no value.
[‡] The overall rating is calculated as necessary. EPA may not always provide a comment for a metric that has been categorized as High.
[*] If any individual metrics are deemed Unacceptable, then the overall rating is also unacceptable. Otherwise, the overall rating is based on the following scale: High: ≥ 1 to < 1.7; Medium: $=\geq 1.7$ to < 2.3; Low: $=\geq 2.3$ to ≤ 3.