United States
Environmental Protection Agency

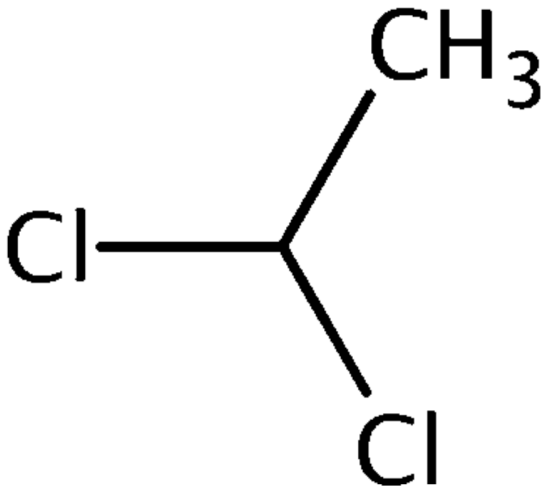
July 2024
Office of Chemical Safety and
Pollution Prevention

Draft Risk Evaluation for 1,1-Dichloroethane

Systematic Review Supplemental File:

**Data Quality Evaluation Information for
General Population, Consumer, and Environmental Exposure**

CASRN: 75-34-3



July 2024

This supplemental file contains information regarding the data quality evaluation results for data sources that met the PECO screening criteria for the *Draft Risk Evaluation for 1,1-Dichloroethane*. EPA conducted data quality evaluation and extraction based on author-reported descriptions and results; additional analyses (e.g., statistical analyses) potentially conducted by EPA are not contained in this supplemental file. EPA performs data quality evaluation as a part of the TSCA systematic review process described in the *Draft Systematic Review Protocol Supporting TSCA Risk Evaluations for Chemical Substances*. The systematic review steps are further described in the *Draft Risk Evaluation for 1,1 Dichloroethane – Systematic Review Protocol*.

Additionally, the overall quality determination (OQD) for each reference represents the data as a whole for each evidence stream, not for individual scenarios described within a study. For example, a reference that has both monitoring and experimental data would have OQDs using the data quality evaluation metrics for monitoring and experimental data, respectively. An OQD utilizing the data quality evaluation metrics for monitoring data, or any other single evidence stream, would consider all data pertinent to that evidence stream in the reference. Acronyms and abbreviations used within this supplemental file are defined in the table at the end of this file. This supplemental file may also be referred to as 1,1-Dichloroethane Data Quality Evaluation Information for General Population, Consumer, and Environmental Exposure.

Within the contents of this document, 1,1-dichloroethane may be referred to as the acronyms 1,1-DCA and 1,1-DCE. The acronyms 1,2-DCA, 1,2-DCE, and DCE refer to the chemical 1,2-dichloroethane. The acronyms 1,1,2-TCE, 1,1,2-TCA, and TCE refer to the chemical 1,1,2-trichloroethane. The acronym trans1,2-DCE refers to the chemical trans-1,2-dichloroethylene. The acronym 1,2-DCP refers to the chemical 1,2-dichloropropane

Table of Contents

Study Citation:	Ferrario, J. B., Lawler, G. C., Deleon, I. R., Laseter, J. L. (1985). Volatile organic pollutants in biota and sediments of Lake Pontchartrain. Bulletin of Environmental Contamination and Toxicology 34(1):246-255.
HERO ID:	28993

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sizes of collected oysters and clams not reported; depth and method of sediment sampling not reported; location of sampling only broadly described.
	Metric 2:	Analytical Methodology	Low	GC-MS. Highly modified version of National Bureau of Standards procedure for organics (1976). Described analysis methods adequately. LOD not explicitly specified.
	Metric 3:	Biomarker Selection	N/A	Parent chemical analyzed in environmental media; tissue analyzed was not specified; presumably whole animal (they are consumed whole).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Louisiana, New Orleans, Lake Pontchartrain
	Metric 5:	Currency	Low	1980, May, June
	Metric 6:	Spatial and Temporal Variability	Low	Only 5 oyster samples and 1 composite clam sample analyzed per location; 4 areas sampled.
	Metric 7:	Exposure Scenario	High	Clam and oyster tissues sampled and analyzed for organic chemicals; relevant to both human and biota exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Oysters: only the mean of 5 samples (at least 4 g tissue each) reported for each location. Clams: single composite sample sample (4 g tissue) per location.
	Metric 9:	Quality Assurance	Medium	Three recovery standards; 1 system blank for every 4 samples;
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Few sampling locations, single concentration reported for clams and for oysters per location, single sampling season.

Overall Quality Determination Low

Study Citation:	Westrick, J. J., Mello, J. W., Thomas, R. F. (1984). The groundwater supply survey. Journal of the American Water Works Association 76(5):52-59.
HERO ID:	29196

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling equipment, log procedure, and map included
	Metric 2:	Analytical Methodology	High	USEPA methods 502.1 and 503.1; quantitation limits in tables
	Metric 3:	Biomarker Selection	N/A	groundwater
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	U.S.
	Metric 5:	Currency	Low	published 1984
	Metric 6:	Spatial and Temporal Variability	High	n = ~500 broken into groups, replicates for a percentage of samples
	Metric 7:	Exposure Scenario	Medium	groundwater
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	median and max
	Metric 9:	Quality Assurance	High	QA discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	variability discussed

Overall Quality Determination High

Study Citation: Lee, L. J. H., Chan, C. C., Chung, C. W., Ma, Y. C., Wang, G. S., Wang, J. D. (2002). Health risk assessment on residents exposed to chlorinated hydrocarbons contaminated in groundwater of a hazardous waste site. Journal of Toxicology and Environmental Health, Part A: Current Issues 65(3-4):219-235.

HERO ID: 33739

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	groundwater sampling from off-site residential wells located 50m to 1KM away from factory; collected samples both upstream and downstream; water drawn directly from wells with a bailer and stored in brown bottles (completely filled) containing 30mg preadded ascorbic acid; stored at 4C; timing of sampling not discussed
	Metric 2:	Analytical Methodology	Medium	purge and trip device used to collect analytes; GC/MS; calibration by internal standard; LOD ranged from 0.01 to 0.1 ug/L
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taoyuan City, Taiwan
	Metric 5:	Currency	Low	1999-2000
	Metric 6:	Spatial and Temporal Variability	High	49 off-site residential wells; downstream - 69 samples from 44 wells with 1 sample per well for 32 wells and 2 to 3 samples per well for the other 12; upstream - 2 samples from 2 wells south of factory and another 3 samples from 3 wells west of factory; 74 groundwater samples total; samples over a year
	Metric 7:	Exposure Scenario	High	groundwater at a hazardous waste site contaminated by manufacturing of electronic appliances after on-site remediation
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 1 provided concentration data; geometric mean and range; arithmetic mean and 95% UCL; description of data set not summarized
	Metric 9:	Quality Assurance	Low	reproducibility was evaluated with 9 set of samples and calculated from 2 duplicate analyses; relative mean deviation of duplicates was 20% for most of the VOCs
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no discussion of variability or uncertainty

Overall Quality Determination Medium

Study Citation:	Serrano-Trespalacios, P. I., Ryan, L., Spengler, J. D. (2004). Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City metropolitan area. Journal of Exposure Analysis and Environmental Epidemiology 14 Suppl 1(S1):S118-S132.
HERO ID:	56224

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology described
	Metric 2:	Analytical Methodology	Medium	No LOD reported, MDL reported
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Mexico City Metropolitan Area
	Metric 5:	Currency	Low	Data collected between March 1998 and February 1999
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates
	Metric 7:	Exposure Scenario	High	Personal exposure for families living within 5 km radius of 5 central monitoring sites - indoor and outdoor exposures dynamics
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data provided
	Metric 9:	Quality Assurance	High	QA samples and analytical QC provided and described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Sources of variability discussed with respect to study goals.

Overall Quality Determination High

Study Citation:	Lindstrom, A. B., Proffitt, D., Fortune, C. R. (1995). Effects of modified residential construction on indoor air quality. Indoor Air 5(4):258-269.
HERO ID:	78782

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The air sampling methodology was described in detail and is scientifically sound.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were described, including instrumentation and LOD but recoveries were not reported.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed air samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	United States
	Metric 5:	Currency	Low	The study took place in 1993.
	Metric 6:	Spatial and Temporal Variability	Low	24-h air sampling was done in 9 homes, twice.
	Metric 7:	Exposure Scenario	Medium	The data likely represent a relevant exposure scenario related to indoor air in Colorado, but the sample size limits the study results generalizability.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Limited summary statistics were reported per study site (geometric means).
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was not characterized. Uncertainties were briefly discussed.

Overall Quality Determination Medium

Study Citation: Campbell, M. E., Benson, B. A., Muir, M. A. (1995). Urban air quality and human health: A Toronto perspective. Canadian Journal of Public Health 86(5):351-357.

HERO ID: 79425

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Few sampling methods reported
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical method not described
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Toronto, Canada
	Metric 5:	Currency	Low	Sampling conducted in 1990 and study published in 1995
	Metric 6:	Spatial and Temporal Variability	Medium	n=100 but no replicates
	Metric 7:	Exposure Scenario	Medium	Source of exposure not well characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported
	Metric 9:	Quality Assurance	Low	QA/QC implied. SD provided in table 3.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No gaps nor limitations reported

Overall Quality Determination Uninformative

Study Citation:	Bouhamra, W. S., Buhamra, S. S., Thomson, M. S. (1997). Determination of volatile organic compounds in indoor and ambient air of residences in Kuwait. Environment International 23(2):197.
HERO ID:	83230

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Limited information reported about sampling methodology (such as sampling procedures, performance of the sampler)
	Metric 2:	Analytical Methodology	Low	LOD nor LOQ reported
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Kuwait
	Metric 5:	Currency	Low	Data collected December 1994 to January 1995
	Metric 6:	Spatial and Temporal Variability	Medium	no replicates
	Metric 7:	Exposure Scenario	High	Indoor and ambient air
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data provided
	Metric 9:	Quality Assurance	Low	Limited QA/QC reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited information provided on gaps and limitations

Overall Quality Determination Medium

Study Citation:	Smith, S. A., Mecham, C. C., Schimmoller, B. J., Wheeler, M. H. (1997). Using measured contaminant concentrations versus modeling for CERCLA-related air pathway risk assessments. Toxicology and Industrial Health 13(2-3):231-245.
HERO ID:	84433

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description, cited EPA method TO-14
	Metric 2:	Analytical Methodology	High	Detailed analytical methodology
	Metric 3:	Biomarker Selection	N/A	Did not test for biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Utah, USA
	Metric 5:	Currency	Low	Sampling in 1993 and 1994
	Metric 6:	Spatial and Temporal Variability	Low	15 samples, no replicate sites
	Metric 7:	Exposure Scenario	High	Data closely represents a relevant exposure scenario
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	9 chlorinated VOCs were measured, but only 3 had measurements above the LODs (TCE, TCA, and Chloroform). The paper however only reports results for two in a table: TCE and Chloroform, to compare with modeled results. The results are reported as ranges for two time periods (March and July) in 1994. Background concentration ranges for 5 VOCs were also reported from a distance far away from the study area, although there is no other detail of where the background samples were collected. Indoor air results for DCE are reported as below the detection limit.
	Metric 9:	Quality Assurance	Low	Limited description of QA QC techniques, analyzed control samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was not characterized, uncertainties were discussed

Overall Quality Determination Medium

Study Citation:	Lesage, S., Jackson, R. E., Priddle, M. W., Riemann, P. G. (1990). Occurrence and fate of organic solvent residues in anoxic groundwater at the Gloucester Landfill, Canada. Environmental Science and Technology 24(4):559-566.
HERO ID:	195913

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	groundwater collected in May from selected monitoring wells (Fig 3); set of 5 samples collected from piezometers; others from bundle-type multilevel samples by peristaltic pumps; collected in glass vials and kept on ice
	Metric 2:	Analytical Methodology	Low	EPA method 624; GC/MS; no detection limits provided
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ottawa, Ontario, Canada (Fig 1)
	Metric 5:	Currency	Low	May 1988
	Metric 6:	Spatial and Temporal Variability	Medium	37 samples, collected in May, from selected monitoring points within the monitoring well network (Fig 3)
	Metric 7:	Exposure Scenario	High	contaminated aquifer from disposal of organic chemicals (incinerated laboratory organic solvents and wood preservatives) in trenches at a waste disposal site; disposal took place from 1969-1980
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides a range and DF; Table III provides concentration per monitoring well; individual data not provided; no SI
	Metric 9:	Quality Assurance	Low	QA/QC not discussed but implied by standard lab protocols
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	minimal discussion of variation p.564

Overall Quality Determination Medium

Study Citation:	Squillace, P. J., Moran, M. J., Price, C. V. (2004). VOCs in shallow groundwater in new residential/commercial areas of the United States. Environmental Science and Technology 38(20):5327-5338.
HERO ID:	200607

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	19 shallow groundwater sites in urban areas as part of the National Water-Quality Assessment (NAWQA) Program of the USGS; 518 monitoring wells; Table 1 describes the hydrogeologic conditions of each site and number of wells; wells installed by USGS, screened near top of water table; samples collected in amber glass vials and stored on ice or refrigerated
	Metric 2:	Analytical Methodology	Low	purge-and-trap, capillary column gas chromatography/massspectrometry; GC/MS; detection limits not provided
	Metric 3:	Biomarker Selection	N/A	Did not use biomarkers.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	urban sites geographically distributed across the United States (Fig 1)
	Metric 5:	Currency	Low	1996-2002
	Metric 6:	Spatial and Temporal Variability	High	19 locations; 518 wells; sampling over a long period of time
	Metric 7:	Exposure Scenario	High	concentrations in shallow groundwater in 19 urban areas representing various hydrogeologic conditions and aquifers
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	chemical occurrence summarized and listed in SI (Table A1-A3); Table 2 provides the DF
	Metric 9:	Quality Assurance	High	Source solution blanks, equipment blanks, field blanks,laboratory blanks, replicate samples, and spike samples aresome of the types of quality-control/-assurance samples thatwere collected on a routine basis
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some of the smallest reported concentrations were estimated, indicating quantitative uncertainty; compared DF with those of previous investigations

Overall Quality Determination High

Study Citation:	Fan, C., Wang, G. S., Chen, Y. C., Ko, C. H. (2009). Risk assessment of exposure to volatile organic compounds in groundwater in Taiwan. Science of the Total Environment 407(7):2165-2174.
HERO ID:	631540

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The authors did not describe the sampling procedure in detail, but cited protocols from the Taiwan EPA.
	Metric 2:	Analytical Methodology	High	The analytical methods and instrument were described, including recoveries and LOD. Analytical methods conducted by TEPA (NIEA W785.54B).
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taiwan
	Metric 5:	Currency	Medium	The samples were collected in 2005.
	Metric 6:	Spatial and Temporal Variability	High	n=54, with samples collected on three separate occasions in duplicates.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to o-DCB present in groundwater samples from remediation sites in Taiwan.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations were reported. Summary statistics not reported.
	Metric 9:	Quality Assurance	Medium	QA/QC techniques were briefly described, including the use of control samples. Recoveries between 90%-110%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized. Uncertainties and limitations were briefly discussed.

Overall Quality Determination Medium

Study Citation:	Wu, T., Bhanegaonkar, A. J., Flowers, J. W. (2006). Blood concentrations of selected volatile organic compounds and neurobehavioral performance in a population-based sample. Archives of Environmental and Occupational Health 61(1):17-25.
HERO ID:	632720

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Blood specimen collection procedures briefly described, but NHANES methodology with known validated publicly available methods.
	Metric 2:	Analytical Methodology	High	Blood specimen sample analysis procedures briefly described, but NHANES methodology with known validated publicly available methods.
	Metric 3:	Biomarker Selection	N/A	Sampling for parent chemicals of interest in blood samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	NHANES III US sampling
	Metric 5:	Currency	Low	Dates of samples not specifically stated, but NHANES III sampling 1988-1994.
	Metric 6:	Spatial and Temporal Variability	Medium	Spatial variability across NHANES nationwide sampling, however single blood samples provided by each participant for 1,018 participants.
	Metric 7:	Exposure Scenario	Medium	Participant characteristics summarized for nationwide NHANES sample.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Most key criteria met. Lack of frequency of detection and raw data.
	Metric 9:	Quality Assurance	Medium	NHANES Q/A methodologies, although not detailed within study.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Most key criteria met, authors briefly discussed study limitations of lack of accounting for complex sampling design of NHANES due to random sample of NHANES participants.
Overall Quality Determination			**Medium**	

Study Citation:	Götz, R., Bauer, O., Friesel, P., Roch, K. (1998). Organic trace compounds in the water of the River Elbe near Hamburg: Part I. Chemosphere 36(9):2085-2101.
HERO ID:	644836

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedure, sample storage, site characteristics are described in detail.
	Metric 2:	Analytical Methodology	High	analytical methods well described. LOD reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in surface water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The two locations of sampling in Germany are well described.
	Metric 5:	Currency	Low	Samples were collected in 1992-1993.
	Metric 6:	Spatial and Temporal Variability	Medium	20 samples were collected over the two year period in each of the two locations. No replicates
	Metric 7:	Exposure Scenario	High	The River Elbe is an appropriate site for environmental exposures.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The median, minimum and maximum concentrations are provided. The raw data is not provided.
	Metric 9:	Quality Assurance	High	The study provided QA/QC measures.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some variability discussed in Tables 2a, 2b, and 5, but limited discussion of uncertainties.

Overall Quality Determination High

Study Citation:	Dewulf, J. P., Van Langenhove, H. R., Van der Auwera, L. F. (1998). Air/water exchange dynamics of 13 volatile chlorinated C1- and C2-hydrocarbons and monocyclic aromatic hydrocarbons in the southern North Sea and the Scheldt estuary. Environmental Science and Technology 32(7):903-911.
HERO ID:	644857

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The authors described the sampling site and included a map. The authors also described the sampling equipment and sampling procedures. Sample storage conditions were described but not storage duration times. The performance and calibration of the sampler for the air samples was not reported.
	Metric 2:	Analytical Methodology	High	The authors described the analytical procedures used for water and air samples. The authors described recovery experiments and limits of detection for water sample analysis. The authors described calibration and recovery experiments and limits of detection for air samples.
	Metric 3:	Biomarker Selection	N/A	Water and air, no biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The authors identified the study site as the North Sea in the Scheldt Estuary.
	Metric 5:	Currency	Low	Samples were collected between September 1994 through December 1995.
	Metric 6:	Spatial and Temporal Variability	High	Authors reported collected 38 samples from multiple sites over different temporal sampling campaigns. Replicate air samples were collected.
	Metric 7:	Exposure Scenario	Medium	The samples were collected from an estuary without specific known contamination.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Authors report the sample size, mean, 25th, 75th and median concentrations for air and water. They also report the frequency of detection. No standard deviation was reported nor was the individual sample concentrations.
	Metric 9:	Quality Assurance	Medium	Authors did not report collecting control air or water samples. Recovery experiments were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	A standard deviation was not reported. There was also no discussion on study limitations however the study did present the mean, 25th, 75th and median concentrations.

Overall Quality Determination Medium

Study Citation:	Kawata, K., Tanabe, A., Saito, S., Sakai, M., Yasuhara, A. (1997). Screening of volatile organic compounds in river sediment. Bulletin of Environmental Contamination and Toxicology 58(6):893-900.
HERO ID:	644898

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling details lacking. Sample storage described but no description of how sediment samples were collected.
	Metric 2:	Analytical Methodology	High	GC/MS method described and LODs reported with results.
	Metric 3:	Biomarker Selection	N/A	River sediment
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Niigata, Japan
	Metric 5:	Currency	Low	Samples collected in September 1995.
	Metric 6:	Spatial and Temporal Variability	Medium	7 samples were prepared per sediment.
	Metric 7:	Exposure Scenario	Medium	VOCs from sediment were measured in headspace.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data not provided but summary data is adequate.
	Metric 9:	Quality Assurance	High	Recoveries listed in detail.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limitations were discussed briefly.

Overall Quality Determination Medium

Study Citation:	Roose, P., Brinkman, U. A. (1998). Determination of volatile organic compounds in marine biota. Journal of Chromatography A 799(1-2):233-248.
HERO ID:	645743

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Minimally described; exact location of fish samples not reported; fish (whiting and dab) lengths recorded; analyzed individually; 25 collected from two separate populations.
	Metric 2:	Analytical Methodology	High	Method development; 1 blank per 5 samples, RSD, %recovery, and LOD determined; methods extensively described.
	Metric 3:	Biomarker Selection	N/A	Parent compound was analyzed in liver and in muscle tissue of fish; proportion fat recorded.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Marine, continental shelf off Belgium.
	Metric 5:	Currency	Low	Sampling year not reported, although likely 1997 (or 1996). Publication in 1998.
	Metric 6:	Spatial and Temporal Variability	Medium	25 individual fish samples per species (whiting and dab); two separate populations sampled; intra- and inter-sample variation considered; within population variation in concentrations in muscle and in liver evaluated. Single year of sampling. Unclear if there are replicates.
	Metric 7:	Exposure Scenario	High	Concentration if fish muscle and liver relevant to human and ecological exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Graphic display (Figure 7) of max, min, median, and 25th and 75th percentiles; tabulated results (Table 5) for median, mean, and relative standard deviation, and sample size. No individual points reported.
	Metric 9:	Quality Assurance	High	Extensive discussion of factors that could affect analysis, including: precision, LOD, accuracy, within sample variation, and comparisons with spectral libraries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	DCE and EDC not included in reported results for fish samples; unclear whether all samples were below detection limit or not. Limitations not reported.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (1984). 1981 Buffalo, New York area sediment survey (bass).
HERO ID:	645755

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sediment sampling methodology was well described.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were described, including the LOD but not recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	United States.
	Metric 5:	Currency	Low	Samples were collected in 1981.
	Metric 6:	Spatial and Temporal Variability	Low	Over 150 samples were collected from different sites along the river bank sites were rarely sampled more than once. Not all site samples were analyzed. The data reported used 77 samples from 65 sites.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to polluted sediments.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The raw data is presented in the supplemental materials in table 1 (Appendix C). Summary statistics were not reported.
	Metric 9:	Quality Assurance	High	Methods detailed in Appendix F.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized, nor is uncertainty discussed or characterized.

Overall Quality Determination Medium

Study Citation:	Yamamoto, K., Fukushima, M., Kakutani, N., Kuroda, K. (1997). Volatile organic compounds in urban rivers and their estuaries in Osaka, Japan. Environmental Pollution 95(1):135-143.
HERO ID:	645789

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Site description was provided in details. But the sampling process lacked the description about calibration of sampler.
	Metric 2:	Analytical Methodology	Low	Analytical method was described (GC-MS). MDLs were reported in Figure 1 for select chemicals. However, no MDLs were available for 1,2-dichlorobenzene, 1,4-dichlorobenzene, trans-1,2-dichloroethene (TDCE), and 1,1,2-trichloroethane.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in urban rivers and their estuaries.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Osaka, Japan
	Metric 5:	Currency	Low	August 1993 to February 1995
	Metric 6:	Spatial and Temporal Variability	Medium	30 sites all over the rivers and their estuaries. No replicates
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenario: drinking water and wastewater were identified.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Supplementary or raw data were not reported.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's method and protocol.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study has limited characterization of variability in the population/media studied and discussion of uncertainties, limitations, or gaps.

Overall Quality Determination Medium

Study Citation:	Colomb, A., Yassaa, N., Williams, J., Peeken, I., Lochte, K. (2008). Screening volatile organic compounds (VOCs) emissions from five marine phytoplankton species by head space gas chromatography/mass spectrometry (HS-GC/MS). Journal of Environmental Monitoring 10(3):325-330.
HERO ID:	657285

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Procedures for culturing and sampling phytoplankton were mostly described, but missing information on storage conditions post sample collection.
	Metric 2:	Analytical Methodology	Medium	Detection limit was only provided as a range (0.05 to 5 pptv), and sample extraction methods were unclear.
	Metric 3:	Biomarker Selection	N/A	Parent chemicals were tested in cultured marine phytoplankton.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Only some geographic location is reported, namely that one of the species was collected in the South Atlantic off South Africa. The origin of the four other species studied were not reported.
	Metric 5:	Currency	Low	Only a publication date of 2008 was reported.
	Metric 6:	Spatial and Temporal Variability	Low	Sample size was small (5 cultures), but more than five replicates were collected from each.
	Metric 7:	Exposure Scenario	Low	The paper studied phytoplankton as a source of VOCs, but how this translates into a possible exposure scenario was neither discussed nor implied.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were reported in Table 1, but most summary statistics were missing.
	Metric 9:	Quality Assurance	Medium	There was some discussion of QA/QC techniques via blank tests.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	An uncertainty of 15% for detection limits and a possibility of bacterial contamination were reported. No other discussion of uncertainties, limitations, and gaps were provided Variance was not characterized either.

Overall Quality Determination Low

Study Citation:	Bell, J., Melcer, H., Monteith, H., Osinga, I., Steel, P. (1993). Stripping of volatile organic compounds at full-scale municipal wastewater treatment plants. Water Environment Research 65(6):708-716.
HERO ID:	658661

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Appropriate methodology and clearly described
	Metric 2:	Analytical Methodology	High	Appropriate methodology and clearly described
	Metric 3:	Biomarker Selection	N/A	Testing for parent chemical in environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Geographic area clearly reported
	Metric 5:	Currency	Low	Sampling date not reported, but likely between 1988 and 1993.
	Metric 6:	Spatial and Temporal Variability	Medium	8 (4 in duplicate) samples, each 24-hour composites, at each of 4 sampling locations to account for variability.
	Metric 7:	Exposure Scenario	Medium	Primarily addresses air pathway, additional monitoring of wastewater effluent, both routes of potential exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data not reported
	Metric 9:	Quality Assurance	Medium	More thorough QA documentation previously published (Bell et al. 1988)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	More thorough QA documentation previously published (Bell et al. 1988)

Overall Quality Determination Medium

Study Citation:	Martinez, E., Llobet, I., Lacorte, S., Viana, P., Barcelo, D. (2002). Patterns and levels of halogenated volatile compounds in Portuguese surface waters. Journal of Environmental Monitoring 4(2):253-257.
HERO ID:	659075

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	surface water samples collected manually from shore and bridge at middle of river; glass vials immersed in water, capped, placed in freezer; 46 sampling points during 14 months; map or description of sampling locations not provided
	Metric 2:	Analytical Methodology	High	EPA Method 502, purge and trap techniques; GC-ECD; quantification by external standard using calibration data (Table 1); LOD and recoveries presented in Table 1
	Metric 3:	Biomarker Selection	N/A	Surface water sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Portugal
	Metric 5:	Currency	Low	April 1999-May 2000
	Metric 6:	Spatial and Temporal Variability	High	644 samples; 46 sites over 14 months
	Metric 7:	Exposure Scenario	Medium	sampling surface waters to determine ”hot spots” in relation to activities of each area; studying influence site (agriculture or industrial); location of sampling sites and description of each not provided
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 provides percentage and number of detected positive samples; Fig 1 provides the mean, max, and min throughout the monitoring study; p. 257 has a paragraph discussing results; individual results not provided
	Metric 9:	Quality Assurance	High	percentage recovery (R) provided in Table 1 (94%)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	standard deviation reported in Table 1; discusses variance on p.257

Overall Quality Determination Medium

Study Citation:	Brack, W., Rottler, H., Frank, H. (1998). Volatile fractions of landfill leachates and their effect on Chlamydomonas reinhardtii: In vivo chlorophyll a fluorescence. Environmental Toxicology and Chemistry 17(10):1982-1991.
HERO ID:	659838

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is discussed and is generally appropriate for the chemical and media of interest, however, one or more pieces of sampling information is not described such as sample filtration. The missing information is unlikely to have a substantial impact on results.
	Metric 2:	Analytical Methodology	Low	Analytical methodology including equipment and reagents is discussed in detail and is clear and appropriate for the chemical and media of interest; however, one or more pieces of analytical information is not described such as LOQ, LOD, detection limits, and/or reporting limits is not reported.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in leachates from three hazardous waste sites.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Geographic location is reported; Germany.
	Metric 5:	Currency	Low	Collection date not reported but publication date provided (1997).
	Metric 6:	Spatial and Temporal Variability	Low	Sampling approach poorly captures variability of environmental contamination in population/scenario/media of interest. For example, the study used a low sample size (n= 4), and replicate samples were collected only from one hazardous waste site.
	Metric 7:	Exposure Scenario	Medium	The data likely represent the relevant exposure scenario. A few key pieces of information such as use of exposure controls, microenvironment may not be described but the deficiencies are unlikely to have a substantial impact on the characterization of the exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Individual sample concentrations reported in the study (Table 4) allowing summary statistics to be reproduced.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Low	Variability and uncertainty not discussed.

Overall Quality Determination Medium

Study Citation:	Chen, C. S., Zoltek, J., Jr (1995). Organic priority pollutants in wetland-treated leachates at a landfill in central Florida. Chemosphere 31(6):3455-3464.
HERO ID:	659873

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is only briefly discussed, lacking essential information about equipment, conditions, and storage.
	Metric 2:	Analytical Methodology	Low	GC/MS was used for the analysis; however, LOD was not provided.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in groundwater, surface water, and sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Orange County, Orlando, Florida
	Metric 5:	Currency	Low	The study provided the first year sampling date as 1989-1990, and second year sampling occurred April 1992 to March 1993.
	Metric 6:	Spatial and Temporal Variability	Low	Study reported on the number of monitoring wells (n=4), surface water (n=7), and wetland sampling stations (n=7). However, it is unclear how many samples were collected from each.
	Metric 7:	Exposure Scenario	Medium	The data likely represent the relevant exposure scenario (surface water/groundwater).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Supplementary or raw data were not reported.
	Metric 9:	Quality Assurance	Medium	The study provided quality control measures; however, one or more pieces of QA/QC information was not described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties, limitations, and data gaps were not discussed.

Overall Quality Determination Low

Study Citation:	Hallbourg, R. R., Delfino, J. J., Miller, W. L. (1992). Organic priority pollutants in groundwater and surface water at three landfills in North Central Florida. Water, Air, and Soil Pollution 65(3-4):307-322.
HERO ID:	660040

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	3 north central Florida landfills were studied - OCLF was collected twice during study period for groundwater, surface water, sediment and aquatic biota; ACSWLF was quarterly groundwater sampling and landfill leachate concentrations also provided; and ACNELF was groundwater and surface water samples collected quarterly. Sample collection sites (Fig 2-4) discussed p. 313; sampling equipment, procedures, and storage not discussed
	Metric 2:	Analytical Methodology	Low	detection limits not provided; EPA Method used to analyze samples discussed in Section 2.2
	Metric 3:	Biomarker Selection	N/A	NA - Ground and surface water, no biomarkers needed
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Orange County, Florida
	Metric 5:	Currency	Low	1985-1990
	Metric 6:	Spatial and Temporal Variability	Low	3 wells sites for OCLF; 4 surface water sites for ACSWLF; 3 monitoring sites for ACNELF; number of samples per site provided in Table 1 (ranging from 1-23 samples per site); sampled twice to quarterly; not well defined per media; limited discussion/details
	Metric 7:	Exposure Scenario	High	contaminated groundwater, surface water, sediment, biota and leachate from three landfills
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 1 provides concentration for 9 sampling sites; no other data provided
	Metric 9:	Quality Assurance	Low	QA/QC no discussed but implied through EPA method used
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no measure of variance or discussion of uncertainties

Overall Quality Determination Low

Study Citation:	Huybrechts, T., Dewulf, J., Van Langenhove, H. (2005). Priority volatile organic compounds in surface waters of the southern North Sea. Environmental Pollution 133(2):255-264.
HERO ID:	660096

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample method and equipment, sample storage, and site characteristics are well described.
	Metric 2:	Analytical Methodology	High	Analytical methods well described. LOD provided. Replicate samples analyzed.
	Metric 3:	Biomarker Selection	N/A	Surface water sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Details of the sampling sites in the North Sea are provided.
	Metric 5:	Currency	Low	Samples were collected 1998-2000.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from 10 locations over two years for a total of 47 samples. No indication of replicate analysis of samples.
	Metric 7:	Exposure Scenario	High	Location is relevant for environmental exposures.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are not provided. The mean, median, maximum, 25th percentile and 75th percentile are provided.
	Metric 9:	Quality Assurance	High	QA/QC methods were described in detail.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability is discussed but limited discussion of uncertainties.

Overall Quality Determination High

Study Citation:	Huybrechts, T., Dewulf, J., Van Langenhove, H. (2004). Spatial and temporal variability of priority volatile organic compounds in the Scheldt estuary. Water Research 38(14-15):3241-3250.
HERO ID:	660097

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The authors reported study site characteristics, sampling equipment, procedure, design, and storage conditions.
	Metric 2:	Analytical Methodology	High	The authors report the extraction method, analytical instruction, recovery results and LODs.
	Metric 3:	Biomarker Selection	N/A	Water samples
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The authors report the study location.
	Metric 5:	Currency	Low	Samples were collected between 1998-2000.
	Metric 6:	Spatial and Temporal Variability	High	The authors collected 84 samples total over different sites and different sampling years. The authors collected multiple samples from the same estuary at the same time point (replicates).
	Metric 7:	Exposure Scenario	Medium	The authors describe the microenvironment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The authors reported summary statistics including minimums, maximums, mean, standard deviation, median, 25th and 75th percentile, detection frequency and the number of samples. The authors did not report individual sample data.
	Metric 9:	Quality Assurance	High	The authors reported following standard European QA methods. They reported recovery results, they analyzed reference materials,
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors discussed the variability in the concentrations across the sampling locations and time, but they did not discuss the uncertainty of the study, data gaps, or limitations.

Overall Quality Determination Medium

Study Citation:	Gryder-Boutet, D. E., Kennish, J. M. (1988). Using headspace sampling with capillary column gc-ms to analyze trace volatile organics in water and wastewater. Journal of the American Water Works Association 80(10):52-55.
HERO ID:	660814

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	paper reports wastewater from monitoring wells which draw water from first confining aquifer located on sites that include active and inactive landfills; no further sampling methodology on samples from wastewater versus landfill leachate; high uncertainty in sampling methods used
	Metric 2:	Analytical Methodology	Low	headspace sampling combined with capillary column GC/MS; detection limits not reported
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals from wastewater samples. No additional information is provided on these wastewater samples (e.g., are they effluent or influent from a WWTP or industrial discharges?).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	Critically Deficient	geographic location not reported or discussed
	Metric 5:	Currency	Low	date of sampling not provided; paper published in 1988
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	sample size not reported; sample location and timing not reported
	Metric 7:	Exposure Scenario	Low	samples ranged from pure surface water to highly contaminated landfill leachate; description of various sampling methodology and locations not provided
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 5 provides ”peak identification” and concentration in landfill leachate; no further data provided
	Metric 9:	Quality Assurance	Low	calibration curved used; reported good recovery, but not sure if that applies to all samples or which ones
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no discussion of variability or uncertainty

Overall Quality Determination — Uninformative

Study Citation:	Schrab, G. E., Brown, K. W., Donnelly, K. C. (1993). Acute and genetic toxicity of municipal landfill leachate. Water, Air, and Soil Pollution 69(1-2):99-112.
HERO ID:	661846

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Described some sampling methodology (e.g., equipment, site characteristics) but nothing about storage conditions
	Metric 2:	Analytical Methodology	Low	equipment described; EPA protocol referenced; no LOD
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in landfill leachate
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	U.S.
	Metric 5:	Currency	Low	published 1992
	Metric 6:	Spatial and Temporal Variability	Low	Five samples total - one each from four landfills and one groundwater monitoring well. No replicates
	Metric 7:	Exposure Scenario	High	Potential contamination of groundwater by landfill leachate is relevant if there are drinking water wells.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	average and range provided. no raw data
	Metric 9:	Quality Assurance	Low	QA not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variability and uncertainty not discussed

Overall Quality Determination Medium

Study Citation:	Huff, G. F., Braun, C. L., Lee, R. W. (2000). Assessment of potential for natural attenuation of chlorinated ethenes and ethanes in ground water at a petrochemical reclamation site, Harris County, Texas.
HERO ID:	664358

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Groundwater collected from wells using peristaltic pump after pumping for min of 30 minutes at 0.5 L/min prior. Figure 3 depicted locations of wells. Table 2 listed the vertical screening intervals per well. Further details pertaining to measuring concentration in the groundwater is not provided.
	Metric 2:	Analytical Methodology	Low	Extraction performed by USGS GC/MS and method 8260. Detection limits for this chemical was not reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in groundwater.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Harris County, Texas.
	Metric 5:	Currency	Low	Samples were collected in 1999.
	Metric 6:	Spatial and Temporal Variability	Medium	Sixteen wells were measured between Feb 8-10 without replicates.
	Metric 7:	Exposure Scenario	Medium	Report describes groundwater conditions at a petrochemical reclamation site and and discusses evidence for the occurrence and rates of natural attenuation in groundwater. However, populations of interest and how the groundwater is used were not defined.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 provides concentration per well but not summary statistics.
	Metric 9:	Quality Assurance	Medium	Table 3 provided field blank, triple blank, and method blank; recoveries were not discussed/provided.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The spatial distribution of chemical between the wells (Fig 3) and along groundwater flowpath (fig 4) were characterized. However, paper was missing a characterization of data variance and discussion of limitations/uncertainties.

Overall Quality Determination Medium

Study Citation:	Moon, S., Adamski, J. M., Lichtman, A. (1990). Profile of volatile organic chemicals in Nassau county groundwater. ASTM Special Technical Publication No. 1062 :50-63.
HERO ID:	666861

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The authors reported that the samples were collected from the Nassau County Health Department's Bureau of Public Water Supply and they gave examples of the types of sampling points (e.g., for "drinking water samples," wellheads, taps selected randomly from private residences, hydrants, and other access points in the distribution system), but they did not provide a map of the specific sampling sites or other details on how sampling locations were selected or how many distinct locations there were. The vessels used for sample collection, sample collection procedure, and sample storage conditions and duration were reported.
	Metric 2:	Analytical Methodology	High	The method used was recommended by the NY Dept. of Health. The authors reported the analytical equipment used and the detection limits. They analyzed each sample in duplicate and reported doing recovery experiments daily and calibration experiments once a month.
	Metric 3:	Biomarker Selection	N/A	Parent chemicals were analyzed in water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The authors described the geographic location, Nassau County, NY.
	Metric 5:	Currency	Low	"Most" of the samples were collected in 1987. The paper was published in 1990.
	Metric 6:	Spatial and Temporal Variability	Medium	Replicate samples were not reported, but a total of 973 groundwater samples were collected in 1987. It was unclear the exact timing of sample collection (e.g., over how many months the samples were collected). Samples came from an entire county, a relatively large geographic area.
	Metric 7:	Exposure Scenario	Medium	Drinking water is a relevant exposure scenario. There were no exposure "controls," and the sources of this chemical were not assessed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	The authors reported the frequency of detection in graphical form, and they reported the number of samples within a range of concentrations but not clear summary statistics characterizing the concentration data (no average, SD, etc.). They also did not report individual sample concentrations.
	Metric 9:	Quality Assurance	High	The authors cited that they carried out the analysis according to the New York State's quality assurance requirements. Samples were analyzed in duplicate. They also measured recoveries daily and recalibrated using standards monthly. They did not report any QC issues.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No standard deviation was reported, but some information about variability was included in the text and figures. The authors did not discuss study limitations or uncertainty.

Overall Quality Determination Medium

Study Citation:	Gasperi, J., Garnaud, S., Rocher, V., Moilleron, R. (2009). Priority pollutants in surface waters and settleable particles within a densely urbanized area: Case study of Paris (France). Science of the Total Environment 407(8):2900-2908.
HERO ID:	697727

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling location was well described but there were no details on sampling methods for water and settleable particle collection.
	Metric 2:	Analytical Methodology	Medium	GC-MS and LC-MS were used, LOQs were provided in Table 2.
	Metric 3:	Biomarker Selection	N/A	Surface water sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Parisian river
	Metric 5:	Currency	Medium	2006-2007
	Metric 6:	Spatial and Temporal Variability	Medium	Surface water (n=60) and sediment (n=20). No indication of replicate sampling or analysis
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenario (the population/scenario/media of interest).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean, min, max concentrations were provided; individual data not reported
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Medium	The study has limited discussion of key uncertainties, limitations, and data gaps.
Overall Quality Determination			**Medium**	

Study Citation:	Sabel, G. V., Clark, T. P. (1984). Volatile organic compounds as indicators of municipal solid waste leachate contamination. Waste Management & Research 2(2):119-130.
HERO ID:	724484

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Leachate and groundwater from 20 MSW landfills and two dumps (Fig 1 shows location of sampling sites) that described in detail. Section 2 - Methods; samples collected in 40-ml glass vials without head space; 4 vials per sample; samples iced and analyzed within 48 hr; P.122 describes collection of leachate and groundwater samples.
	Metric 2:	Analytical Methodology	Low	Analyses followed USEPA Method 601. Detection limits not provided.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Minnesota, USA (Fig 1)
	Metric 5:	Currency	Low	Study published in 1984.
	Metric 6:	Spatial and Temporal Variability	Medium	6 leachate samples; 45 groundwater wells at 13 landfills; 21 groundwater at 8 landfills and 2 dumps. Replicate samples.
	Metric 7:	Exposure Scenario	High	Leachate and groundwater contamination at MSW landfill sites in MN. Table 3 indicates if area is urban or rural.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 provides DF and range for leachate and groundwater. No individual data reported.
	Metric 9:	Quality Assurance	Medium	Field blank carried out at all times. Recoveries not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study mentions that the data is limited. There is comparison of results to other leachate data.

Overall Quality Determination Medium

Study Citation:	Blount, B. C., Mcelprang, D. O., Chambers, D. M., Waterhouse, M. G., Squibb, K. S., Lakind, J. S. (2010). Methodology for collecting, storing, and analyzing human milk for volatile organic compounds. Journal of Environmental Monitoring 12(6):1265-1273.
HERO ID:	737432

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Breast milk sampling procedures and equipment described in detail as manual expression directly into pre-cleaned Vacutainer with immediate replacement of stopper following collection or manual expression into pre-cleaned wide-mouth glass jars with subsequent transfer to low headspace Vacutainer for storage and shipment. Samples stored at 4˚C for less than two weeks prior to analysis for most samples. Insufficient information on number of samples expressed into Vacutainer versus those expressed into wide-mouth glass jars. Insufficient information on number of samples stored for longer than two weeks prior to analyses.
	Metric 2:	Analytical Methodology	Low	Method detection limit calculations described, however chemical-specific limits of detection not reported or referenced. Analytical and extraction methodology noted as modified from existing SPME-GC-MS methodology and referenced (Blount et al., 2006) and described in detail. Authors noted a full set of eight calibrators, including one blank, was analyzed with each set of samples to generate calibration curves for each analytical run. Authors report concentrations for the 10 of the 36 original chemicals with median concentrations higher than the lowest reportable level (LRL), but chemical-specific LRL's and recoveries not reported.
	Metric 3:	Biomarker Selection	N/A	Sampling for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from participants in Baltimore, MD.
	Metric 5:	Currency	Low	Insufficient information on dates of sample collection, 2010 publication date.
	Metric 6:	Spatial and Temporal Variability	Low	Single samples from 12 participating women for reported total of twelve samples from a convenience, non-statistical sampling approach at single time.
	Metric 7:	Exposure Scenario	Medium	Data likely represent relevant, non-occupational exposure scenario—authors note participants completed questionnaire, however insufficient information on whether data on occupation was collected.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics reported in Table 5 include number of samples, concentration range, mean and median concentrations for those chemicals of interest with median concentrations higher than the lowest reportable level (LRL). Insufficient information regarding chemical-specific frequency of detection, dates of sampling, raw data and lipid-adjustment for breast milk samples.
	Metric 9:	Quality Assurance	Medium	Chemical-specific recoveries not detailed, however extensive details on quality control measures for sampling, extraction and analyses—characterized control human milk sample described as left exposed to room air while breast milk sample expressed with final sample concentrations corrected for the background air VOC levels derived from the control open-air sample. Each analysis batch described as evaluated at two blind QC-concentration levels and evaluated by an independent, blinded QC officer. Lab blanks utilized with blanks described as prepared from VOC-free blank water.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Study characterized sample variability in terms of concentration range, with detailed discussion regarding potential uncertainties derived from sampling, extraction and analysis procedures. Authors discussed differences in reported concentrations between this pilot study and previous reports, however additional potential limitations, such as sample size, not discussed (although this was noted as a pilot study).

Overall Quality Determination Medium

Study Citation:	Yamamoto, N., Okayasu, H., Murayama, S., Mori, S., Hunahashi, K., Suzuki, K. (2000). Measurement of volatile organic compounds in the urban atmosphere of Yokohama, Japan, by an automated gas chromatographic system. Atmospheric Environment 34(26):4441-4446.
HERO ID:	824617

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling method was described: automatic measurements. Calibration was reported, equipment was described.
	Metric 2:	Analytical Methodology	High	GC/MS was performed for analysis, and detection limit was reported to be 0.001ppb.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Hiyoshi, Japan
	Metric 5:	Currency	Low	1994-1997
	Metric 6:	Spatial and Temporal Variability	Medium	11 air samples were reported to be sampled. No replicates were reported to be taken.
	Metric 7:	Exposure Scenario	Medium	Concentrations measured in ambient air but no discussion of exposed population.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Average concentrations with summary statistics were reported. No individual data were reported.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Medium	The study discussed temporal variations. No discussion of limitations.

Overall Quality Determination Medium

Study Citation:	Logue, J. M., Small, M. J., Stern, D., Maranche, J., Robinson, A. L. (2010). Spatial variation in ambient air toxics concentrations and health risks between industrial-influenced, urban, and rural sites. Journal of the Air and Waste Management Association 60(3):271-286.
HERO ID:	1255270

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedure was described, and calibration was carried out. Sampling sites were described,
	Metric 2:	Analytical Methodology	Medium	GC-MS was used to analyze the samples, LOD was not reported.
	Metric 3:	Biomarker Selection	N/A	Paper measures concentration of parent compound in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Pittsburgh, PA
	Metric 5:	Currency	Medium	2006 to 2008
	Metric 6:	Spatial and Temporal Variability	High	4 sites in Pittsburgh were sampled. And each site has 70 days of samples, and 103 days of samples were available for at least 3 sites.
	Metric 7:	Exposure Scenario	Medium	Ambient air
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Average concentrations were reported with summary statistics; no individual data were reported.
	Metric 9:	Quality Assurance	High	The study reported that it followed QA.QC procedures outlined in EPA methods TO-11A and TO-15.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study addressed spatial variability but lacked discussion on limitations.

Overall Quality Determination High

Study Citation:	Hartenstein H-U (1994). Fixed bed activated coke filters for the control of toxic metals and organics from waste incinerators- the second generation. Chemosphere 29(9-11):2071-2081.
HERO ID:	1268067

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The volatile halogenated hydrocarbons were sampled according to VDI method 3482. Sampling procedure, equipment were described.
	Metric 2:	Analytical Methodology	Low	Extraction and analytical methods, instrument (GC/ECD was used to analyze organic pollutants) described. LOD was not provided.
	Metric 3:	Biomarker Selection	N/A	Chemical is in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	Low	1992
	Metric 6:	Spatial and Temporal Variability	Low	2 samples for organic compounds. No replicates.
	Metric 7:	Exposure Scenario	Medium	Releases from waste incinerator. Unclear what the exposed population is.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentration was provided, but lacked summary statistics.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Low	The study has little to no discussion of key uncertainties, limitations, and data gaps.

Overall Quality Determination Medium

Study Citation:	Standard Oil Co, (1984). Comments to reports of groundwater contamination at Pfaudler plant site with attached hydrogeologic report.
HERO ID:	1269532

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is described in the field investigation section
	Metric 2:	Analytical Methodology	Medium	LOD is not reported, analytical methodology described in table 3
	Metric 3:	Biomarker Selection	N/A	DCE in groundwater
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Wheatfield, N.Y.
	Metric 5:	Currency	Low	1984
	Metric 6:	Spatial and Temporal Variability	Medium	10 samples , sample triplicates
	Metric 7:	Exposure Scenario	High	Ground water contamination from a graphite plant
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3, VI and XI presents summary of data, but there is not report on the statistics analysis
	Metric 9:	Quality Assurance	High	QA parameter presented in table XI
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No information on variability or key limitations

Overall Quality Determination **Medium**

Study Citation:	AT&T, (1990). Letter from AT&T to USEPA submitting enclosed initial submission concerning the preliminary soil contamination study with attachments.
HERO ID:	1270143

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology not reported
	Metric 2:	Analytical Methodology	High	Methodology summary reported in page 7
	Metric 3:	Biomarker Selection	N/A	Parent chemical in soils
Domain 2: Representativeness				
	Metric 4:	Geographic Area	Critically Deficient	Geographic location not reported
	Metric 5:	Currency	Low	Samples collected in 1990
	Metric 6:	Spatial and Temporal Variability	Low	4 samples
	Metric 7:	Exposure Scenario	Critically Deficient	Exposure scenario not reported
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data reported in page 24
	Metric 9:	Quality Assurance	High	The study used standardized EPA methods
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Critically Deficient	Variability and uncertainty can't be assessed

Overall Quality Determination Uninformative

Study Citation:	Hazleton Laboratories, (1986). Pollutant analyses on effluent discharge - phenol - with cover letter dated 072387.
HERO ID:	1316229

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methods not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Wisconsin, USA
	Metric 5:	Currency	Low	Sampling in 1986
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size is not reported
	Metric 7:	Exposure Scenario	Low	Data lacks key pieces of information and this impacts the exposure scenario characterization
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized, uncertainties and limitations were not discussed

Overall Quality Determination Uninformative

Study Citation:	Ciba-Geigy, (1981). Briefing for the assistant administrator - record for decision on the Lone Pine Landfill.
HERO ID:	1316232

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology not described
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	New Jersey
	Metric 5:	Currency	Low	Published in 1987
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size is not reported
	Metric 7:	Exposure Scenario	Low	Data may represent a relevant exposure scenario but lacks key data details to support its validity
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only reported maximum concentrations detected, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC details not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability, uncertainties and limitations were not characterized

Overall Quality Determination Uninformative

Study Citation:	Geraghty & Miller Incorporated, (1990). Phase II - Site investigation Bordern site Carson, California (Volume I) with attached appendices and cover letter dated 032790.
HERO ID:	1316237

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology only briefly described
	Metric 2:	Analytical Methodology	Critically Deficient	Not described
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	California
	Metric 5:	Currency	Low	Sampling began in 1987
	Metric 6:	Spatial and Temporal Variability	Low	10 soil samples, 15 water samples
	Metric 7:	Exposure Scenario	High	Provided an exposure assessment
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	High	Detailed QA/QC description
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized, uncertainties were briefly discussed

Overall Quality Determination Uninformative

Study Citation:	Ecology & Environment Inc, (1991). Letter from Vulcan Chemicals to USEPA submitting enclosed final report concerning RCRA facility assessment with tetrachloroethylene and trichloromethane with attachments.
HERO ID:	1316245

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Well described sampling methods
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology was not described
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in USA
	Metric 5:	Currency	Low	Published in 1991
	Metric 6:	Spatial and Temporal Variability	Low	n=15, no replicates
	Metric 7:	Exposure Scenario	Medium	Limited description about the population of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	Only briefly described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability or discussed uncertainties and limitations

Overall Quality Determination Uninformative

Study Citation:	Rohm and Haas, (1981). Landfill monitoring wells and stream survey attach cover letter.
HERO ID:	1332944

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methods not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	Landfill samples no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	Critically Deficient	Geographic location not reported
	Metric 5:	Currency	Low	Published in 1982
	Metric 6:	Spatial and Temporal Variability	Low	7 sampling sites, no replicates
	Metric 7:	Exposure Scenario	Low	Lack of location details, population of interest and methods make this metric uncertain
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentration data, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC was not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability, uncertainties and limitations were not discussed

Overall Quality Determination Uninformative

Study Citation:	ERM, (1988). Hydrogeological investigation at the Union Carbide solvents and materials coating plant with cover letter dated 070688.
HERO ID:	1332986

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Only briefly described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Sampling began in 1985
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Low	The exposure scenario is unclear.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Medium	Limited description of QA/QC techniques, analyzed control samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainties were not characterized.

Overall Quality Determination Uninformative

Study Citation:	Enwright Assoc Inc, (1984). Groundwater and wastewater monitoring report with cover letter dated 120385.
HERO ID:	1335577

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample containers, preparation, and collection procedures followed a 1977 EPA method where applicable.
	Metric 2:	Analytical Methodology	High	Analytical procedures followed various EPA approved methods for NPDES sampling and analysis
	Metric 3:	Biomarker Selection	N/A	The study tested parent chemicals in the environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Testing took place in the US.
	Metric 5:	Currency	Low	Samples were collected in 1984.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected in duplicates at 8 locations.
	Metric 7:	Exposure Scenario	Medium	Data may represent a relevant exposure scenario, but details about the population of interest are missing.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations are provided. Summary statistics are missing.
	Metric 9:	Quality Assurance	High	QA/QC techniques, which consisted of blanks, spiked samples, field replicates, duplicate analysis, and analysis of standards, were described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance and uncertainties were not discussed

Overall Quality Determination Medium

Study Citation:	Versar, (1984). Final report on existing environmental conditions of the upper Manasquan River, New Jersey.
HERO ID:	1335589

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methods not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	New Jersey
	Metric 5:	Currency	Low	Report from 1983
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Low	Missing sufficient details about methods, sample size, limiting the reliability of the data to represent an exposure scenario of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC was not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized, limited discussion on uncertainties and limitations

Overall Quality Determination Uninformative

Study Citation:	Chem-Dyne, (1984). CRA sampling and analytical tables on nine chemicals with attachments.
HERO ID:	1335590

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology not reported
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology is not described
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Hamilton, Ohio
	Metric 5:	Currency	Low	1984
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported or hard to read
	Metric 7:	Exposure Scenario	Critically Deficient	The exposure scenario is not reported
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Critically Deficient	There is no explanation regarding the data
	Metric 9:	Quality Assurance	Medium	the study reports key QA parameters
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Critically Deficient	Key limitations or sample variability not reported

Overall Quality Determination Uninformative

Study Citation:	H+A, (1986). Phase III: Investigation of groundwater quality and hydrogeologic conditions, Summa Corporation Facility, Culver City, California (final report) with attach and letter dated 013192.
HERO ID:	1356129

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods briefly described
	Metric 2:	Analytical Methodology	Medium	Cited EPA method 624, included LOD, did not describe the method
	Metric 3:	Biomarker Selection	N/A	Did not test for biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	California, USA
	Metric 5:	Currency	Low	Samples from 1985
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size was not reported
	Metric 7:	Exposure Scenario	Medium	Data may represent a relevant exposure scenario but the report doesn't have details about the population or microenvironment of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Medium	Limited description of QA/QC techniques
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not characterized

Overall Quality Determination Uninformative

Study Citation:	Westinghouse Electric Corporation, (1991). Hydrogeological investigation of the Hoechst Celanese facility Spartanburg, South Carolina - Westinghouse project 4122-90-022A with attachments and cover letter dated 052291.
HERO ID:	1356133

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Well described sampling methods
	Metric 2:	Analytical Methodology	Low	Limited description of analytical methods
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Report from 1991
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Medium	Missing details about the population of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations only
	Metric 9:	Quality Assurance	Medium	Analyzed control samples, techniques briefly described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainties were not characterized

Overall Quality Determination Uninformative

Study Citation:	AT&T, (1990). Results of site investigation at the Cleveland Service Center Solon, Ohio with attachments, cover sheet and letter dated 020690.
HERO ID:	1356151

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Only briefly described
	Metric 2:	Analytical Methodology	High	Analytical Reports included containing information on QA/QC, methods, and LoD/RL
	Metric 3:	Biomarker Selection	N/A	Did not test for biomarker
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Solon, OH
	Metric 5:	Currency	Low	1988
	Metric 6:	Spatial and Temporal Variability	Low	Small sample size: 4 soil borings and 1 GW sample with a duplicate
	Metric 7:	Exposure Scenario	Medium	Data may represent relevant exposure scenarios, missing details about the population of interest and microenvironment
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Independent sample concentrations only, no summary statistics
	Metric 9:	Quality Assurance	High	Well described QA/QC techniques
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability or uncertainty

Overall Quality Determination Medium

Study Citation:	E I Dupont De Nemours & Co, (1989). Endangement assessment, on-site conditions on seven chemicals with cover letter dated 022489.
HERO ID:	1356167

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sample storage conditions and sampler calibration
	Metric 2:	Analytical Methodology	Medium	Recovery samples not reported
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Study was conducted in 1988.
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples were collected but there were not replicates.
	Metric 7:	Exposure Scenario	High	The exposure source was characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data were reported.
	Metric 9:	Quality Assurance	Low	Limited QA were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Few gaps and limitations were reported

Overall Quality Determination Medium

Study Citation:	Great Lakes Chemical Corp, (1987). Exposure assessment for hazardous waste landfill with cover letter dated 072187.
HERO ID:	1356178

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology not described, only briefly mentioned
	Metric 2:	Analytical Methodology	High	Analytical reports included in the appendix
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	El Dorado, AR
	Metric 5:	Currency	Low	1986
	Metric 6:	Spatial and Temporal Variability	Medium	7 waste samples analyzed along with air samples collected in the months of Jan-March (33 samples) and May 1985 (14 days). No replicates.
	Metric 7:	Exposure Scenario	High	Report characterizes facility and sources as well as nearby residential communities and explores various exposure pathways through different medias.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points available for waste samples but only monthly averages and summaries available for air samples. No other statistics were used
	Metric 9:	Quality Assurance	Low	QA/QC was not mentioned but lab reports for analyses and air data from the Arkansas Dept of Pollution Control Ecology imply SOP and methods.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key limitations and data gaps not addressed.

Overall Quality Determination Medium

Study Citation:	Ghassemi, M., Quinlivan, S., Bachmaier, J. (1984). Characteristics of leachates from hazardous waste landfills. Journal of Environmental Science and Health, Part A: Environmental Science and Engineering 19(5):579-620.
HERO ID:	1358515

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling method was not directly mentioned in the report, but can be inferred that the sampling was done in manners according to U.S EPA standards.
	Metric 2:	Analytical Methodology	Low	Analytical method was not directly mentioned in the report, but can be inferred that the analysis was done in manners according to U.S EPA standards.
	Metric 3:	Biomarker Selection	N/A	Tested for parent chemicals in landfill leachate
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The leachate site was not mentioned, but can be inferred that it's in the US because these landfills are subject to EPA regulations.
	Metric 5:	Currency	Low	No sampling date is provided, but a publication date is available - 1984.
	Metric 6:	Spatial and Temporal Variability	Medium	30 leachate data sets, 11 leachate sites, no replicates
	Metric 7:	Exposure Scenario	High	Exposure scenario was described and relevant (leachate, landfill). See Table 1 for more details.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Some individual data were reported, but not all. Summary statistics were not reported.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Low	The report compared results among municipal leachates and limited discussion of variability. No discussion of limitations, uncertainties, and data gaps.

Overall Quality Determination Low

Study Citation:	Ethyl Corporation, (1977). Hexachlorobutadiene with attachment.
HERO ID:	1441890

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	limited description of sampling methods
	Metric 2:	Analytical Methodology	Critically Deficient	Not described
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Samples from 1977
	Metric 6:	Spatial and Temporal Variability	Low	16 samples
	Metric 7:	Exposure Scenario	Medium	Data likely represents a relevant exposure scenario
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Limited individual sample concentrations reported as wt%
	Metric 9:	Quality Assurance	Low	Analyzed control samples, did not describe techniques
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability or uncertainties.

Overall Quality Determination Uninformative

Study Citation:	Harding Lawson Assoc, (1986). Site assessment report - amphenol products (Garden Grove, California) with cover letter dated 050986.
HERO ID:	1481067

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Only briefly discussed
	Metric 2:	Analytical Methodology	Low	Not described but cited EPA methods, LOD reported on page 16
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	California
	Metric 5:	Currency	Low	Sampling in 1985
	Metric 6:	Spatial and Temporal Variability	Low	7 sample sites, no replicates
	Metric 7:	Exposure Scenario	Medium	Data may represent a relevant exposure scenario, missing details about the population of interest and exposure characteristics
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability, uncertainties and limitations were not characterized

Overall Quality Determination Low

Study Citation:	Battelle Ocean Sciences, (1989). Fate and effects of produced water discharges in nearshore marine waters: Final report.
HERO ID:	1481687

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods described, such as procedures, site information, sample information, storage, and equipment (pg 30-38).
	Metric 2:	Analytical Methodology	Low	Extraction and analytical methods, instrument, calibration reported. LOD only reported for metals.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Study collected in 1986.
	Metric 6:	Spatial and Temporal Variability	High	Between 2-96 samples were collected depending on sample type and season. Not all sampling sites had replicates but more than 10 did.
	Metric 7:	Exposure Scenario	High	Measuring chemical from discharged produced water in the Gulf of Mexico.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The raw data and summary statistics were not reported, although the chemical was measured as non detect.
	Metric 9:	Quality Assurance	Medium	Quality control was reported but there is no mention of recoveries for this chemical for group of chemicals.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The study acknowledges that there is limited comparative data available (pg 285). There is variation in the collecting samples in the spring and fall.

Overall Quality Determination Medium

Study Citation:	ICI Americas Inc, (1990). Letter from ICI Americas Inc to USEPA submitting initial submission concerning phenol in groundwater with attachments.
HERO ID:	1481739

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	No aspects of sampling methodology are described, but field and trip blanks are reported.
	Metric 2:	Analytical Methodology	Low	September samples show method of analysis as "EPA, GC." EPA method 624, LOD reported in page 10, for November samples. January samples list method of analysis as "EPA." Instrument calibration and recoveries are not discussed.
	Metric 3:	Biomarker Selection	N/A	They analyzed parent chemicals in water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Hopewell, Virginia
	Metric 5:	Currency	Low	1990
	Metric 6:	Spatial and Temporal Variability	Low	Samples were collected in September (but none were analyzed for this chemical), December (of the 8 samples reported, 5 appear to have been analyzed for this chemical, along with 2 blanks), and January (4 samples, all analyzed for this chemical, along with 2 blanks). No replicates identified.
	Metric 7:	Exposure Scenario	High	Primarily groundwater monitoring at ICI Americas, Inc., along with monitoring for VOCs in a potable water tank and water from a water fountain.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only individual data reported for the 3 monitoring surveys, no summary statistics.
	Metric 9:	Quality Assurance	Low	The report doesn't include any QA/QC parameter for sample analysis, but does mention they followed an EPA method.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability is shown in the concentrations across three monitoring studies, but it is not discussed. There is not information regarding key limitations.

Overall Quality Determination Low

Study Citation:	Bi, E., Liu, Y., He, J., Wang, Z., Liu, F.,ei (2012). Screening of Emerging Volatile Organic Contaminants in Shallow Groundwater in East China. Ground Water Monitoring and Remediation 32(1):53-58.
HERO ID:	1488836

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology and sites described.
	Metric 2:	Analytical Methodology	High	Analytical methods mentioned, described and briefly summarized.
	Metric 3:	Biomarker Selection	N/A	Ground water samples no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in China
	Metric 5:	Currency	Medium	The study took place in 2008 and 2009
	Metric 6:	Spatial and Temporal Variability	Medium	n=130 samples (from Table 2). No replicate samples.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to polluted ground water in China.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Maximum concentrations reported, no raw data.
	Metric 9:	Quality Assurance	High	QA/QC was described, including MDLs and recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty sources were not discussed or attributed to anything.

Overall Quality Determination High

Study Citation:	Shell Oil, (1986). Fate of some specific compounds in the Norco chemical biotreater and their effect on the outcome of effluent bioassays.
HERO ID:	1629033

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	There is limited description included. It says water samples were daily composites, but there is little other information about water sampling protocol. Missing information includes sampling equipment for water, sampling procedures, sample storage, and performance/calibration of sampler. Page 35 explains in some detail sampling and analysis procedures for the vapor samples collected with TENAX traps, including calibration information.
	Metric 2:	Analytical Methodology	Medium	There is limited description included. They used GC/MS. MDLs listed for water samples listed as 10 ppb, based on EPA published values. Analytical methodologies for water samples were EPA-approved. It appears standards were used, but their use is not well-explained. Recoveries are only mentioned for SVOCs. Spiking is only mentioned for the June 1984 samples. Although MDLs are not listed for air samples, p. 35 explains in some detail sampling and analysis procedures for the vapor samples collected with TENAX traps, including calibration information. Medium applies to water, the primary medium analyzed; low applies to air samples due to missing MDLs and generally limited information.
	Metric 3:	Biomarker Selection	N/A	Samples were from environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Sampling began in 1984
	Metric 6:	Spatial and Temporal Variability	Medium	Sampling approach poorly captures variability of environmental contamination. Only water samples were analyzed for this contaminant. Samples from 3 locations (including effluent) collected on 3 dates in April of 1984 were analyzed for this chemical (see p. 26). Also in May of 1984, four samples (including effluent) were analyzed for this chemical (see p. 41). In June of 1984, 8 samples were analyzed (pp. 53 and 55). Only one duplicate was collected, in June 1984 (see p. 60).
	Metric 7:	Exposure Scenario	Medium	Data may represent a relevant exposure scenario, but come from ”pilot plants,” with different aeration methods and temperatures to actual WWTPs. Data are missing details about the population of interest, the climate, and contextual information such as what types of manufacturing facilities the wastewater treated is coming from.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations are provided, no summary statistics.
	Metric 9:	Quality Assurance	Low	There was only one blank water sample, from June 1984. Spiking of a blank air sample for calibration is mentioned too. Recoveries are only discussed for samples analyzed for SVOCs but were from 11 to 38 percent. They did not correct for low recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized, and there was minimal discussion of uncertainties. No standard deviations were reported.

Overall Quality Determination Low

Study Citation:	Westinghouse Savannah River Company, (1997). Sanitary landfill groundwater monitoring report. Fourth quarter 1996 and 1996 summary. 14(GRA and I):506.
HERO ID:	1740826

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sample storage conditions and sampler calibration
	Metric 2:	Analytical Methodology	High	Key analytical methods reported
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Samples collected in 1996
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	High	Exposure source characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported
	Metric 9:	Quality Assurance	High	Key QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Few gaps and limitations reported

Overall Quality Determination Medium

Study Citation:	Westinghouse Savannah River Company, (1992). Sanitary Landfill 1991 annual groundwater monitoring report.
HERO ID:	1740870

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology is only briefly discussed, therefore, most sampling information is missing and likely to have a substantial impact on results. The type of monitoring wells are reported.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology was not described, including analytical instrumentation.
	Metric 3:	Biomarker Selection	N/A	The study tested for the parent chemical in environmental media (groundwater).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in Savannah River Site, Aiken, SC.
	Metric 5:	Currency	Low	The samples were collected in 1991.
	Metric 6:	Spatial and Temporal Variability	Low	The collection of replicates was not reported. Fifty-seven wells were sampled, but sample size is not reported. It's inferred that at least one sample was collected from each well.
	Metric 7:	Exposure Scenario	Medium	Groundwater samples were collected from monitoring wells beneath a sanitary landfill. The use of exposure controls are not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data is reported in tables for each monitoring well starting on page 168. Summary statistics are not reported.
	Metric 9:	Quality Assurance	Low	QA/QC techniques and results were not directly discussed and recoveries were not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The characterization of variability is absent (no measure of variance reported). Key uncertainties, limitations, and data gaps are not discussed.

Overall Quality Determination Uninformative

Study Citation:	ATSDR, (1994). Petitioned public health assessment: E. I. du Pont de Nemours, Pompton Lakes, Passaic County, New Jersey.
HERO ID:	1741389

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling procedure was not directly described but can be inferred that it was done according to the NJDEP standards.
	Metric 2:	Analytical Methodology	Low	Analysis was not mentioned in the report but can be inferred. LOD was not reported.
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Pompton Lakes, NJ
	Metric 5:	Currency	Low	No sampling date was provided, an onsite investigation date was available - 1989.
	Metric 6:	Spatial and Temporal Variability	Medium	3 surface water bodies were monitored from 1984-1988, 15 wells were monitored. 5000 soil samples were taken in the area. 93 fish samples were obtained.
	Metric 7:	Exposure Scenario	High	The exposure scenario seems to be highly relevant (covers surface water, groundwater, soil, dietary exposure).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Average concentrations were reported without summary statistics.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Medium	The study had some discussion of the variability and uncertainties.

Overall Quality Determination Medium

Study Citation:	Geraghty & Miller Incorporated, (1983). Hydrogeology of the Hill Site the Bendix corporation Sidney, New York with cover letter.
HERO ID:	1745520

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	There is some (limited) sampling methodology reported for soil collection on pg 62, but half of that page is illegible. Sampling methods for groundwater were almost nonexistent, as the report primarily focused on boring installation.
	Metric 2:	Analytical Methodology	High	Volatile organic compounds analyzed by EPA method 601. LODs are reported in Appendix E at the bottom of the table on page 81.
	Metric 3:	Biomarker Selection	N/A	Parent chemicals were tested in soil and water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sampling conducted at the Bendix Corporation plant in Sidney, New York.
	Metric 5:	Currency	Low	Samples collected in 1983.
	Metric 6:	Spatial and Temporal Variability	Low	Samples were collected from the wells five times as the drillings proceeded. There is no report of number of samples. Duplicate sampling occurred some but not all of the time.
	Metric 7:	Exposure Scenario	High	Soil and ground water were sampled to investigate the extent of contamination at this site.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 3 presents the results but due to the quality of the scan it is impossible to read. Appendix E contains the laboratory reports.
	Metric 9:	Quality Assurance	Low	The laboratory followed an EPA method so QA/QC can be inferred.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There is no information on sample variability or statistics. The document reports the need to keep monitoring the next steps.

Overall Quality Determination Low

Study Citation:	ERM, (1984). Preliminary hydrogeologic evaluation of on-site and off-site ground water contamination at the hill site with cover letter.
HERO ID:	1745526

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods only briefly described and missing details
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	New York, USA
	Metric 5:	Currency	Low	Sampling in 1983
	Metric 6:	Spatial and Temporal Variability	Low	7 sampling sites, only one with duplicate samples
	Metric 7:	Exposure Scenario	Medium	Data may represent a relevant exposure scenario, but report lacks sufficient details about methods for data reliability
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points only, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC details not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability not characterized, uncertainties and limitations were briefly discussed

Overall Quality Determination Uninformative

Study Citation:	Allied Chem Corp, (1982). Hydrogeologic investigation summary report with cover letter.
HERO ID:	1745530

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology was not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology was not described
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Michigan, USA
	Metric 5:	Currency	Low	Report from 1984
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Medium	Missing details about methods, population and microenvironment of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized, uncertainties and limitations were not discussed

Overall Quality Determination Uninformative

Study Citation:	DEE, (1984). State purgeable organic testing program (spot) quarterly report from April 1, 1987 to July 31, 1987 with cover letter dated 080387.
HERO ID:	1745594

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	The sampling methodology is not discussed in the data source or companion source
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology is not described
	Metric 3:	Biomarker Selection	N/A	Parent chemical in an environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Massachusetts, US
	Metric 5:	Currency	Low	1987
	Metric 6:	Spatial and Temporal Variability	Low	There is no information regarding the samples, the sample size could be around 600 samples
	Metric 7:	Exposure Scenario	Critically Deficient	The exposure scenario is not reported or discussed
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Since there is no information regarding the samples it is possible that the tables only report raw data
	Metric 9:	Quality Assurance	Critically Deficient	There is no information regarding QA/QC procedures
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Critically Deficient	There is no information regarding variability or uncertainty

Overall Quality Determination Uninformative

Study Citation:	Ciba-Geigy, (1987). Annual report on results of water quality monitoring water year 1985-86 with cover letter dated 082887.
HERO ID:	1745597

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Monitoring methods reported in appendix A
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not reported
	Metric 3:	Biomarker Selection	N/A	Parent chemical in water samples
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Montebello Forebay, California
	Metric 5:	Currency	Low	Water quality data 1985-1986
	Metric 6:	Spatial and Temporal Variability	High	Samples collected in 20 wells in Montebello Bay, 170 wells for basin wide ground water
	Metric 7:	Exposure Scenario	High	Water quality data from Montebello Bay
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 reports raw data, no statistics calculated
	Metric 9:	Quality Assurance	Low	No information on analytical methods, but sampling program well described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability reported in ranges in page 49

Overall Quality Determination Uninformative

Study Citation:	CA State Dept of Health Services, (1987). Organic chemical contamination of large public water systems in California April 1986 on seven chemicals with attachments.
HERO ID:	1745610

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology is not described, but the report is from the California State Department of Health Services.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology was not described, including analytical instrumentation.
	Metric 3:	Biomarker Selection	N/A	The study tested for the parent chemical in environmental media (groundwater).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in several locations across California.
	Metric 5:	Currency	Low	The samples were collected in 1984 and 1985.
	Metric 6:	Spatial and Temporal Variability	Medium	The collection of replicates was not reported. 2947 groundwater wells were sampled. The report lists only positive test results and Table E-1 lists how many wells tested positively for the contaminant. Negative test results are on file at the SEB district offices.
	Metric 7:	Exposure Scenario	Medium	Groundwater samples were collected from light industrial/residential, heavy industrial, agricultural and contamination free settings in California. The use of exposure controls are not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data is reported in Table II-16 (pg 95). Summary statistics (concentration range and median concentration) are reported in the text on pg 16.
	Metric 9:	Quality Assurance	Low	QA/QC techniques and results were not directly discussed, but can be implied through the study's use of standard field and laboratory protocols. Certified laboratories analyzed the samples (pg 6).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The characterization of variability is absent (no measure of variance reported).Key uncertainties, limitations, and data gaps are not discussed.

Overall Quality Determination Uninformative

Study Citation:	SC DHEC, (1981). Investigation of groundwater at South Carolina recycling and disposal company Bluff Road site, Richland County, South Carolina.
HERO ID:	1745613

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology only briefly described missing details about storage conditions, volume of sample.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology not described
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Carolina, USA
	Metric 5:	Currency	Low	Sampling in 1980
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Medium	Missing details about the population and microenvironment of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only presence/absence
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability not characterized, limitations were briefly described

Overall Quality Determination Uninformative

Study Citation:	Geraghty & Miller Incorporated, (1988). Results of the second phase of a hydrogeologic investigation at the Allied-Signal Inc facility, Morristown, New Jersey with cover letter dated 012089.
HERO ID:	1745619

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	The study did not report storage conditions, sampling equipment or procedures.
	Metric 2:	Analytical Methodology	Low	The study did not describe analytical methods or reported LODs however it cited EPA Method 601.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media (water).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Geographic location is reported; New Jersey, USA.
	Metric 5:	Currency	Low	Timing of sample collection for monitoring data is not consistent with when current exposures (sampling occurred in 1987; >15 years old) may be expected and likely to have a substantial impact on results.
	Metric 6:	Spatial and Temporal Variability	Low	Sampling approach does not captures variability of environmental contamination in population/scenario/media of interest. The study used 20 samples and no replicates.
	Metric 7:	Exposure Scenario	Medium	The study did not provide details about the population of interest or exposure assessment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations (raw data) reported but there is no summary statistics.
	Metric 9:	Quality Assurance	Medium	Limited description of QA/QC techniques.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability, or discussed uncertainties and limitations.

Overall Quality Determination Uninformative

Study Citation:	Dames & Moore, (1989). Ground water and soils data summary report with attachments, appendices, cover sheets and letter dated 080989.
HERO ID:	1745621

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description of sampling methodology
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	Did not sample for biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Illinois, USA
	Metric 5:	Currency	Low	Samples from 1987
	Metric 6:	Spatial and Temporal Variability	Low	5 samples, no replicates
	Metric 7:	Exposure Scenario	Medium	Data likely represents a relevant exposure scenario, missing details about the population of interest and microenvironment
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Medium	Limited description of QA/QC techniques, analyzed control samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not characterized or described

Overall Quality Determination Uninformative

Study Citation:	Aeroject General Corp, (1979). Letter from Aeroject general corporation to USEPA regarding information on trichloroethylene with attachments.
HERO ID:	1745640

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology was not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology was not described
	Metric 3:	Biomarker Selection	N/A	Parent chemical
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sacramento, CA
	Metric 5:	Currency	Low	1979
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size was not reported
	Metric 7:	Exposure Scenario	Medium	Contamination near Aeroject Center
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	No summary of statistics, only individual data points
	Metric 9:	Quality Assurance	Critically Deficient	No report regarding QA/QC
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and Uncertainty not discussed

Overall Quality Determination Uninformative

Study Citation:	Hazardous Substance & Waste Management Research,, Inc, (1993). Toxicological evaluation of sampling data for Little Rocky Creek, Greenville, South Carolina with cover letter dated 050793.
HERO ID:	1745693

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Only briefly described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods were not described
	Metric 3:	Biomarker Selection	N/A	Did not test for biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Samples taken in 1990
	Metric 6:	Spatial and Temporal Variability	Low	82 samples from 20 locations, <5 samples per site
	Metric 7:	Exposure Scenario	Medium	Data likely represents relevant exposure scenarios, missing methodological details
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited characterization of variability, did not discuss uncertainties and limitations

Overall Quality Determination Uninformative

Study Citation:	ERM-Northeast,, Inc., (1994). Hydrogeologic investigation (including ground water quality) north of Husky Brook Eatontown, New Jersey, with cover letter dated 011894.
HERO ID:	1745841

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology followed NJDEPE's (NJ Department of Environmental Protection) Field Sampling Procedures Manual published in 1992.
	Metric 2:	Analytical Methodology	High	Followed EPA 624+15. Detection limits reported on page 80.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in ground water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was performed in Eatontown, New Jersey, USA.
	Metric 5:	Currency	Low	Sampling was performed in 1993.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from six new and existing monitoring wells. While the number of samples collected from each well was not reported, we can infer that there were at least 12 samples. Surface water samples collected from 3 wells. No replicates were collected.
	Metric 7:	Exposure Scenario	Medium	On-site ground and surface water quality was assessed for the conditions AlliedSignal Aerospace Company. The population of interest is not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only individual data points and no statistics were provided.
	Metric 9:	Quality Assurance	Medium	Some QA/QC parameters reported in the laboratory reports. Through the use of EPA methods, QA/QC was also implied.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There is no characterization of variance or report of uncertainties, limitations, and gaps.

Overall Quality Determination Medium

Study Citation:	Roose, P., Dewulf, J., Brinkman, U. A. T., Van Langenhove, H. (2001). Measurement of volatile organic compounds in sediments of the Scheldt Estuary and the Southern North Sea. Water Research 35(6):1478-1488.
HERO ID:	1937708

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedure, apparatus, storage were described in details.
	Metric 2:	Analytical Methodology	High	Analytical process was described - GCMS, LOD was reported for each chemical.
	Metric 3:	Biomarker Selection	N/A	Sediment sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Belgian sea
	Metric 5:	Currency	Low	1997-1998
	Metric 6:	Spatial and Temporal Variability	Medium	11 stations were sampled, n =8 for concentrations in water
	Metric 7:	Exposure Scenario	Medium	The data likely represent the relevant exposure scenario (seawater).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Average concentrations were reported with no individual data attached. Summary statistics were reported.
	Metric 9:	Quality Assurance	High	The study applied quality assurance/quality control measures and all pertinent quality assurance information is provided in the data source or companion source. Deviations of over 30% were considered as out of control and were corrected.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study's discussion of variability and limitation was focused on the experimental methodology and equipment.

Overall Quality Determination Medium

Study Citation:	Boillot, C., Bazin, C., Tissot-Guerraz, F., Droguet, J., Perraud, M., Cetre, J. C., Trepo, D., Perrodin, Y. (2008). Daily physicochemical, microbiological and ecotoxicological fluctuations of a hospital effluent according to technical and care activities. Science of the Total Environment 403(1-3):113-129.
HERO ID:	1941262

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling described. Sampling was performed with several EPIC 1011 automatic samplers which were installed in parallel
	Metric 2:	Analytical Methodology	Low	The analytical instrument was provided in Table 1 for each chemical, but references to the standards were not in the reference section. Little description of QA/QC.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	Low	Unclear because date is not in standard form. "The samples were taken from 06/04/12 at 1 p.m. to 06/04/13 at 1 pm." This seems to be Apr-12-2006 to Apr-13-2006
	Metric 6:	Spatial and Temporal Variability	Low	One 24 hour air sample and five samples of various time extents (5–9 a.m.; 9 a.m.–1 p.m.; 1–5 p.m.; 5–11 p.m. and 11 p.m.–5 a.m)
	Metric 7:	Exposure Scenario	Medium	This measured effluent from a hospital.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only one result from the average sample.
	Metric 9:	Quality Assurance	Low	Used a standard method so QC implied, but no info on QA procedures or results.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The sample is a 24 average, so a little implied variability.

Overall Quality Determination Low

Study Citation:	Mcdonald, T. J., Kennicutt M C, I. I., Brooks, J. M. (1988). VOLATILE ORGANIC COMPOUNDS AT A COASTAL GULF OF MEXICO SITE. Chemosphere 17(1):123-136.
HERO ID:	1946098

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sampled 5 times (Fig 1); water samples in glass bottles; refrigerated in dark;
	Metric 2:	Analytical Methodology	Low	stripping of VOC; GC; recoveries and extraction efficiencies were estimated; detection or reporting limits not provided
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Brazos River located in the northwestern Gulf of Mexico
	Metric 5:	Currency	Low	1981-1982
	Metric 6:	Spatial and Temporal Variability	High	5 sampling events; Fig 1 shows sampling sites - sites greater than 10; replicate samples
	Metric 7:	Exposure Scenario	High	surface waters from River in Golf of Mexico; coastal location impacted by shipping activities, industrial outfalls, and urban runoff
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 3 provides concentration at chemical outfall and river mouth; two lines for DCE - seems to be a mistake to report the same chemical twice
	Metric 9:	Quality Assurance	Low	QA/QC not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	briefly compared to other studies

Overall Quality Determination Medium

Study Citation:	Oldaker G B, III, Taylor, W. D., Parrish, K. B. (1995). Investigations of ventilation rate, smoking activity and indoor air quality at four large office buildings. Environmental Technology 16(2):173-180.
HERO ID:	1946147

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Detailed description of Sampling methodology provided.
	Metric 2:	Analytical Methodology	High	Detailed description of analytical methodology provided.
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	It may be inferred that the location of the four buildings studies is in the US including the Midwest.
	Metric 5:	Currency	Low	Data collected in 1991
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	High	the exposure scenario discussed in the monitored study represents the exposure scenario of interest for the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	no raw data reported
	Metric 9:	Quality Assurance	Low	Limited QA/QC information reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Little information provided on gaps and limitations and variability of results

Overall Quality Determination Uninformative

Study Citation:	T A Gleason Assoc, (1986). Hydrological and groundwater quality investigations (final report) with cover letter dated 071587.
HERO ID:	1973128

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The method is described
	Metric 2:	Analytical Methodology	High	The study followed the USA EPA method 1624
	Metric 3:	Biomarker Selection	N/A	Parent chemical in ground water
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Fostoria OH
	Metric 5:	Currency	Low	1987
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Number of samples not reported
	Metric 7:	Exposure Scenario	High	Off site ground water contamination from Autolite
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual data reported, no summary of statistics. The data can not be read do to the quality of the scan
	Metric 9:	Quality Assurance	Critically Deficient	QA/QC not reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty is nor discussed

Overall Quality Determination Uninformative

Study Citation:	Bookman-Edmonston, (1985). Annual report on results of water quality monitoring water year 1983-84 on seven chemicals with attachments.
HERO ID:	1973144

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methods were not described.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods were not described.
	Metric 3:	Biomarker Selection	N/A	They did not test for biomarkers, but rather for parent chemicals in water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	California, USA
	Metric 5:	Currency	Low	Sampling was conducted in 1983 and 1984.
	Metric 6:	Spatial and Temporal Variability	Low	I found it difficult to ascertain the total number of samples analyzed for this chemical, but it was more than 10, as there were more than 10 locations (wells) sampled, some ”intensively.” There were no replicates.
	Metric 7:	Exposure Scenario	Low	Data likely represents a relevant exposure scenario, but methodological details are missing to describe the reliability of the data. Exposure sources are not well-characterized. It’s a bit unclear whether the samples analyzed for this chemical came from ground water or drinking water wells.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	For 16 samples from October 1984, Table B-4 shows individual sample concentrations from Montebello Forebay, without summary statistics. Table IV-6 summarizes the range of detections in samples of local storm water, reclaimed water, imported water, unchlorinated well water, and chlorinated well water, respectively. It says there were 57 samples of reclaimed water, but the number of samples of water in other categories is not specified.
	Metric 9:	Quality Assurance	Low	Little to no discussed of QA/QC techniques was included.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Uncertainty and gaps were not characterized, and there was minimal discussion of variability (see p. 15, which is the 25th page of the PDF, and the tables with data on this chemical).

Overall Quality Determination — Uninformative

Study Citation:	T A Gleason Assoc, (1990). Letter from Allied Signal Inc to US EPA regarding well water test result data from a closed landfill site with attachment.
HERO ID:	1973153

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description of sampling methods
	Metric 2:	Analytical Methodology	Low	Analytical methods only briefly discussed
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Bend, Indiana
	Metric 5:	Currency	Low	Sampling in1990
	Metric 6:	Spatial and Temporal Variability	Low	12 sampling sites, no replicates
	Metric 7:	Exposure Scenario	Medium	Missing details about the population of interest and exposure characteristics
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Medium	Limited description of QA/QC techniques, analyzed control samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability, study limitations and uncertainties were not discussed

Overall Quality Determination Low

Study Citation:	Buhamra, S. S., Bouhamra, W. S., Elkilani, A. S. (1998). Assessment of air quality in ninety-nine residences of Kuwait. Environmental Technology 19(4):357-368.
HERO ID:	1992664

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	no inconsistencies in the reporting of sampling information
	Metric 2:	Analytical Methodology	Low	No LOD or LOQ reported
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Kuwait
	Metric 5:	Currency	Low	Data collected December 1994 to June 1996
	Metric 6:	Spatial and Temporal Variability	Medium	no replicates collected
	Metric 7:	Exposure Scenario	High	the exposure scenario discussed in the monitored study does represent the exposure scenario of interest for the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Good reporting of results.
	Metric 9:	Quality Assurance	Low	Limited QA/QC information provided
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited gaps and limitations reported

Overall Quality Determination Medium

Study Citation:	Dames & Moore, (1988). Report of hydrogeologic and environmental assessment for sixteen chemicals at the former Allied Automotive Plant with cover letter dated 033188.
HERO ID:	2048351

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples were collected according to publicly available SOPs that are scientifically sound and widely accepted. VOCs were collected according to EPA Analytical Methods 601 and 602. Base/neutral extractable organic compounds were collected according to EPA Analytical Method 625 for groundwater and Method 8270 for soil. Sampling methodology described in section 1.1, groundwater sampling methods in section 1.1.2, and soil in section 1.1.3.
	Metric 2:	Analytical Methodology	High	Samples were analyzed according to publicly available analytical methods. VOCs were analyzed according to EPA Analytical Methods 601 and 602. Base/neutral extractable organic compounds were analyzed according to EPA Analytical Method 625 for groundwater and Method 8270 for soil. The detection level used is specified in the standard methods, but the values are listed in the report.
	Metric 3:	Biomarker Selection	N/A	The study tested for the parent chemical in environmental media (groundwater and soil).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in Port Huron, Michigan.
	Metric 5:	Currency	Low	The samples were collected in 1987.
	Metric 6:	Spatial and Temporal Variability	Medium	The collection of replicates was not reported. Composite soil samples were collected from five sites at three different depths. One sample was collected from three different monitoring wells.
	Metric 7:	Exposure Scenario	Medium	Groundwater and soil samples were collected from monitoring wells and the land on the site of a former automotive plant with previous contamination. The use of exposure controls are not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data is reported in Appendix C for groundwater and Appendix D for soil samples. Summary statistics are not reported.
	Metric 9:	Quality Assurance	Low	The study applied QA/QC measures like preventing cross contamination while collecting samples; however, recoveries and baseline samples are not reported. It's implied that QA/QC techniques were used through the study's use of standard field and laboratory protocols.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The characterization of variability is absent (no measure of variance reported). Key uncertainties, limitations, and data gaps are not discussed.

Overall Quality Determination Medium

Study Citation:	Brenner, D. (2010). Results of a long-term study of vapor intrusion at four large buildings at the NASA Ames research center. Journal of the Air and Waste Management Association (1990-1992) 60(6):747-758.
HERO ID:	2127874

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods and approaches described.
	Metric 2:	Analytical Methodology	Medium	Analytical methods provided, LOD missing.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed air samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	NASA, Research Park site, located in Moffett Field, CA, US
	Metric 5:	Currency	Low	Data collected in 2004
	Metric 6:	Spatial and Temporal Variability	High	Over 10 samples collected
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to indoor and outdoor air in and near NASA Ames Research Center buildings.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data provided, only summary statistics.
	Metric 9:	Quality Assurance	Medium	Missing recoveries and blanks. Mentioned doing them, but not reported or summarized.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No gaps nor limitations reported. Variability was characterized (SD).

Overall Quality Determination Medium

Study Citation:	Liu, L., Zhou, H. (2011). Investigation and assessment of volatile organic compounds in water sources in China. Environmental Monitoring and Assessment 173(1-4 (Feb 2011)):825-836.
HERO ID:	2129986

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology, sample storage, analytical methods, and site characteristics are described in detail.
	Metric 2:	Analytical Methodology	High	Analytical method is described in detail. Followed USEPA Method 524.2. LODs are provided.
	Metric 3:	Biomarker Selection	N/A	measured parent metabolite in water sources
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sampling locations in China are described in detail.
	Metric 5:	Currency	Medium	Samples were collected in 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	152 water sources were sampled including 54 reservoirs or lakes, 79 rivers and 19 groundwaters. Three sampling points for each water source. Duplicate samples were collected. Samples were only for one time point so no measure of temporal variability.
	Metric 7:	Exposure Scenario	High	The water sources sampled are all sources for drinking water.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The data are pooled and the data for each water source is not provided. The raw data is not provided. The minimum and maximum values are reported,
	Metric 9:	Quality Assurance	High	The study applied quality assurance/quality control measures and all pertinent quality assurance information is provided.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The data are analyzed in several ways to gain an understanding of the distribution of the chemicals. Variability and uncertainties are discussed somewhat

Overall Quality Determination High

Study Citation:	Yamamoto, K., Fukushima, M., Kakutani, N., Tsuruho, K. (2001). Contamination of vinyl chloride in shallow urban rivers in Osaka, Japan. Water Research 35(2):561-566.
HERO ID:	2310570

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedure, equipment, storage, and sites were described.
	Metric 2:	Analytical Methodology	Medium	The authors reported the method of extraction and analysis (GC-MS) and method detection limits. An earlier paper discussed method accuracy, precision, and detection limits in more detail.
	Metric 3:	Biomarker Selection	N/A	Chemicals of interest were analyzed in parent media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Osaka, Japan
	Metric 5:	Currency	Low	Samples were collected in 1995-1997.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 106 samples. 1,1-DCA and cis-DCE were among the most frequently detected chemicals; trans-DCE and 1,1,2-TCA were detected in less than 66% of samples. There was no mention of replicates, but that may have been addressed in prior papers.
	Metric 7:	Exposure Scenario	High	The data likely represent the relevant exposure scenario (surface water). Possible sources of the primary chemicals discussed (but not all chemicals) were hypothesized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Data were log-transformed and presented in a figure. Also, the top of p. 564 reports the frequency of detection (pr), range, mean (”m”), SD, and median (”me”) for cis-1,2-DCE and 1,1-DCA. No individual data were presented.
	Metric 9:	Quality Assurance	Medium	There is discussion of using standards for calibration, but no mention of determining recoveries. The paper says the accuracy and precision of the methods were discussed in detail elsewhere. While specific quality assurance/quality control techniques and results were not discussed further, they are implied through the study’s use of standard field and laboratory protocols and the language included in this paper. Site 1 had no detection of the four VOCs that were discussed at greatest length in this paper, serving as something of a ”control” location.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study had some discussion of temporal and spatial variability. The only uncertainty mentioned was whether contaminated groundwater might be responsible for the detections in surface water. Gaps and limitations were not discussed.

Overall Quality Determination Medium

Study Citation:	Ras-Mallorqui, M. R., Marce-Recasens, R. M., Borrull-Ballarin, F. (2007). Determination of volatile organic compounds in urban and industrial air from Tarragona by thermal desorption and gas chromatography-mass spectrometry. Talanta 72(3):941-950.
HERO ID:	2443817

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	air samples by active collection on multisorbent tubes; air sampling pump; tubes transported in glass jars; analyzed as soon as possible or kept refrigerated during storage and analyzed day after sampling (Section 2.1)
	Metric 2:	Analytical Methodology	High	thermal desorption and GC-MS; compounds quantified by a target ion and identified by qualifier ions and retention time; Table 1 provides MDL and MQL; recoveries
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Tarragona, Spain
	Metric 5:	Currency	Medium	December 2005 and January 2006
	Metric 6:	Spatial and Temporal Variability	High	urban samples (4sites) taken every 2 hrs from 8AM-8PM; industrial samples (3 sites) taken in morning, mid-day, and afternoon;
	Metric 7:	Exposure Scenario	High	samples in urban and industrial areas
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 provides MDL and MQL; only chemicals detected were presented; this chemical was not one of the chemicals detected; chemical not listed in Table 2
	Metric 9:	Quality Assurance	High	recoveries higher than 98.9%; linearity I the responses and the repeatability was also good; analyzed blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discussed variability throughout the day and between urban and industrial areas

Overall Quality Determination High

Study Citation:	Martí, V., Jubany, I., Pérez, C., Rubio, X., De Pablo, J., Giménez, J. (2014). Human health risk assessment of a landfill based on volatile organic compounds emission, immission and soil gas concentration measurements. Applied Geochemistry 49:218-224.
HERO ID:	2517712

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The air sampling methodology, sites and equipment was well described. Some information missing such as storage conditions.
	Metric 2:	Analytical Methodology	Medium	The analytical methods and equipment were described, but the LOD were only reported as a range and not for each chemical.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed air samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in Barcelona, Spain.
	Metric 5:	Currency	Medium	The samples were collected in 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	36 samples for RH2. No replicates taken.
	Metric 7:	Exposure Scenario	Medium	The data likely represent relevant exposure scenarios at a landfill and affected populations, but the small sample size limited the results' generalizability.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The authors only reported summary statistics. Point values not reported.
	Metric 9:	Quality Assurance	Medium	QA/QC techniques were discussed by the authors. Recoveries were not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was characterized (SD) and different scenarios tested. The uncertainties were briefly discussed. Limitations were not reported.

Overall Quality Determination Medium

Study Citation:	Kuo, M. C. T., Chen, C. M., Lin, C. H., Fang, H. C., Lee, C. H. (2000). Surveys of volatile organic compounds in soil and groundwater at industrial sites in Taiwan. Bulletin of Environmental Contamination and Toxicology 65(5 (Nov 2000)):654..
HERO ID:	2529812

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	30 sites (fig 1 shows locations); 3-6 soil sampling points randomly selected within each site at 3 depths (0.5, 1.5, and 3 m); direct push sampling method; gw samples from existing monitoring wells at each site; each soil and gw sample taken twice at two different times; samples stored at 4C
	Metric 2:	Analytical Methodology	Low	analyzed according to EPA SW846 Method 5035 using purge and trap and Method 8260B using GC/MD reported- references could provide more information on methodology; LOD not provided.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taiwan
	Metric 5:	Currency	Low	Table 1 indicates gw samples taken 1999
	Metric 6:	Spatial and Temporal Variability	High	30 industrial sites (8 chemical and petrochemical districts, 2 technology industrial parks, 11 general industrial districts, 2 metal processing areas, 2 oil refinery plants, 1 pesticide manufacturing, and 4 landfills); 3 to 6 sampling points within each site
	Metric 7:	Exposure Scenario	High	soil and groundwater samples from various industrial sites in Taiwan
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Fig 2 and 3 show DF; Table 1 show concentrations in gw wells; soil concentrations not reported
	Metric 9:	Quality Assurance	Low	QA/QC is not discussed but can be implied through the study's use of EPA analysis methods
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discusses variability in gw by location; no apparent correlation of chemicals in gw and soil samples from a particular site; may be due to large areas studies and relatively small sample sizes within a site. No limitation discussion.

Overall Quality Determination Medium

Study Citation: Huybrechts, T., Dewulf, J., Moerman, O., Van Langenhove, H. (2000). Evaluation of purge-and-trap-high-resolution gas chromatography-mass spectrometry for the determination of 27 volatile organic compounds in marine water at the ng l(-1) concentration level. Journal of Chromatography A 893(2):367-382.

HERO ID: 2797870

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The authors reported on the sampling design, sampling equipment, sampling procedures, storage conditions, but not storage duration.
	Metric 2:	Analytical Methodology	High	The authors report the analytical equipment, quantification experiments using standards, and recovery experiments. They also reported the limits of detection.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The authors report the geographic location.
	Metric 5:	Currency	Low	Samples were collected in 1999.
	Metric 6:	Spatial and Temporal Variability	High	The authors reported collecting two samples at every sampling location. The exact number of samples is not reported but can be inferred based on the number of sampling sites (Fig 1 and Fig 5) and the text stating two samples were collected per location, it is inferred that 28 samples were collected.
	Metric 7:	Exposure Scenario	Medium	The exposure scenario is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Critically Deficient	The results are not reported for DCE in this paper.
	Metric 9:	Quality Assurance	High	The authors report on QA procedures and analyzed blank samples, and reference materials.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors did not report a standard deviation and did not discuss limitations or variations related to the field samples.

Overall Quality Determination Uninformative

Study Citation:	Nikolaou, A. D., Golfinopoulos, G., Kostopoulou, M. N., Kolokythas, G. A., Lekkas, T. D. (2002). Determination of volatile organic compounds in surface waters and treated wastewater in Greece. Water Research 36(11):2883-2890.
HERO ID:	2859218

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling was performed seasonally at 10 rivers, 2 sampling points in each river. Three sampling points were established in seawater areas. Samples were also collected from three municipal wastewater treatment plants and in wastewater from two industries.
	Metric 2:	Analytical Methodology	High	Samples were analyzed using a Hewlett Packard Purge and Trap Concentrator 7695 and a Hewlett Packard Gas Chromatograph 5890 Series II FMass Spectrometer HP 5971. QA/QC described, reported, including detection limits.
	Metric 3:	Biomarker Selection	N/A	NA - water samples no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Greece
	Metric 5:	Currency	Low	Data collected from October 1998 to September 1999
	Metric 6:	Spatial and Temporal Variability	High	Sampling was performed seasonally, from October 1998 to September 1999, at 10 rivers. Duplicate samples for VOCs measurement were collected (sample size is unclear).
	Metric 7:	Exposure Scenario	High	The data closely represent exposure scenarios from various water bodies in Greece.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	no raw data reported. Limited summary statistics were reported.
	Metric 9:	Quality Assurance	Medium	Some analytical QA reported in Table 2, missing information about blanks
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability among locations was not addressed, only providing range of concentrations. Uncertainty sources were not identified.

Overall Quality Determination Medium

Study Citation:	Wallace, L., Zweidinger, R., Erickson, M., Cooper, S., Whitaker, D., Pellizzari, E. (1982). Monitoring individual exposure. Measurements of volatile organic compounds in breathing-zone air, drinking water, and exhaled breath. Environment International 8(1/6):269-282.
HERO ID:	3227643

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample storage and instrument calibration not detailed, but study site characteristics described as campus near-industrial site and non-industrial campus area with sampling conducted for 5-9 hour/day as participants had normal daily activities with spirometry conducted at end of day when returning personal air and drinking water samples; sampling equipment/procedures for personal exposure monitoring (MSA Model C-200 pump w/Tenax cartridge), drinking water and spirometry breath samples described.
	Metric 2:	Analytical Methodology	Medium	Instrument calibration not described, but analytical instrumentation (GC/MS) described and methodology referenced (unknown if standard, accepted methods); LOD's (Table 7) and recoveries (Table 3) detailed.
	Metric 3:	Biomarker Selection	High	The authors measured DCE as parent chemical in human breath.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Lamar University campus near industrial site and UNC campus areas.
	Metric 5:	Currency	Low	March 4-5, 1980 (Lamar Univ) and June 10-11, 1980 (UNC)
	Metric 6:	Spatial and Temporal Variability	Low	Acceptable moderate sample size with 11 Lamar Univ samples and 6 UNC samples for personal air (5-9 hours for one day) and spirometry breath (single sample, for each of 11 Lamar Univ and 6 UNC participants), similar number with drinking water as samples provided for each time participant drank water during sampling day. Non-statistical sampling approach and no duplicate samples. Sampling conducted for one day for each participant.
	Metric 7:	Exposure Scenario	Medium	Exposure source/scenario described as industrial and non-industrial, field and laboratory blanks and controls described, however unable to distinguish between indoor/outdoor (ambient) sampling for breathing-zone personal air monitoring, indoor/ outdoor sampling scenario not described (building characteristics, climate, etc.), although questionnaire noting residence on/off campus, etc. administered to subjects.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data from each participant noted within Tables 7-8, summary data Tables 13-14 with range, percent detected, SD, mean and sample size.
	Metric 9:	Quality Assurance	Medium	No baseline pre-exposure samples, but field and lab controls and percent recoveries detailed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties and data gaps not discussed but variability characterized in summary statistics and limited discussion. Discussion of contribution to variance within regression modeling, and discrepancies between personal air monitoring and spirometry breath samples taken after personal air monitoring. Measurement of non-specific chemical isomers. Authors discuss need for additional studies to validate concentrations reported in various media.

Overall Quality Determination — Medium

Study Citation:	Kingsbury, J. A., Delzer, G. C., Hopple, J. A. (2008). Anthropogenic organic compounds in source water of nine community water systems that withdraw from streams, 2002–05. Scientific Investigations Report 2008-5208 :68.
HERO ID:	3364193

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methods followed standard USGS sampling protocols.
	Metric 2:	Analytical Methodology	Medium	Analyzed using USGS approved analytical methods, but recoveries and LOD were not reported.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in United States.
	Metric 5:	Currency	Medium	Samples were collected between 2002-2005.
	Metric 6:	Spatial and Temporal Variability	High	n=12-17 source-water samples collected at each site over 12-month period; variety of flow conditions; field blanks and replicates.
	Metric 7:	Exposure Scenario	High	The data likely represent relevant exposure scenarios related to stream water collected prior to water treatment and then finished water tested at nine community water systems.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Limited summary statistics were reported DF, n, max concentration reported in appendices.
	Metric 9:	Quality Assurance	High	QA/QC techniques were described in detail, including the use of field blanks and replicates.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was not characterized. Section "Changes in Concentration" address uncertainties and need for additional information.

Overall Quality Determination High

Study Citation:	Dai, H., Jing, S., Wang, H., Ma, Y., Li, L., Song, W., Kan, H. (2017). VOC characteristics and inhalation health risks in newly renovated residences in Shanghai, China. Science of the Total Environment 577(Elsevier):73-83.
HERO ID:	3453725

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Canister sampling. Followed the national standard TechnicalSpecifications for Monitoring of Indoor Air Quality (HJ/T167-2004), however, info such as storage conditions and duration is not provided. Blanks were collected in field.
	Metric 2:	Analytical Methodology	Medium	Analysis via GC-MS/FID. Only range of LOD provided. Calibrations were linear.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	High	2015
	Metric 6:	Spatial and Temporal Variability	Medium	8 homes sampled in only one month in one city.
	Metric 7:	Exposure Scenario	Medium	Condition of homes only briefly described - renovated in last year
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	DF, min, max, mean, median provided, but no raw data.
	Metric 9:	Quality Assurance	Medium	No QC issues specifically identified, but QC results not well described. Did use field blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Monte Carlo and sensitivity assessment conducted.

Overall Quality Determination Medium

Study Citation:	Ma, H., Zhang, H., Wang, L., Wang, J., Chen, J. (2014). Comprehensive screening and priority ranking of volatile organic compounds in Daliao River, China. Environmental Monitoring and Assessment 186(5):2813-2821.
HERO ID:	3488897

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling method, sample storage, site characteristics are well described.
	Metric 2:	Analytical Methodology	High	The analytical methods are well described. LODs are reported (in supplemental file).
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in river water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The site locations in China are well described.
	Metric 5:	Currency	Medium	Samples were collected in October 2011.
	Metric 6:	Spatial and Temporal Variability	High	Triplicate samples were collected from 20 sites in the river for target VOCs and duplicates for non-target VOCs.
	Metric 7:	Exposure Scenario	High	Sampling from the river is relevant for environmental exposures.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The data are pooled and the mean and maximum are provided, as well as the frequency of detection. The raw data are not provided and there is no measure of variability.
	Metric 9:	Quality Assurance	High	QA/QC procedures were described and are provided in the supplemental file.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There is limited discussion of variability and uncertainty.

Overall Quality Determination High

Study Citation:	Ellis, P. A., Rivett, M. O. (2007). Assessing the impact of VOC-contaminated groundwater on surface water at the city scale. Journal of Contaminant Hydrology 91(1-2):107-127.
HERO ID:	3544475

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling method was generally described, lacking some details but expected to have no major impacts on the results.
	Metric 2:	Analytical Methodology	Medium	Method was generally described (GC-MS); Detection limits reported as a range- more information on DL referenced in another study (Ellis 2003).
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sampling was conducted in Birmingham, UK.
	Metric 5:	Currency	Medium	Specific sampling through piezometers was conducted in summer and fall of 2001.
	Metric 6:	Spatial and Temporal Variability	Medium	The study reported that ”samples were taken at up to 35 river sites over a day” for 3 days. Unclear if there are replicates.
	Metric 7:	Exposure Scenario	High	The exposure scenario was relevant (surface water).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The data were reported as mean and maximum. No individual data were reported.
	Metric 9:	Quality Assurance	Low	Quality assurance was not directly discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The study discussed variability about the different methods used to estimate the environmental concentrations.

Overall Quality Determination Medium

Study Citation:	Hopple, J. A., Delzer, G. C., Kingsbury, J. A. (2009). Anthropogenic organic compounds in source water of selected community water systems that use groundwater, 2002-05. SIR 2009-5200 :76.
HERO ID:	3975066

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods for source groundwater and finished drinking water samples prior to distribution were described in detail.
	Metric 2:	Analytical Methodology	High	Analytical methods were described and detailed as using USGS approved analytical methods. Laboratory reporting limits were provided within tables.
	Metric 3:	Biomarker Selection	N/A	Study tested parent chemicals in selected community water systems.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sampling was conducted across the U.S. (Fig 1).
	Metric 5:	Currency	Medium	Sampling was conducted October 2002 through July 2005.
	Metric 6:	Spatial and Temporal Variability	High	Sampling was conducted within 12 principal aquifers across the United States within about 15 wells in each SWQA study with 221 well samples. Replicate sampling was conducted.
	Metric 7:	Exposure Scenario	High	Exposure sources were described for contamination in source water (groundwater) and finished water (drinking water) across the U.S.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistic data was provided in Table 5, Appendix 1, and Appendix 3 and included detection frequency, number of samples, maximum concentration in source water (groundwater) and finished water (drinking water). Raw data was not provided.
	Metric 9:	Quality Assurance	Medium	Quality assurance was detailed within descriptions of use of field blanks, replicate samples, and recoveries. Recoveries were generally within acceptable limits for most compounds but actual numbers were not provided.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Authors did not provide measures of variance within statistical summary measures of results, but maximum groundwater concentrations were presented. There was little discussion of limitations, uncertainties, or data gaps.

Overall Quality Determination High

Study Citation: OBG, (1987). Waste disposal sites assessment.
HERO ID: 4213875

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology was not described.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology is not described, including analytical instrumentation, extraction method, and detection limits.
	Metric 3:	Biomarker Selection	N/A	The study tested for the parent chemical in environmental media (soil and groundwater).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in Ohio.
	Metric 5:	Currency	Low	The sample collection date is not reported. The document is from 1987.
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	The sample size was not reported.
	Metric 7:	Exposure Scenario	Low	Data may represent relevant exposure scenarios related to polluted soil and groundwater at waste disposal sites in the US, but the report lacks methodological, exposure and contextual descriptions.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The raw data is reported. Summary statistics are not reported.
	Metric 9:	Quality Assurance	Low	QA/QC techniques and results were not directly discussed and cannot be implied.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The characterization of variability is absent (no measure of variance reported). Key uncertainties, limitations, and data gaps are not discussed.

Overall Quality Determination Uninformative

Study Citation:	UT Austin, (1987). Analysis and interpretation of batch equilibrium and column studies of the partitioning of chlorinated hydrocarbons to soil materials from the PPG Lake Charles site.
HERO ID:	4213876

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	sampling procedure, equipment were described, lacking calibration and storage conditions
	Metric 2:	Analytical Methodology	Low	GC was used for analysis, LOD was not reported.
	Metric 3:	Biomarker Selection	N/A	NA - soil samples no need for biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Lake Charles, LA
	Metric 5:	Currency	Low	No sampling date is provided, but a publication date is available - 1987.
	Metric 6:	Spatial and Temporal Variability	Low	Sample amount was not reported, but at least 2 boring sites were reported.
	Metric 7:	Exposure Scenario	Low	Exposure scenario lacks detailed description, but mainly focused on soil.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Some individual data were reported, but it was not clear whether full sampling results were reported.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Low	The study has limited discussion of key uncertainties, limitations.

Overall Quality Determination Low

Study Citation:	Ken E Davis Assoc, (1984). Investigation of contamination at the North Dock Storage Area Phase I - PPG Industries, Lake Charles, LA.
HERO ID:	4213877

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods not described. Only states that soil and water samples were taken.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	Environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Louisiana
	Metric 5:	Currency	Low	Sampling in 1984
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Medium	Lacking details about the population of interest, exposure characteristics
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability, limitations and uncertainties

Overall Quality Determination Uninformative

Study Citation:	D'Appolonia Consulting Eng, (1987). Phase II - Hydrogeological impact assessment - Waste disposal facilities.
HERO ID:	4213879

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is described at the methods of investigation section
	Metric 2:	Analytical Methodology	Medium	Table 1, ground water quality parameter and analytical methods. LOD not reported
	Metric 3:	Biomarker Selection	N/A	Parent chemical in groundwater
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Barberton plant at Ohio
	Metric 5:	Currency	Low	1983
	Metric 6:	Spatial and Temporal Variability	Low	Single sample collected per site. A total of 15 samples collected
	Metric 7:	Exposure Scenario	High	waste disposal facility groundwater contamination
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Table 12 reports individual data points. No statistics
	Metric 9:	Quality Assurance	Medium	Sample duplicates collected for QA
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variability across wells, no uncertainty reported

Overall Quality Determination Medium

Study Citation: ESC, (1985). Groundwater monitoring summary - Hranica Landfill, Sarver, Penn.
HERO ID: 4213880

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methods are not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods are not described
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Pennsylvania, USA
	Metric 5:	Currency	Low	Sampling in 1984 and 1985
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Medium	May represent a relevant exposure scenario, but lacks sufficient methodological details and population of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC was not discussed
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability, uncertainties or limitations

Overall Quality Determination Uninformative

Study Citation:	ERM, (1992). ECRA sampling and analysis plan report - AlliedSignal Aerospace Company Bendix Electric Power Division with cover letter dated 111693.
HERO ID:	4213973

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology was not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology was not discussed
	Metric 3:	Biomarker Selection	N/A	Not applicable
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	NJ, USA
	Metric 5:	Currency	Low	Published in 1992
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size was not reported
	Metric 7:	Exposure Scenario	Medium	Did not describe the population of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	High	Analyzed control samples, described QA/QC techniques
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limited description of uncertainties, no characterization of variability

Overall Quality Determination Uninformative

Study Citation:	PFAUDLER CO, (1984). Results of analytical data with attached tables.
HERO ID:	4214049

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology was not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology was not described
	Metric 3:	Biomarker Selection	N/A	Not applicable, did not test for biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	New York, USA
	Metric 5:	Currency	Low	Report from 1984
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size was not reported
	Metric 7:	Exposure Scenario	Low	Data may represent a relevant exposure scenario, lacking details about microenvironment and population of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations only, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not characterized

Overall Quality Determination Uninformative

Study Citation:	Geraghty & Miller Incorporated, (1982). Ground-water quality conditions in the vicinity of waste oil disposal facilities at the Sidney, New York, plant.
HERO ID:	4214163

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methods not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	New York
	Metric 5:	Currency	Low	Sampling in 1982
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Low	Insufficient methodological details, no information about population of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability, uncertainties, and limitations were not discussed

Overall Quality Determination — Uninformative

Study Citation:	Allied Signal Inc, (1990). Letter from Allied-Signal Inc notifying USEPA of their intentions to conduct an environmental assessment pursuant to the Environment Cleanup Responsibility Act with attachments.
HERO ID:	4214323

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling and analytical plan are described across the document from 1983 (page 168) -1986 (page 455)
	Metric 2:	Analytical Methodology	Medium	Sampling and analytical plan are described across the document from 1983 (page 168) -1986 (page 455). LOD or LOQ reported in most of the data tables
	Metric 3:	Biomarker Selection	N/A	Parent chemical in ground water and soil samples
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Eatontown, New Jersey
	Metric 5:	Currency	Low	1983-1986
	Metric 6:	Spatial and Temporal Variability	Low	Sample size in total is not reported, but the report has sampling data from 1983-1986
	Metric 7:	Exposure Scenario	High	Organic compounds contamination in ground water and solids from the Bendix- Electric Power Division facility
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only individual data points, no summary of statistics
	Metric 9:	Quality Assurance	High	QA/QC reported for most of the sampling periods
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Sampling from 1983-1986, no report on key limitations

Overall Quality Determination Medium

Study Citation:	ICI Americas Inc, (1991). Letter from ICI Americas Inc to USEPA submitting follow-up information concerning phenol and other chemicals in groundwater at the facility in Hopewell, Virgina with attachments.
HERO ID:	4214419

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methods were not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods were not described
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Virginia, USA
	Metric 5:	Currency	Low	Sampling in 1990
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size is not reported
	Metric 7:	Exposure Scenario	Low	Data lacks key pieces of information and this impacts the exposure scenario characterization
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No summary statistics
	Metric 9:	Quality Assurance	Low	Analyzed control samples, did not describe QA/QC techniques
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability, did not discuss uncertainties or study limitations

Overall Quality Determination Uninformative

Study Citation:	Rhone-Poulenc Inc, (1993). Initial submission: Notice of monitored concentrations of 1,1-dichloroethane, 1,2-dichloropropane, trichlor* in local wells by letter from Rhone-Poulenc inc to USEPA dated 11/15/93.
HERO ID:	4214434

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	This is only a letter and no sampling methodology discussed.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology is not described, including analytical instrumentation, extraction method, and detection limits.
	Metric 3:	Biomarker Selection	N/A	The study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in Gastonia, NC.
	Metric 5:	Currency	Low	The sample collection date is not reported. The letter was submitted in 1993.
	Metric 6:	Spatial and Temporal Variability	Low	The collection of replicate samples was not reported. The sample size was not specified, but assumed to be one.
	Metric 7:	Exposure Scenario	Low	Samples were from a monitoring well near a facility, but no further information is provided.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	No raw data or summary statistics are reported. Only one concentration value is provided on page 2 (assumed to be the only sample).
	Metric 9:	Quality Assurance	Critically Deficient	QA/QC techniques and results were not directly discussed and cannot be implied.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Critically Deficient	The characterization of variability is absent (no measure of variance reported). Key uncertainties, limitations, and data gaps are not discussed. Only one sample and no other supporting information is provided, making value highly uncertain.

Overall Quality Determination — Uninformative

Study Citation:	Battelle Ocean Sciences, (1987). Draft final report on the fate and effects of produced water discharges in nearshore marine waters (volume I & II) with cover letter dated 091187.
HERO ID:	4214480

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description of sampling methods
	Metric 2:	Analytical Methodology	Critically Deficient	No description of analytical methods
	Metric 3:	Biomarker Selection	N/A	Does not measure biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	United States
	Metric 5:	Currency	Low	Published in 1987
	Metric 6:	Spatial and Temporal Variability	N/A	Sample size not reported
	Metric 7:	Exposure Scenario	Medium	Data may represent relevant exposure scenarios, missing details about the population of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	Low	Techniques only briefly described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not characterized

Overall Quality Determination Uninformative

Study Citation:	Dow Chemical, (1980). Introductory study of the biodegradation of the chlorinated methane, ethane and ethene compounds: Progress report CR806890-01 coop agreement.
HERO ID:	4215582

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	The sampling methodology is not discussed
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology not described
	Metric 3:	Biomarker Selection	N/A	parent chemical in water
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Miami, Florida
	Metric 5:	Currency	Low	1982
	Metric 6:	Spatial and Temporal Variability	Medium	No sample replicates, 116 samples at the water treatment plants
	Metric 7:	Exposure Scenario	High	Volatile organic compounds in raw, lime softened and finished water
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	No individual data points reported, only average concentrations
	Metric 9:	Quality Assurance	Critically Deficient	QA/QC procedures not mentioned in the document
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No sample variability or discussion of key limitations

Overall Quality Determination Uninformative

Study Citation:	Ciba-Geigy, (1984). Memo from S. Workman to C. Staton on Scrdi Dreyfus street site dated September 24, 1984 on one chemical.
HERO ID:	4215637

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	There is no information on sampling methods included; this document cites a memo to the file (not attached) that describes sampling methodology.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods were not described, but the sample was analyzed by South Carolina Department of Health and Environmental Control, Analytical Services Division, suggesting the analytical methods were scientifically sound and accepted, as of that time. The LODs were not specified.
	Metric 3:	Biomarker Selection	N/A	They did not test for biomarkers, but rather for parent chemicals in water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Carolina
	Metric 5:	Currency	Low	Sample was from May 1984.
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	The paper notes that the well was sampled after it was installed, and the analytical data shows only a single sample from a single date.
	Metric 7:	Exposure Scenario	Low	The memo lacked details about the exposure source(s) and microenvironment. There was mention of the groundwater likely impacting a nearby creek, but no samples were collected from the creek. It was not specified whether the groundwater was being used for drinking water.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	They provided individual sample concentrations. No summary statistics could be calculated given that there was only 1 sample.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not characterized, but it was suggested they resample the well in the future, for verification.

Overall Quality Determination — Uninformative

Study Citation:	Geraghty & Miller Incorporated, (1983). Investigation of ground-water conditions in the vicinity of western electric company Princeton, New Jersey with attachments, cover sheet and letter dated 020690.
HERO ID:	4215684

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods only briefly described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology not described
	Metric 3:	Biomarker Selection	N/A	Did not test for biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	New Jersey
	Metric 5:	Currency	Low	Report from 1980 to 1982
	Metric 6:	Spatial and Temporal Variability	Low	9 samples
	Metric 7:	Exposure Scenario	Medium	Data likely represents relevant exposure scenarios, missing details about the population of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations only, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not characterized

Overall Quality Determination Uninformative

Study Citation:	ENSR, (1987). Environmental soil investigation AT&T Kansas City works & quality assurance plan for identifying contaminants around underground storage tanks w-attachments, cover sheet & letter.
HERO ID:	4215685

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedures, equipment, and calibration were reported.
	Metric 2:	Analytical Methodology	High	GC/FID was used to analyze the samples. Reporting limit was reported.
	Metric 3:	Biomarker Selection	N/A	No biomarkers used
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Kansas City, MO
	Metric 5:	Currency	Low	1987
	Metric 6:	Spatial and Temporal Variability	High	36 soil samples were collected.
	Metric 7:	Exposure Scenario	Medium	Exposure scenario was relevant (soil).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Average data were reported, individual data were not reported.
	Metric 9:	Quality Assurance	Medium	QA/QC was performed. And there was no major concerns.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study discussed variability among the different sampling sites.

Overall Quality Determination Medium

Study Citation:	Allied Signal Inc, (1990). Results of the phase III hydrogeologic investigation report with attachments and cover letter dated 020890.
HERO ID:	4215688

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology reported
	Metric 2:	Analytical Methodology	High	USEPA Method 601, detection limits in appendix C
	Metric 3:	Biomarker Selection	N/A	Parent chemical in groundwater
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Morris Township, New Jersey
	Metric 5:	Currency	Low	1987
	Metric 6:	Spatial and Temporal Variability	Medium	19 wells, no sample replicates
	Metric 7:	Exposure Scenario	High	Groundwater quality conditions at the Allied-Signal facility
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported in appendix C. Summary of concentrations presented in table 3
	Metric 9:	Quality Assurance	Low	No QA/QC reported, but the laboratory followed an EPA method
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability or uncertainty not discussed

Overall Quality Determination Medium

Study Citation:	NJ DEP, (1987). Data generated from three water departments on untreated well water, plant delivered water and distribution system with cover letter dated 030387.
HERO ID:	4290379

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Sampling methodology not described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology not described
	Metric 3:	Biomarker Selection	N/A	Parent chemical in groundwater
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	State of New Jersey
	Metric 5:	Currency	Low	1987
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size is not reported
	Metric 7:	Exposure Scenario	Medium	Raw water quality from three different areas the State of New Jersey
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Critically Deficient	Data reported but it is not possible to read it
	Metric 9:	Quality Assurance	Critically Deficient	QA/QC not reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Critically Deficient	Estimates are highly uncertain since there is not enough information from the study

Overall Quality Determination Uninformative

Study Citation:	Geosciences Research Assoc, (1987). Identification of ground water characteristics at the Knauf Fiberglass Company plant - Shelbyville, Indiana (final report).
HERO ID:	4412645

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods only briefly described
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methods not described
	Metric 3:	Biomarker Selection	N/A	Did not test for biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Indiana, USA
	Metric 5:	Currency	Low	Sampling began in 1983
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size not reported
	Metric 7:	Exposure Scenario	Medium	Data may represent a relevant exposure scenario, missing details about the population and microenvironment of interest
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations only, no summary statistics
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty were not characterized

Overall Quality Determination — Uninformative

Study Citation:	Buszka, P. M., Barber, L. B., Schroeder, M. P., Becker, L. D. (1994). Organic compounds downstream from a treated-wastewater discharge near Dallas, Texas, March 1987.
HERO ID:	4506342

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	water samples collected at 4 sites (Fig 1 and Table 1); collected in glass bottles by submerging the bottles and allowing them to fill completely; refrigerated
	Metric 2:	Analytical Methodology	Low	purge-and-trap, closed-loop stripping, and pH-adjusted solvent extraction methods used for water samples; GC/MS; All compound identities were confirmed by matching sample mass spectra and retention indices with those of authentic standards; detection limit not provided
	Metric 3:	Biomarker Selection	N/A	environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Rowlett Creek near Dallas, Texas
	Metric 5:	Currency	Low	March 9 and 10,1987
	Metric 6:	Spatial and Temporal Variability	Low	1 site upstream; 3 sites downstream; no replicates
	Metric 7:	Exposure Scenario	High	streambed sediments from upstream and downstream of discharge from a WWTP
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 provides the concentrations from water samples by purge-and-trap extraction per sites; no further statistics provided
	Metric 9:	Quality Assurance	Low	no discussion on recoveries for pure-and-trap extraction with GC/MS; Site 1 was the upstream control site representing background conditions
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	provided concentrations determined from other studies (Table 4 and text); further discussion absent

Overall Quality Determination Medium

Study Citation:	Xing, L., Wang, L., Zhang, R. (2018). Characteristics and health risk assessment of volatile organic compounds emitted from interior materials in vehicles: a case study from Nanjing, China. Environmental Science and Pollution Research 25(15):14789-14798.
HERO ID:	4697151

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling described in detail. Additional information reported in reference (USEPA 1999) and an associated reference (Xu et al. 2016).
	Metric 2:	Analytical Methodology	Medium	Detection limits reported as a range and not for each chemical.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Nanjing, China
	Metric 5:	Currency	High	April 2015
	Metric 6:	Spatial and Temporal Variability	Medium	Ten sets of samples. Unclear if there are replicates.
	Metric 7:	Exposure Scenario	Medium	Relevant scenario of car interiors. Missing information of car details- such as model, condition.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics provided. Raw data not provided
	Metric 9:	Quality Assurance	Low	QA/QC not directly discussed but can be interpreted.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No discussion of limitations or variability.

Overall Quality Determination Medium

Study Citation:	Grosjean, E., Rasmussen, R. A., Grosjean, D. (1999). Toxic air contaminants in Porto Alegre, Brazil. Environmental Science and Technology 33(12):1970-1978.
HERO ID:	4697228

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling procedure, equipment, and matrix characterization were discussed.
	Metric 2:	Analytical Methodology	Medium	Extraction and analytical method (GC/MS) were described. LOD not reported, MDL were reported as 0.1 ppbv.
	Metric 3:	Biomarker Selection	N/A	NA - air samples no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Porto Alegre, Brazil
	Metric 5:	Currency	Low	1996-1997
	Metric 6:	Spatial and Temporal Variability	Medium	Most compounds have more than 23 sample points.
	Metric 7:	Exposure Scenario	Medium	ambient air
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Range and average of the concentrations were reported with standard deviation and background concentration.
	Metric 9:	Quality Assurance	Low	Quality assurance measures were not described in details
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The study discussed in details the variability from one urban area to the next area.

Overall Quality Determination Medium

Study Citation:	Buszka, P. M., Yeskis, D. J., Kolpin, D. W., Furlong, E. T., Zaugg, S. D., Meyer, M. T. (2009). Waste-indicator and pharmaceutical compounds in landfill-leachate-affected ground water near Elkhart, Indiana, 2000-2002. Bulletin of Environmental Contamination and Toxicology 82(6):653-659.
HERO ID:	4912133

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methodology parameters were missing such as sampler calibration and storage conditions. Samples were "chilled" but did not provide temperature.
	Metric 2:	Analytical Methodology	Medium	Some analytical methodology parameters were missing, such as calibration. Detailed methods were provided in references listed by the study. LOD reported (Table 3).
	Metric 3:	Biomarker Selection	N/A	Parent chemical was measured in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The samples were collected in Elkhart, Indiana.
	Metric 5:	Currency	Low	The samples were collected in 2000-2002.
	Metric 6:	Spatial and Temporal Variability	Low	Only 4 wells were sampled. No duplicates were collected.
	Metric 7:	Exposure Scenario	High	The exposure scenario represented closely the environment of wells downgradient from a landfill.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only individual data but no summary statistics were reported. Data reported in table 2.
	Metric 9:	Quality Assurance	Low	The study reported low recoveries (<70%). Field blanks were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Comparison of results were made to other studies. No sample variability and key limitations were reported.

Overall Quality Determination Medium

Study Citation:	Chung, Y., Shin, D., Park, S., Lim, Y., Choi, Y., Cho, S., Yang, J., Hwang, M., Park, Y., Lee, H. (1997). Risk assessment and management of drinking water pollutants in Korea. Water Science and Technology 36(12):309-323.
HERO ID:	5189402

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Samples were collected at treatment plants. No further detail is provided.
	Metric 2:	Analytical Methodology	Low	Samples were analyzed by GC/MSD (references US EPA, 1990, which has little detail on analytical methods; no further information provided).
	Metric 3:	Biomarker Selection	N/A	Environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Six cities in Korea were specified.
	Metric 5:	Currency	Low	March and June 1993-1995
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	Sample size is not reported.
	Metric 7:	Exposure Scenario	Medium	Provides limited characterization of urban surface waters
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only the mean and range are reported.
	Metric 9:	Quality Assurance	Low	QA/QC was not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No discussion or quantification of variability

Overall Quality Determination — Uninformative

Study Citation:	Zimmerman, M. J., Massey, A. J., Campo, K. W. (2005). Pushpoint sampling for defining spatial and temporal variations in contaminant concentrations in sediment pore water near the ground-water / surface-water interface. :1-75.
HERO ID:	5258475

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	The study detailed a validation study of a new sampler, a push point sampler. The method was not compared to standard methods within this study. The sampling procedures and storage conditions were reported by the authors. Storage duration times were not reported.
	Metric 2:	Analytical Methodology	Low	The authors refer to analytical methods listed in an appendix that was not part of the pdf. The article refers to the samples being analyzed by an USEPA laboratory so one could assume that standard analytical methods were used but it is unclear from the main text. Reporting level was reported by authors.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The authors report the study location.
	Metric 5:	Currency	Low	Data was collected in 2002 and 2003.
	Metric 6:	Spatial and Temporal Variability	High	The authors collected replicate samples, at two different sampling sites and over multiple time points. The reported total sample size for location A was 148 and for location B 159.
	Metric 7:	Exposure Scenario	Medium	The study site was a river where ground-water discharge of pollutants was known.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The authors provide the individual samples concentrations, range of concentration, detection frequency, number of samples within the dataset. They did not report a standard deviation or measure of central tendency.
	Metric 9:	Quality Assurance	Medium	The authors reported detailed results of trip blanks, replicates, and equipment blanks. Recovery tests were not reported. Chemical of interest was not detected in trip or laboratory blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors do not report a standard deviation. The authors discussed variability in the data, but did not discuss gaps or limitations.

Overall Quality Determination Medium

Study Citation:	Huang, Y., Su, T., Wang, L., Wang, N., Xue, Y., Dai, W., Lee, S. C., Cao, J., Ho, S. S. H. (2019). Evaluation and characterization of volatile air toxics indoors in a heavy polluted city of northwestern China in wintertime. Science of the Total Environment 662:470-480.
HERO ID:	5431563

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Field blanks were used. Storage temp provided. Equipment calibration and flow rates provided. Detailed sampling procedures in other publications (Spaulding et al., 1999; Ho et al., 2011).
	Metric 2:	Analytical Methodology	Medium	Details on method shown in Dai et al., 2012, but relatively robust description provided. Limits only provided as a range.
	Metric 3:	Biomarker Selection	N/A	Paper reports chemical concentrations in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	High	2016-2017
	Metric 6:	Spatial and Temporal Variability	High	44 samples from 11 homes.
	Metric 7:	Exposure Scenario	High	Questionnaire provided details to characterize the building and activity patterns of occupants. No known pollution sources near buildings.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Mean and sd in main report. Individual samples appear o have been provided in SI. Conducted source apportionment for indoor sources.
	Metric 9:	Quality Assurance	Medium	Calibration curve was established. Precision was <25%. Recoveries not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability assessed via factor analysis. No discussion of uncertainties.
Overall Quality Determination			**High**	

Study Citation:	Roy F. Weston Inc, (1986). Installation restoration program phase ii-confirmation/quantification, stage 1. Final report for Burlington Air national guard base, Burlington, Vermont.
HERO ID:	5436115

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling equipment, procedure was described in detail for the samples in groundwater and surface water.
	Metric 2:	Analytical Methodology	High	GC/MS was used to analyze the chemicals, detection limits was reported - 10 ug/L.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Burlington Air National Guard Base, Vermont
	Metric 5:	Currency	Low	In 1984, soil and surface water samples from the site were collected.
	Metric 6:	Spatial and Temporal Variability	Medium	5 monitoring wells and 3 existing wells, 6 surface water stations were sampled.
	Metric 7:	Exposure Scenario	Medium	Exposure scenario was about an Airforce base.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Individual data were reported for each chemical at each sampling location, though no summary statistics were provided.
	Metric 9:	Quality Assurance	High	QA/QC measures were performed and all pertinent quality assurance information is provided in the data source or companion source.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study is a site investigation, not having much discussion on study limitations or variability because the study followed standard procedure.

Overall Quality Determination Medium

Study Citation:	Buzska, P. M. (1987). Relation of water chemistry of the Edwards aquifer to hydrogeology and land use, San Antonio Region, Texas.
HERO ID:	5436763

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling was not performed because the study used a standard database, but no major concerns were raised.
	Metric 2:	Analytical Methodology	Medium	Analytical procedure was not performed in this study because it used a database.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Edwards aquifer, TX
	Metric 5:	Currency	Low	Sampling occurred during 1984 and 1985.
	Metric 6:	Spatial and Temporal Variability	High	The WATSTORE database contained more than 1500 water chemistry analyses from 280 wells and 3 spring waters.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenario (surface water/groundwater in an aquifer).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Average data with summary statistics were presented, though individual data were not reported.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Medium	The study had detailed discussion of data variability and compared among each subareas.

Overall Quality Determination Medium

Study Citation:	Cummings, T. R., Twenter, F. R. (1986). Assessment of ground-water contamination at Wurtsmith Air Force Base, Michigan, 1982-85. :1-110.
HERO ID:	5437163

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedure, procedure of building of purge wells, and site matrix were described.
	Metric 2:	Analytical Methodology	High	Analytical method was described (GC/FID). Detection limit was reported to be 1 ug/L.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Wurtsmith air force base, MI
	Metric 5:	Currency	Low	1983
	Metric 6:	Spatial and Temporal Variability	High	Sample size was not reported directly, but at least 25 wells were sampled (page 75).
	Metric 7:	Exposure Scenario	Medium	Groundwater, soil from an Airforce base site
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data were reported, but indicated as NA for not applicable or ND for not detected.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Medium	The study did not have much discussion much variability and limitation, mainly focused on the report of results.

Overall Quality Determination Medium

Study Citation:	Guimaraes, W. B. (1995). Water quality in the Withers Swash Basin, with emphasis on enteric bacteria, Myrtle Beach, South Carolina, 1991-93. :1-102.
HERO ID:	5438210

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The water sampling methods were discussed but didn't include procedure details. The authors cited previously published articles.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were reported, including instrumentation, LOD but did not include recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in South Carolina, USA.
	Metric 5:	Currency	Low	The samples were taken in 1991 and 1992.
	Metric 6:	Spatial and Temporal Variability	High	n≥ 10 samples for a single scenario. The sample size was not explicitly reported but the results throughout the report suggest a large sample collection from 51 sites in total.
	Metric 7:	Exposure Scenario	Medium	The data likely represent relevant exposure scenarios related to water contamination in Withers Swash and its two tributaries in Myrtle Beach, S.C, USA.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics were reported (median, min, max).
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The authors provided a limited characterization of variability (range). Uncertainties and limitations were not discussed.

Overall Quality Determination Medium

Study Citation:	Heck, B. A., Myers, N. C., Hargadine, D. A. (1992). Hydrogeology and ground-water quality conditions at the Reno County Landfill, South-Central Kansas, 1990-91.
HERO ID:	5438509

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sampler calibration
	Metric 2:	Analytical Methodology	Low	LOD nor LOQ reported
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Reno County, Kansas
	Metric 5:	Currency	Low	Data collected in 1991
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized. Further investigation needed to determine usefulness of information.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data reported. Most summary statistics provided.
	Metric 9:	Quality Assurance	Low	Limited QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported

Overall Quality Determination Medium

Study Citation:	Hunt, J., Birch, G., Warne, M. S. J. (2007). Deriving trigger values for, and assessing hazard posed by, volatile chlorinated hydrocarbons in a sydney estuary. Australasian Journal of Ecotoxicology 13(1):33-42.
HERO ID:	5438705

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedure and program designs were described in details. Site matrix was provided, including graphs and maps.
	Metric 2:	Analytical Methodology	High	Analytical procedure was reported to follow EPA methodology (USEPA 5030B)
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Penrhyn Estuary, Sydney, Australia
	Metric 5:	Currency	Medium	2004-2005
	Metric 6:	Spatial and Temporal Variability	High	5 rounds of samples were collected every 3 months from 7 sites along the estuary and 2 storm water sites in the span of 1 year.
	Metric 7:	Exposure Scenario	High	Exposure scenario was closely related to the chemicals of interest - surface water and storm water drainage.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean concentrations for each site were reported along with summary statistics.
	Metric 9:	Quality Assurance	High	Quality control was undertaken; recovery rates were acceptable (80% to 120%). No major concerns were noticed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The study had a robust discussion about the limitation and uncertainty of the hazard assessment conducted in this study.

Overall Quality Determination High

Study Citation:	Macintosh, R., Trnovsky, M., Jackson, S. (1988). Contamination assessment and remedial alternatives for former printed circuit board manufacturing facility contaminating the Biscayne aquifer. :161-163.
HERO ID:	5440300

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Site matrix and history were described. However, the study did not have much information on sampling process.
	Metric 2:	Analytical Methodology	Low	The study provided that the soil samples were analyzed for metals using EPA standard test method. The study mentioned the analysis for organic pollutants only in groundwater samples but did not describe the specific process used.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	A circuit board manufacturing facility in Fort Lauderdale, Florida
	Metric 5:	Currency	Low	Neither sampling date or publication date was available. The sampling site was closed in 1987, which shows that the sampling occurred after the site closure.
	Metric 6:	Spatial and Temporal Variability	Medium	16 monitoring wells were sampled for groundwater data for the organic compounds.
	Metric 7:	Exposure Scenario	Medium	Exposure matrix seems relevant - groundwater samples of a previous circuit board manufacturing facility.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only maximum concentrations were reported.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control techniques and results were not directly discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties, limitations, and data gaps are not discussed.

Overall Quality Determination Low

Study Citation:	Mack, T. J. (1997). Design of monitoring wells, hydrogeology, and ground-water quality beneath Country Pond, Kingston, New Hampshire.
HERO ID:	5440304

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	Limited sampling methods were discussed.
	Metric 2:	Analytical Methodology	Critically Deficient	The analytical methods were not described.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed water samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in New Hampshire, USA.
	Metric 5:	Currency	Low	The samples were collected in 1993.
	Metric 6:	Spatial and Temporal Variability	Low	n=17 samples were collected (two samples per location). Estimated from Table 4.
	Metric 7:	Exposure Scenario	Low	The data may represent relevant water exposure scenarios in New Hampshire, but the lack of methodological details limits the study's results.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations were reported, without summary statistics.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized. Limitations were not reported.

Overall Quality Determination — Uninformative

Study Citation:	Miermans, C. J. H., Van Der Velde, L. E., Frintrop, P. C. M. (2000). Analysis of volatile organic compounds, using the purge and trap injector coupled to a gas chromatograph ion-trap mass spectrometer review of the results in Dutch surface water of the Rhine, Meuse, Northern Delta area and Westerscheldt, over the period 1992-1997. Chemosphere 40(1):39-48.
HERO ID:	5440660

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Automatic online sampling system takes composite samples on a daily basis, supplemented by manual sampling if values are high. The authors noted grab samples of volatile compounds needs to be improved.
	Metric 2:	Analytical Methodology	High	Both onsite and lab samples were analyzed with (novel) purge and trap injection (PTI) coupled to a chromatograph/ion trap mass spectrometer. Detection limits are reported.
	Metric 3:	Biomarker Selection	N/A	Environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	River sampling locations in the Netherlands are named.
	Metric 5:	Currency	Low	1992-1997
	Metric 6:	Spatial and Temporal Variability	Medium	13-14 samples per year at 11 sites. No replicates
	Metric 7:	Exposure Scenario	Medium	Timing of sampling (e.g., season) is missing. Figure 4 implies the samples may have been taken monthly.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only maximum values are reported. No raw data
	Metric 9:	Quality Assurance	Medium	Method validation study; discussed standards, reliability, and recovery to some extent.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Quantitative and qualitative descriptions of variability are lacking for most chemicals (some have greater spatiotemporal detail in the discussion).

Overall Quality Determination Medium

Study Citation:	Naber, S., Verducci, J. (1988). Statistical analysis of ground water contamination of the Alert Apron and northern landfill areas of Wurtsmith AFB, Michigan.
HERO ID:	5440990

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sources, sampling procedure were described in details, though calibration and storage were not mentioned.
	Metric 2:	Analytical Methodology	Low	Analysis was mentioned but not described in details.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Wurtsmith Air Force Base, Michigan
	Metric 5:	Currency	Low	Sampling occurred from 1980 to 1987.
	Metric 6:	Spatial and Temporal Variability	Medium	3 agencies(USGS, USAF, MDNR) collected samples for the 2 sites of interest near the AFB over the sampling period.
	Metric 7:	Exposure Scenario	Medium	The exposure scenario was relevant - groundwater samples near the AFB.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data were provided for each site.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	High	Key uncertainties and errors have been identified.

Overall Quality Determination Medium

Study Citation:	USGS, (1989). Inorganic and organic ground-water chemistry in the Canal Creek area of Aberdeen Proving Ground, Maryland.
HERO ID:	5443295

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Description of sampling area was well described.
	Metric 2:	Analytical Methodology	High	GC/FID was used perform the analysis of chemicals. Detection limits were reported (page 59).
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemicals.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Canal Creek, Maryland
	Metric 5:	Currency	Low	1986 - 1987
	Metric 6:	Spatial and Temporal Variability	High	Water samples were collected from 87 wells; at least 2 well volumes of water were collected from each well.
	Metric 7:	Exposure Scenario	High	Exposure scenarios were highly related - groundwater from the aquifer (sources were discussed).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Individual data were provided for each well in Table 10.
	Metric 9:	Quality Assurance	High	Quality control and assurance measures were performed and no major concerns were seen.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study characterizes variability in the media studied.

Overall Quality Determination High

Study Citation:	Watts, K. R., Ortiz, R. F. (1990). Geohydrology and ground-water quality at the pueblo depot activity landfill near Pueblo, Colorado.
HERO ID:	5443405

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample storage missing
	Metric 2:	Analytical Methodology	Medium	Some analytical methods not reported, such as recovery samples
	Metric 3:	Biomarker Selection	N/A	NA - Water samples no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Colorado, USA
	Metric 5:	Currency	Low	Data collected in 1988
	Metric 6:	Spatial and Temporal Variability	Medium	Multiple wells sampled about 3-5 times each, unclear if there are replicates
	Metric 7:	Exposure Scenario	High	Proximity to landfill water. Can be used in general population, and environmental exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 10 start after page 95 while some ranges can be found within text too.
	Metric 9:	Quality Assurance	Low	QA/QC implied
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Few limitations reported

Overall Quality Determination Medium

Study Citation:	Bigsby, P. R., Myers, N. C. (1989). Hydrogeology and ground-water-quality conditions at the Geary County landfill, northeast Kansas, 1988.
HERO ID:	5449639

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	USGS conducted study; 7 monitoring wells sampled (MW- to MW-2); samples retrieved with a Teflon-bottom check-valve bailer and immediately put on ice; samples filtered; also samples of Smoky Hill River collected by dipping bottles into the stream and allowing to fill
	Metric 2:	Analytical Methodology	Low	Performed by Kansas Department of Health and Environment laboratory, no discussion of analytical methodology. Although missing analytical description and other QA and uncertainties in this report they have references in which this information can be found. Most of the used methodology are accepted methods performed by accredited labs.
	Metric 3:	Biomarker Selection	N/A	NA - water samples no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Geary County, northeast Kansas
	Metric 5:	Currency	Low	Sept 20-22, 1988
	Metric 6:	Spatial and Temporal Variability	Medium	7 wells sampled Sept 20-22; also 3 samples from the river; no replicate samples indicated
	Metric 7:	Exposure Scenario	High	groundwater quality conditions at a county landfill
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Table 8 provides concentration per site
	Metric 9:	Quality Assurance	Low	QA/QC not reported but implied as it is a USGS investigation
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	no discussion of variability or uncertainty

Overall Quality Determination Medium

Study Citation:	Demas, C. R., Demcheck, D. K. (1989). Uptake of manmade organic compounds by Rangia cuneata in the lower Calcasieu River, Louisiana. :309-319.
HERO ID:	5451873

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Rangia, sediment, and water collection are specified in the materials and methos section.
	Metric 2:	Analytical Methodology	High	Detection limits are reported in table E-16. Samples were analyzed using an standardized U.S. EPA method (625).
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Lake Charles in the lower Calcasieu river, Louisiana.
	Metric 5:	Currency	Low	Data collected in July, August and September of 1987.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates collected. Samples divided in two sets and collected in 4 sites in 3 different seasons.
	Metric 7:	Exposure Scenario	High	The study used Rangia Cuneata as a sentinel to evaluate the concentrations of VOCs in an affected and a recovery area of the Calcasieu river.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Data reported in table E-17 - E-19 seem to be individual point values. No summary of statistics reported.
	Metric 9:	Quality Assurance	High	QA/QC assumed since the study followed an U.S. EPA methodology.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No limitations reported. Variability reported in terms of seasonal variation.

Overall Quality Determination High

Study Citation:	(1993). Mixed waste management facility (MWMF) groundwater monitoring report. Fourth quarter 1992 and 1992 summary. Progress rept.
HERO ID:	5452031

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology is only briefly discussed. Described sampling locations and study site characteristics. Did not report sample storage conditions/duration or sampling equipment and procedure.
	Metric 2:	Analytical Methodology	Critically Deficient	Analytical methodology is not described, including analytical instrumentation.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Savannah River Site, Aiken, SC
	Metric 5:	Currency	Low	Samples collected throughout second quarter 1992.
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples were collected but there no replicate samples collected. Several wells sampled, but only one sample per well.
	Metric 7:	Exposure Scenario	Medium	The report provides extensive background information about the sites and wells. The data likely represent the relevant exposure scenario. Routes of exposure and populations of interest not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data were reported.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control techniques and results were not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The characterization of variability is absent and key uncertainties, limitations, and data gaps are not discussed.

Overall Quality Determination Uninformative

Study Citation:	Dreisch, F. A., Gower, M., Munson, T. O. (1980). Survey of the Huntington and Philadelphia River water supplies for purgeable organic contaminants.
HERO ID:	5471952

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling procedure and storage conditions were described. EPA methods.
	Metric 2:	Analytical Methodology	High	Analytical method was described (hall detector/flame ionization detector), LOD was reported in Table 2.
	Metric 3:	Biomarker Selection	N/A	environmental media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ohio River, Huntington, WV, and Schuylkill River, Philadelphia, PA
	Metric 5:	Currency	Low	1978-1979
	Metric 6:	Spatial and Temporal Variability	High	Quadruplicate samples were taken every 12 hours at the 2 locations. Sampling was from December 4, 1978 to January 29, 1979 for Ohio River and from November 27, 1978 to February 24, 1979.
	Metric 7:	Exposure Scenario	Medium	The data likely represent the relevant exposure scenario - surface water.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Data were reported for each sampling point with no summary reports.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	High	The study provided the limitation of the study including short sampling time period, no individual sample run, and inherent time lag between sampling collection and analysis.

Overall Quality Determination Medium

Study Citation:	Schneider, B. J., Oaksford, E. T. (1986). Design, operation, and monitoring capability of an experimental artificial-recharge facility at East Meadow, Long Island, New York.
HERO ID:	5477444

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	The "inclined gravity lysimeters" described in the report only measured pH, dissolved oxygen, and suspended solids. Regarding the monitoring wells samples, we know they were obtained "by submersible pump" and "sent to the U.S. Geological Survey." Screen depth is provided in a table, and certain location information is provided. Sampling procedures, sample volume, and sample storage conditions/duration are missing. Soil samples mentioned were not analyzed for volatile organic compounds.
	Metric 2:	Analytical Methodology	Low	Analytical processes were not directly mentioned but publicly available methods that are scientifically sound can be inferred to have been used because water samples were analyzed by the U.S. Geological Survey. Detection limits were shown in Table 7 for all samples for which there were non-detects among the samples reported (including 1,1-DCE, 1,2-EDC, 1,1,1-TCA, and 1,2-DCE [total], but not DBP). Page 31 also says Table 7 shows chemicals detected at 1 ppb or more, suggesting that was typically the detection limit, which is consistent with the data shown in Table 7 in almost all cases.
	Metric 3:	Biomarker Selection	N/A	They analyzed for parent chemicals in water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Artificial recharge facility at East Meadow, Long Island, New York.
	Metric 5:	Currency	Low	Samples are from 1978-1983, according to the text of the report.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples analyzed for chemicals of interest are shown on the last page. There is no indication that replicate samples were ever collected. The number of samples varied by analyte and by location. All chemicals of interest were sampled in 3 wells post-recharge. In addition, there were 2 (DBP), 6 (1,2-DCE [total]) or 7 (1,1,1-TCA; 1,1-DCE; 1,2-EDC) samples from a storage tank. There were also 1 (DBP), 3 (1,2-EDC and 1,2-DCE [total]), 5 (1,1-DCE), or more background samples (e.g., 27 were analyzed for 1,1,1-TCA), collected pre-recharge.
	Metric 7:	Exposure Scenario	Medium	The exposure scenario was relevant - the groundwater aquifer was identified the source of drinking water for the local residents. The post-recharge samples would have been affected by tertiary treated sewage. Sources of chemicals in pre-recharge samples were not discussed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	For each chemical, they reported mean, median, min, max and number of samples. Raw data were provided for the three post-recharge samples, but not for the background and storage tank samples (except for DNP, because there was only one background sample from a well and two from a storage tank, with the range shown by the min and max reported).
	Metric 9:	Quality Assurance	Medium	Quality assurance/quality control techniques and results were not directly discussed but were implied because the study was conducted by the U.S. Geological Survey, which likely had standard field and laboratory protocols that needed to be followed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There was no discussion of variability, uncertainty, and study limitations. However, the inclusion of samples collected over time and, at one location that was sampled both before and after recharge began, provides some information about variability. Also, there is a comment that "the mechanisms of mixing, dilution, and dispersion are causing concentrations of some chemical constituents in the water-table aquifer to fluctuate. This fluctuation is directly related to the introduction of reclaimed water to the aquifer and its subsequent interaction with native ground water." However, this reviewer would note that levels of some chemicals also fluctuated prior to the introduction of reclaimed water into the aquifer, which began in late 1982.

Continued on next page . . .

. . . continued from previous page

Study Citation:	Schneider, B. J., Oaksford, E. T. (1986). Design, operation, and monitoring capability of an experimental artificial-recharge facility at East Meadow, Long Island, New York.
HERO ID:	5477444

Domain	Metric	Rating	Comments
Overall Quality Determination		**Low**	

Study Citation:	Campbell, T. R. (1997). Soil, water, and streambed quality at a demolished asphalt plant, Fort Bragg, North Carolina, 1992-94.
HERO ID:	5489294

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	samples were collected and handled according to procedures outlined in the work plan for Ft. Bragg SWMU's and approved by local government and EPA (p.17)
	Metric 2:	Analytical Methodology	High	samples were analyzed in accordance with the USEPA methods or ASTM standards; Table 4 provides LODs for water and soil
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ft. Bragg, Fayetteville, NC
	Metric 5:	Currency	Low	December 1992-April 1994
	Metric 6:	Spatial and Temporal Variability	Medium	7 wells for groundwater sampling; 22 soil samples at various depths; several sub-samples of streambed sediment at various locations; soil samples collected at 7 locations across the site;
	Metric 7:	Exposure Scenario	Medium	soil, ground water, surface water, and sediments in the area of a demolished asphalt plant at Ft. Bragg; aim to determine if site should added to list of solid-waste management units under the RCRA permit; p. 12-16 contains information on the area of contamination
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 7 provides concentrations in soil samples; no results specific to this chemical; only data is for LOD
	Metric 9:	Quality Assurance	Low	QA/QC not directly discussed but implied through standard methods and lab protocols
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	characterization of variability and uncertainties are absent

Overall Quality Determination Medium

Study Citation:	Rowe, B. L., Toccalino, P. L., Moran, M. J., Zogorski, J. S., Price, C. V. (2007). Occurrence and potential human-health relevance of volatile organic compounds in drinking water from domestic wells in the United States. Environmental Health Perspectives 115(11):1539-1546.
HERO ID:	5553456

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	methods cited elsewhere for a USGS book on protocols and procedures
	Metric 2:	Analytical Methodology	High	MRLs reported in supporting info; method cites a USGS reference
	Metric 3:	Biomarker Selection	N/A	no biomonitoring data
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Figure 2 shows the wells in the US
	Metric 5:	Currency	Low	1985-2002
	Metric 6:	Spatial and Temporal Variability	Medium	single sample collected at each well (no replicates)
	Metric 7:	Exposure Scenario	High	Domestic well throughout the USA.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	info likely in the supporting information
	Metric 9:	Quality Assurance	Medium	quality-control samples used in this study have been reported elsewhere (USGS references); unclear what was done exactly
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	study characterizes variability around the US based on samples collected in many states but no standard deviation/measure of variation mentioned (unclear if in SI)

Overall Quality Determination Medium

Study Citation:	Garcia, C., Tiedra, P. G., Ruano, A., Gomez, J. A., Garcia-Villanova, R. J. (1992). Volatile halo-organic compounds in treated waters of the province of Salamanca (Spain). European Water Pollution Control 2(4):46-49.
HERO ID:	5608960

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling procedure, equipment, and storage condition were described. Calibration was not described.
	Metric 2:	Analytical Methodology	High	Analytical process (GC with ECD) and equipment were described. Detection limit for each compound was reported in Table 2.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Salamanca, Spain
	Metric 5:	Currency	Low	May to July 1991
	Metric 6:	Spatial and Temporal Variability	High	The study reported that a total of 117 duplicate analyses were made, corresponding to 30 raw, 30 finished and 57 distribution system water samples.
	Metric 7:	Exposure Scenario	Medium	Exposure scenario was relevant - surface and drinking water.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	It is stated that ”none of the 16 halo-organic compounds were detected in any of the raw water samples” and treated water only some compounds were identified- therefore no concentrations were not reported for DCP.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control 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 10:	Variability and Uncertainty	Low	The study discussed variability of the data, but discussion did not involve the chemicals of interest. No discussion of limitations.

Overall Quality Determination Medium

Study Citation:	Landmeyer, J. E., Campbell, B. G. (2014). Assessment of ethylene dibromide, dibromochloropropane, other volatile organic compounds, radium isotopes, radon, and inorganic compounds in groundwater and spring water from the Crouch Branch and McQueen Branch aquifers near McBee, South Carolina, 2010-2012.
HERO ID:	5639273

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	USGS method
	Metric 2:	Analytical Methodology	High	USGS method
	Metric 3:	Biomarker Selection	N/A	NA- water samples no biomarker needed.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	SC, USA
	Metric 5:	Currency	Medium	2010-2011
	Metric 6:	Spatial and Temporal Variability	Medium	single samples over multiple years
	Metric 7:	Exposure Scenario	High	Ground water and spring water, for environmental and general population scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	only average
	Metric 9:	Quality Assurance	High	Analytical QA/QC was reported and is reliable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Sources or variability and uncertainly are not discussed.

Overall Quality Determination High

Study Citation:	Li, Y., Cakmak, S., Zhu, J. (2019). Profiles and monthly variations of selected volatile organic compounds in indoor air in Canadian homes: Results of Canadian national indoor air survey 2012-2013. Environment International 126:134-144.
HERO ID:	5736601

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling storage not described. More information may be in the following: Indoor air VOC samples were collected as part of the Canadian Health Measures Survey (Statistics Canada, 2016) using the same methodology as previously described for the 2009–2011 survey (Zhu et al., 2013; Patry-Parisien et al., 2013).
	Metric 2:	Analytical Methodology	High	Analytical methods described in detail. LOD provided in S1.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Canada
	Metric 5:	Currency	Medium	Data collected from 2009 to 2013
	Metric 6:	Spatial and Temporal Variability	High	3524 homes including duplicates.
	Metric 7:	Exposure Scenario	High	Measuring VOC in residential homes.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported in the study. Summary statistics provided in detail.
	Metric 9:	Quality Assurance	High	QA reported in detail, including field quality control samples which included 133 field blanks and recoveries (in S1).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited information on limitations and gaps reported. Standard errors, coefficients of variation and 95%confidence intervals were calculated. Monthly variation also calculated.

Overall Quality Determination High

Study Citation:	LTI Limno-Tech, (1993). Preliminary evaluation of Dow Corning Carrollton, Kentucky environmental effects to surface waters with cover letter dated 04/20/94.
HERO ID:	5885319

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description of sampling methods
	Metric 2:	Analytical Methodology	Medium	Limited description of analytical methods
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ohio, USA
	Metric 5:	Currency	Low	Sampling in 1992
	Metric 6:	Spatial and Temporal Variability	Low	Sample size is reported in Appendix B - Laboratory Data Report (page 74 of the 134 pages of the .PDF file). There are 4 water and 4 soil samples.
	Metric 7:	Exposure Scenario	Medium	Missing information about the population of interest, limited description of microenvironment
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations, no summary statistics
	Metric 9:	Quality Assurance	High	Described QA/QC techniques, analyzed control samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variability, or discussed uncertainties and limitations

Overall Quality Determination Medium

Study Citation:	Bechtel Env, (1988). Final site investigation report for the Rohm and Haas Redwood City Facility.
HERO ID:	6307465

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology is discussed and is generally appropriate (i.e., scientifically sound) for the chemical and media of interest. Details regarding soil sampling page 18-23, 28; groundwater sampling page 37-38, 41-47; monitoring well sampling page 48-58; concrete and asphalt sampling page 60-64.
	Metric 2:	Analytical Methodology	High	Samples were analyzed according to EPA Methods. Table 2-2 reports EPA methods followed for each contaminant.
	Metric 3:	Biomarker Selection	N/A	Study tested for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in California, USA.
	Metric 5:	Currency	Low	Samples were collected in 1986-1987.
	Metric 6:	Spatial and Temporal Variability	High	Duplicate samples were collected for all media types; 95 soil samples, 53 groundwater samples, 26 monitoring well samples, and 55 concrete and asphalt samples.
	Metric 7:	Exposure Scenario	Medium	The data likely represent relevant/realistic exposure scenario, but the use of expose controls was not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data reported in Tables 4-1, A-1, B-1, C-1, C-2. No summary statistics reported.
	Metric 9:	Quality Assurance	Medium	The use of QA/QC techniques were described such as the use of standards, blanks, laboratory duplicates, field duplicates, and spikes. However, recovery values and baseline samples were not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The study has limited characterization of variability and no measure of variance is provided. Key uncertainties, limitations, and data gaps are not discussed.

Overall Quality Determination Medium

Study Citation:	Hargis & Montgomery Inc., (1984). Phase I Investigation of Groundwater Quality and Hydrogeological Conditions Summa Corporation Facility Culver City, California.
HERO ID:	6311565

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methods were only briefly described.
	Metric 2:	Analytical Methodology	Low	The authors cited analytical methods from EPA with brief descriptions.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in the USA.
	Metric 5:	Currency	Low	Samples were collected in 1983.
	Metric 6:	Spatial and Temporal Variability	High	14 monitoring wells, with replicates.
	Metric 7:	Exposure Scenario	Medium	The data may represent a relevant exposure scenario, but it's missing details about the population of interest.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only individual sample concentrations were reported.
	Metric 9:	Quality Assurance	High	The authors described QA/QC techniques and analyzed control samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The authors did not characterize variability or uncertainties.

Overall Quality Determination Medium

Study Citation:	McKesson Environmental Services, (1984). Priority pollutant analysis.
HERO ID:	6574972

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Critically Deficient	The groundwater sampling methodology was not described.
	Metric 2:	Analytical Methodology	Critically Deficient	The analytical methodology was not described.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in groundwater.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in California, USA.
	Metric 5:	Currency	Low	The analysis is from 1984.
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	The sample size is not reported.
	Metric 7:	Exposure Scenario	Low	The data may represent a relevant exposure scenario, but the document lacks sufficient details about sampling and analytical methods, population of interest and microenvironment characteristics.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The authors only reported individual sample concentrations, without summary statistics.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described, control samples were not analyzed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized. Uncertainties and limitations were not described.

Overall Quality Determination Uninformative

Study Citation:	U.S. EPA, U.S.G.S. and National Water Quality Monitoring Council (2022). 1,1-Dichloroethane (1,1-DCA) (CAS RN: 75-34-3): WQP Output (NWIS, STEWARDS & STORET), Site data & sample results (physical/chemical metadata).
HERO ID:	10709390

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology information is provided in columns AF to AJ, including the sampling method code and the equipment used. No information was provided on transportation or storage conditions for any sample. Note that for a large portion of the samples (n=58,692) the sampling methodology was reported as "UNKNOWN".
	Metric 2:	Analytical Methodology	High	99 different analytical method codes are reported in column BO, 3 point values have an "unknown" code, 240-point values report a "unknown/ unspecified procedure, and column BS has 8 codes for the analytical method description text. 1529 point values do not have an analytical method. Description of the methods reported in column BQ and detection limit in column BY.A detection limit was not provided for all samples, 103-point values report the detection limit as "unknown", and 49-point values as "non detected'. While there is heterogeneity in the information provided, the confidence rating of high is based on the samples with the most complete data.
Domain 2: Representative				
	Metric 3:	Geographic Area	High	Column X reports the location identifier code. All samples are from the U.S. The station.xlsx file included as part of the HERO reference provides detailed information on the sites sampled. The information of each code can be found at https://waterdata.usgs.gov/nwis/si
	Metric 4:	Temporal	High	Data reported from 1980 to 2022. The date is reported in column G.
	Metric 5:	Exposure Scenario	Medium	Media are reported in column E and F; location and time are also reported. The station.xlsx file included as part of the HERO reference provides, for some samples, more detailed information on the sites sampled, such as sample depth. There is no information provided on sources of chemicals.
Domain 3: Accessibility/Clarity				
	Metric 6:	Availability of Database and Supporting Documents	High	The database is widely accepted, and a user guide is available which describes all of the data fields.
	Metric 7:	Reporting Results	Medium	The database does not report summary of statistics, only point values. While the data are well organized, since the data originates from numerous different entities (states) and monitoring programs, some data may be difficult to interpret due to the lack of populated data fields or discrepancies between columns.
Domain 4: Variability and Uncertainty				
	Metric 8:	Variability and Uncertainty	Medium	Uncertainty is characterized by the inclusion of data qualifier column AR; however, it was not expected for all rows to have a data qualifier code. Column AS reports the results status identifier that indicates the acceptability of the result with respect to QA/QC criteria.

Overall Quality Determination High

Study Citation:	Centers for Disease Control and Prevention : CDC (2022). 1,1-Dichloroethane (1,1-DCA) (CAS RN: 75-34-3): NHANES Biomonitoring Data (Blood).
HERO ID:	10709913

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Widely accepted sampling methodology from a source known to use sound approaches. Information on sampling design can be found at https://wwwn.cdc.gov/nchs/nhanes/tutorials/SampleDesign.aspx.
	Metric 2:	Analytical Methodology	High	Widely accepted analytical methodology, outlined at https://www.cdc.gov/exposurereport/data_sources_analysis.html. Additional detail is listed in references listed at https://www.cdc.gov/exposurereport/biomonitoring_references.html.
Domain 2: Representative				
	Metric 3:	Geographic Area	High	Samples were collected from the US population.
	Metric 4:	Temporal	Medium	Data reported from 2003 to 2012.
	Metric 5:	Exposure Scenario	Medium	Exposure to DCE for the civilian, noninstitutionalized population in the United States based on age, gender, and race/ethnicity. There is no information provided on sources of exposure to the chemical, amount of exposure, or microenvironments.
Domain 3: Accessibility/Clarity				
	Metric 6:	Availability of Database and Supporting Documents	High	The database is widely accepted and well known. There is an abundance of information online about the database.
	Metric 7:	Reporting Results	High	The database reports summary statistics (geometric mean, 50th/75th/90th/95th percentiles). The years of collection and sample size is reported for each row. Raw data can be downloaded from the CDC website https://wwwn.cdc.gov/nchs/nhanes/default.aspx
Domain 4: Variability and Uncertainty				
	Metric 8:	Variability and Uncertainty	High	There is no characterization of uncertainty. Variability reported as summary of statistics and the analysis of data by age, gender, and race/ethnicity. NHANES does not include state-level data. Considerations related to the data are discussed at https://www.cdc.gov/exposurereport/data_interpretation.html

Overall Quality Determination High

Study Citation:	U.S. EPA, (2023). UCMR 3 (2013-2015) Occurrence Data: 1,1-dichloroethane (CAS RN: 75-34-3).
HERO ID:	10989380

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sample location, date, and other information provided in the database output; however, there is no specific information about the sample method. No information was provided on transportation or storage conditions for any sample.
	Metric 2:	Analytical Methodology	High	A Method ID and MRL is provided in Columns P and Q. More information is provided here: https://www.epa.gov/sites/default/files/2017-02/documents/ucmr3-data-summary-january-2017.pdf
Domain 2: Representative				
	Metric 3:	Geographic Area	High	Data was collected in the United States. The state is reported in Column W.
	Metric 4:	Temporal	High	Data was collected from 2013-2016. Date is reported in column M.
	Metric 5:	Exposure Scenario	Medium	The exposure scenario is contaminants in drinking water in the US. Some specific details about scenarios (location, date) are provided in the output file.
Domain 3: Accessibility/Clarity				
	Metric 6:	Availability of Database and Supporting Documents	High	The database is widely accepted and guidance materials are available which describes all of the data fields.
	Metric 7:	Reporting Results	High	The database is organized and key information is readily accessible. Raw data is provided in the output file.
Domain 4: Variability and Uncertainty				
	Metric 8:	Variability and Uncertainty	Low	No measurement of variability or characterization of uncertainty is provided.

Overall Quality Determination High

Study Citation:	U.S. EPA, (2022). Ambient Monitoring Technology Information Center (AMTIC) - Ambient Monitoring Archive for HAPs.
HERO ID:	11195094

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Widely accepted sampling methodologies, the sampling frequency, duration, and description of sampling collection are reported in columns SAMPLING_FREQUENCY_CODE, DURATION_DESC, and SAMPLE_COLLECTION_DESC.
	Metric 2:	Analytical Methodology	High	Analytical methodology described at the SAMPLE_ANALYSIS_DESC column. A description of all the methods is reported in the compendium: https://www.epa.gov/amtic/compendium-methods-determination-toxic-organic-compounds-ambient-air.
Domain 2: Representative				
	Metric 3:	Geographic Area	High	Data was collected in the United States. Columns MONITOR_LATIDUDE and MONITOR_LONGITUDE report the exact monitoring location.
	Metric 4:	Temporal	High	The database reports data from 1990-2020.
	Metric 5:	Exposure Scenario	High	The exposure scenario is the measurement of key hazardous air pollutants across cities, regions and specific areas of interest.
Domain 3: Accessibility/Clarity				
	Metric 6:	Availability of Database and Supporting Documents	High	The database is widely accepted, and guidance materials are available which describes all of the data fields.
	Metric 7:	Reporting Results	High	The database is organized, and key information is readily accessible. Raw data is provided in the output file, and a summary of statistics is presented here: https://www.epa.gov/system/files/documents/2022-10/AMA2020_annual.xlsx
Domain 4: Variability and Uncertainty				
	Metric 8:	Variability and Uncertainty	High	Variability reported in the annual statistics as variance of daily averages and percentiles. Uncertainty reported as data qualifiers.

Overall Quality Determination High

Study Citation:	PRC Environmental Management, (1995). Final baseline risk assessment for the Jayhawk Plant in Jayhawk, Kansas, with cover letter dated 02/22/95.
HERO ID:	666891

Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	The assessment uses techniques that are from reliable sources and are generally accepted by the scientific community; however, a discussion of sampling methodology for data previously collected is limited.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Characterization of geographic area with maps provided of site exposure sources, details and modeling of potential exposure, media of interest described, summary statistics and number of samples lacking within most tables, although raw data printouts provided. Data printout tables difficult to read at times.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Low	Statistical summary measures of variability for concentration data lacking, robust discussion of limitations lacking, however model and exposure data uncertainties discussed.

Overall Quality Determination Medium

Study Citation:	Goldberg-Zoino & Assoc Inc, (1989). Monsanto 409 building phase II - site risk characterization Everett, Massachusetts volume III with attached tables, appendices and cover letter dated 072889.
HERO ID:	1269798

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Sampling and analytic methodologies, modeling equations reported in detail.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	Medium	Characterization of geographic area with map provided of site exposure sources, media of interest described, sample sizes not noted, temporal variability limited.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	Low	Statistical summary measures of variability for concentration data lacking for most concentration data reported (some data reports concentration range), robust discussion of limitations lacking.

Overall Quality Determination Medium

Study Citation:	Monsanto, (1988). Monsanto Pensacola plant ground water assessment feasibility study on nineteen chemicals with attachments and cover letter dated 020389.
HERO ID:	1316231

Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	Sampling and analytic methodologies reported as following state of Florida regulations.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Characterization of geographic area with maps provided of site exposure sources, media of interest described, sample sizes not noted, temporal variability limited.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Low	Statistical summary measures of variability for concentration data lacking for most concentration data reported (some data reports concentration range). Robust discussion of uncertainties and limitations lacking.

Overall Quality Determination Medium

Study Citation:	Union Carbide, (1994). Remedy selection report River Road Landfill; human health and environmental assessment, with cover letter dated 05/18/94.
HERO ID:	1316263

Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Low	Low: There is only a brief discussion of sampling, however text reports investigation followed RCRA Facility Investigation (RFI) and New Jersey Department of Environmental Protection and Energy guidance.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Medium: The exposure activity assessed likely represents the population/scenario/media of interest. Characterization of geographic area with maps provided of site exposure sources. Variability in sampling of soil and surface water depths. Report notes potentially exposed populations will be characterized, however details not provided within PDF. Risk characterization concludes with brief assessment of human health and environmental impact.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Medium	Medium: References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Low	Low: Statistical summary measures of variability for concentration data lacking, discussion of limitations lacking.

Overall Quality Determination Low

Study Citation:	Geraghty & Miller Incorporated, (1994). Risk assessment for the BFGoodrich chemical division facility, Henry, Illinois with cover letter dated 05/06/94.
HERO ID:	1333011

Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Low	Other than years and media of sample collection, sampling and analytic methodology not described. However, there is a detailed discussion of sampling assumptions provided.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	The exposure activity assessed likely represents the population/scenario/media of interest. Characterization of geographic area with maps provided of site exposure sources, however characterization of population at risk lacking.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Statistical summary measures of variability for concentration data for some, but not all reported concentrations in tables. Discussion of uncertainties detailed.

Overall Quality Determination Medium

Study Citation:	Dow Environmental Inc, (1995). The Dow Chemical Company Slaughter Road site baseline risk assessment report with cover letter dated 01/05/96.
HERO ID:	1335695

Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment utilizes methods generally accepted by the scientific community for sampling and risk assessment. Followed EPA guideline.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	The exposures likely represent the population scenarios of interest, with potentially exposed populations, geographic maps, and potential exposure pathways discussed.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	High	Characterization of variability within statistical summary modeled results included standard deviation, standard error, range and variation within reported results tables. Discussion of uncertainties presented.

Overall Quality Determination High

Study Citation:	Chemical Manufacturers Association, (1988). Petitioners and exhibits to petitioners memorandums in support of their motion for a remand with attachments and cover letter dated 012389.
HERO ID:	1481091

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The assessment methodology is described
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	The data represent the exposure scenario of interest
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	Critically Deficient	the reported data is not legible
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	Low	No summary of statistics or report of key limitations

Overall Quality Determination Uninformative

Study Citation: ENSR, (1991). Acute ISC input data-full grid & AB 2588 health risk assessments: Corrected & alternative emissions cases for the Cymric area oil fields McKittrick, California with letter 090591.

HERO ID: 1481763

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Critically Deficient	The exposure assessment is described in section 3-2. Industrial Source Complex Short-Term (ISCST) dispersion model was used to predict concentrations. Receptor locations described in appendix F and modeling inputs in appendix D-1. However, not much information is presented about the methods, resulting in high uncertainty of the methods used.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	Low	The data may represent relevant exposure scenarios to chemicals of interest, but the lack of specific methodological details limits the potential generalization of the report findings.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	Low	References are sparsely documented throughout the report and numerous references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	Low	Variability was not characterized. Uncertainties and limitations were discussed (PDF p. 221)

Overall Quality Determination Uninformative

Study Citation:	Radian Corp, (1995). Initial submission: Baseline risk assessment for the Jayhawk site galena, Kansas with attachments and cover letter dated 030195.
HERO ID:	1482017

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The methodology is well described across the document, equations reported inside tables
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	Exposure to contaminants from the Jayhawk chemical site
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	High	Reported data well documented
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	Medium	Section 2.4.5 reports uncertainty. No statistics of variability reported

Overall Quality Determination High

Study Citation:	Rohm and Haas, (1988). Biological risk assessment for the Redwood City facility and final site investigation report for the ROHM and HAAS Redwood City facility with attachments and cover letter dated 092588.
HERO ID:	1745617

Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The methodology for the risk assessment is well described. Soil and groundwater monitoring methods in sections 2.1 and 2.2. Air quality methodology in section 6
Domain 2: Representative	Metric 2:	Exposure Scenario	High	Fish and wildlife exposure to selected contaminants in the groundwater beneath the Rohm and Hass facility in Redwood City
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	High	Data inputs, references all reported in the study
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Variability across matrices not reported in terms of summary of statistics . Limitations reported in the text

Overall Quality Determination High

Study Citation:	Envirologic Data, (1992). Assessment of risks from potential exposure to airbourne facility emissions under California AB 2588 for the Rohr Inc Facility Riverside, Calif (vol. 1) (final report) w-letter.
HERO ID:	4214360

Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Low	Description of contaminant concentration modeling procedures, and necessity for delineating uncertainties in models reported, however actual discussion of assumptions and limitations lacking.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Characterization of geographic area with maps provided of site exposure sources, details and modeling of potential exposure. Modeling for relevant residential populations presented, however temporality not directly discussed in detail.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Low	Statistical summary measures of variability for concentration data lacking, robust discussion of limitations lacking.

Overall Quality Determination Low

Study Citation:	DERS, (1995). Corrective measures study for SWMU Nos. 2, 3, 16, and 21.
HERO ID:	5068379

Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	Description of exposure sampling data collection and contaminant concentration modeling procedures with assumptions detailed and some references to USEPA methods and requirements, however actual name of sampling method or standard procedures not referenced within sections describing sampling procedures.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Characterization of geographic area with maps provided of site exposure sources, details and modeling of potential exposure, media of interest described, number of samples lacking within most tables, although some raw data printouts provided for some sampling media.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Medium	References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Low	Statistical summary measures of variability for concentration data lacking, robust discussion of limitations lacking, however model and exposure data uncertainties discussed.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, (2015). Technical support document, EPA's 2011 National-scale Air Toxics Assessment, 2011 NATA TSD.
HERO ID:	5113338

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The methods applied in conducting NATA are consistent with the general risk assessment framework used throughout EPA.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	Medium	Data is for the US, representing point, nonpoint, and mobile sources, although inventory year is 2011.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	High	Well documented.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	High	Uncertainty and variability specifically discussed at length throughout the report. There is a robust discussion of how the NATA assessment should and should not be used.

Overall Quality Determination High

Study Citation:	Fang, L., Norris, C., Johnson, K., Cui, X., Sun, J., Teng, Y., Tian, E., Xu, W., Li, Z., Mo, J., Schauer, J. J., Black, M., Bergin, M., Zhang, J., Zhang, Y. (2019). Toxic volatile organic compounds in 20 homes in Shanghai: Concentrations, inhalation health risks, and the impacts of household air cleaning. Building and Environment 157(Elsevier):309-318.
HERO ID:	5262199

Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	High: Sampling and analytic methodology, calibration, equipment detailed and well described and utilizes generally accepted approaches with referenced analytic methods. Exposure model and equations referenced from EPA.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Medium: Exposure activity assessed likely represents the scenarios of interest, with geography, temporality and details of sample timing described within supplemental material. Study conducted in China with asthmatic children might not be the most representative scenario.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Medium	Medium: References are available and provided, however some references may not be publicly available or are not from peer reviewed sources.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	High	Medium: The study characterizes variability within the population/media studied and a key uncertainty within risk estimations noted, potential limitations also detailed.

Overall Quality Determination High

Study Citation:	ATSDR, (1994). Public health assessment for Otis Air National Guard Base/Camp Edwards, Falmouth, Barnstable County, Massachusetts, Region 1. MA2570024487. Final rept.
HERO ID:	5451606

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Critically Deficient	The study reports field data quality, laboratory data quality and sample design. However, no information reported on sample methodology and analytical methods.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	Health risk assessment for a surrounding community from a superfund site.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	Medium	References are available for all reported data, inputs, and defaults; however, some references may not be publicly available or are not from peer reviewed sources. References for background concentrations, and comparison values for both cancerous and non-cancerous effects reported.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	High	Variability reported in terms of different sites. Page 81 includes recommendations for future studies

Overall Quality Determination Uninformative

Study Citation:	Anderson, D., DiCianna, D., Yance, J., Tarnay, A. (1989). Preliminary data summary for the solvent recycling industry.
HERO ID:	5478191

Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	Sampling are referenced in other sources for each plant in section 5.3.1. Analytical methods and instrument are reported, including detection limit range. Simple standard dilution model used to calculate effluent concentrations in Section 6, although effluent concentrations don't appear to reported.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	The study measured chemicals in wastewater. However, the study and sampling dates are old (1986 and 1987).
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Low	Document is well referenced, but many references don't appear to be published.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Data specifically examined for three facilities. Some discussions of analytical uncertainties provided.

Overall Quality Determination Medium

Study Citation:	ENSR, (1991). AB 2588 health risk assessment for the Texaco Refinery Areas 1 and 2 Bakersfield, California.
HERO ID:	6338980

Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	Medium	The modeling (ISCST program) and methodology are described with calculations. However, some of the exposure assumptions and justifications are not fully explained.
Domain 2: Representative	Metric 2:	Exposure Scenario	Low	The data may represent relevant exposure scenarios related to Texaco Inc. Bakersfield Refinery Areas 1 and 2 in Bakersfield, California. However, the lack of methodological details limits the validity of the assessment and the assessment was conducted in 1962, 1963 and 1964.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	Critically Deficient	The reported inputs are only sparsely documented and explained.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Variability was characterized by modeling 3 different years. Uncertainties were discussed.

Overall Quality Determination Uninformative

Study Citation:	Lee, L. J. H., Chan, C. C., Chung, C. W., Ma, Y. C., Wang, G. S., Wang, J. D. (2002). Health risk assessment on residents exposed to chlorinated hydrocarbons contaminated in groundwater of a hazardous waste site. Journal of Toxicology and Environmental Health, Part A: Current Issues 65(3-4):219-235.
HERO ID:	33739

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	Equations for dermal and inhalation chronic daily intakes are provided and cited to U.S. EPA.
	Metric 2:	Model Evaluation	High	Chronic daily intake methodology cited to U.S. EPA, an authoritative source.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Low	Incidental exposure to contaminated water through showering is a reasonable scenario. The data sources are more than 20 years old though, and reflect a scenario in Taiwan rather than U.S.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	Equations and inputs are sufficient to follow calculations.
	Metric 5:	Model Inputs and Defaults	High	All inputs for each intake equation are provided below the equations, mostly with citations or explanations of sources.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Low	Probability risk calculations with Monte Carlo simulation were conducted with a focus on the exposure inputs and their influence on the estimated hazard index and cancer risk rather than the doses. Some discussion related to the uncertainties of the study.

Overall Quality Determination Medium

Table 172: Glossary of Select Terms for Data Evaluation

Term	Definition
μ-	micro-
1,1-DCA or DCE	1,1-Dichloroethane
1,2-DCA or EDC	1,2-Dichloroethane
ACSWLF	Alachua County Southwest Landfill
AFB	Air Force Base
ANELF	Alachua County Northeast Landfill
AR	Arkansas
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
CA, US	California
CA	Canada
CDC	Center for Disease Control
CV	Coefficient of Variation
DCP	Dichloropropane
DF	Detection Free
DWTP	Drinking Water Treatment Plant
ECD	Electron Capture Detector
g	Gram
GC	Gas Chromatography
FID	Flame Ionization Detector
MS	Mass Spectrometry
GW	Groundwater
h	Hour
HS-GC/MS	Head Space Gas Chromatography
ID	Identification
KM	Kilometer
L	Liter
LC	Liquid Chromatography
LDL	Lower Detection Limit
LOD	Limit of Detection
LOQ	Limit of Quantification
LRL	Lowest Reportable Level
MD	Maryland
MDL	Method Detection Limit
MDNR	Michigan Department of Natural Resources
MI	Michigan
Min	Minute
MLQ	Method Limit of Quantification
MN	Minnesota

Continued on next page . . .

Table 172 . . . continued from previous page

Term	Definition
MQL	Method Quantification Limit
MRL	Method Reporting Limit
MS	Mass Spectrometry
MSW	Municipal Solid Waste
MW	Monitoring Well(s)
MWMF	Mixed Waste Management Facility
n	Sample Size
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NC	North Carolina
ND	Non-detect
NHANES	National Health and Nutrition Examination Survey
NJ	New Jersey
NJDEP	New Jersey Department of Environmental Protection
NWQS	National Water Quality Monitoring Council
NY	New York
OCLF	Orange County Landfill
DCB	Dichlorobenzene
OH	Ohio
OQD	Overall Quality Determination
PM	Particulate Matter
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RSD	Relative Standard Deviation
SC	South Carolina
SD	Standard Deviation
SD	Standard Deviation
SE	Standard Error
SI	Supplemental Information
SM	Supplemental Material
SOP	Standard Operating Procedure
SPME	Solid Phase Micro Extraction
STP	Sewage Treatment Plant
SVOC	Semi-Volatile Organic Compound
SWQA	Stormwater Quality Assessment
TCE	Trichloroethylene
1,1,2-TCA	1,1,2-Trichloroethane
TDCE	trans-Dichloroethylene
TEPA	Taiwan Environmental Protection Administration
TSCA	Toxic Substances Control Act
UCL	Upper Control Limit
UCMR	Unregulated Contaminant Monitoring Rule

Continued on next page . . .

Table 172 . . . continued from previous page

Term	Definition
UK	United Kingdom
UNC	University of North Carolina
US or USA	United States
USAF	United States Air Force
USGS	United States Geological Survey
VOC	Volatile Organic Compound
WATSTORE	USGS National Water Data Storage and Retrieval System
WQP	Water Quality Parameters
WWTP	Wastewater Treatment Plant