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Office of Chemical Safety and
Pollution Prevention

Data Quality Evaluation Information for General Population, Consumer, and Environmental Exposure for Diisononyl Phthalate (DINP)

Systematic Review Support Document for the Risk Evaluation

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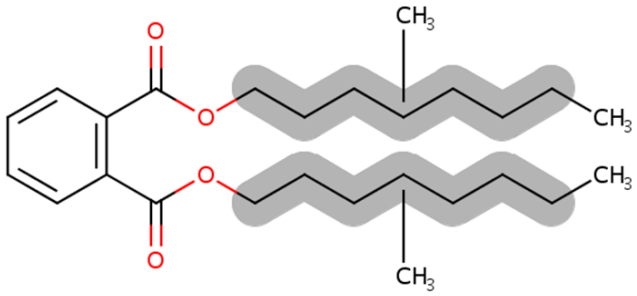

January 2025

This supplemental file contains information regarding the data quality evaluation results for data sources that met the PECO screening criteria for the *Consumer Exposure Assessment for Diisononyl Phthalate (DINP)*, ,*Environmental Media and GenPop Screening for Diisononyl Phthalate (DINP)*, ,*Biomonitoring Assessment for Diisononyl Phthalate (DINP) (NHANES)*, and ,*Environmental Exposure Assessment for Diisononyl Phthalate (DINP)*. 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 *Risk Evaluation for Diisononyl Phthalate (DINP) – 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 exper-imental 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 DINP Data Quality Evaluation Information for General Population, Consumer, and Environmental Exposure.

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Study Citation:	Shi, W., Hu, X., Zhang, F., Hu, G., Hao, Y., Zhang, X., Liu, H., Wei, S., Wang, X., Giesy, J. P., Yu, H. (2012). Occurrence of thyroid hormone activities in drinking water from eastern China: Contributions of phthalate esters. Environmental Science & Technology 46(3):1811-1818.
HERO ID:	1249969

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Describe sampling sites, equipment, preparation, storage.
	Metric 2:	Analytical Methodology	High	Describe analytical instrumentation extraction method; report limit of quantification; recoveries all > 90%.
	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	Yangtze River Delta in eastern China.
	Metric 5:	Currency	Medium	2010
	Metric 6:	Spatial and Temporal Variability	High	5 sampling sites, 3 types of water sources at each site, n = 3 per sample type (so 45 samples total).
	Metric 7:	Exposure Scenario	Medium	Measuring phthalate esters in water sources.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data for individual samples but thorough summary of concentrations; provides averages and standard deviations.
	Metric 9:	Quality Assurance	Medium	Used blanks and standards.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Provide standard deviations and measures of variability but no discussion of limitations/uncertainty.

Overall Quality Determination High

Study Citation:	Mcdowell, D. C., Metcalfe, C. D. (2001). Phthalate esters in sediments near a sewage treatment plant outflow in Hamilton Harbour, Ontario: SFE extraction and environmental distribution. Journal of Great Lakes Research 27(1):9-Mar.
HERO ID:	1322016

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling described, no map
	Metric 2:	Analytical Methodology	High	Method limit of detection provided on p.6; equipment and extraction described; methods paper
	Metric 3:	Biomarker Selection	N/A	Sample collected sediment samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Ontario, Canada.
	Metric 5:	Currency	Low	Samples were collected in 1997.
	Metric 6:	Spatial and Temporal Variability	Medium	5 samples in triplicate
	Metric 7:	Exposure Scenario	Medium	Study collected sediments near a sewage treatment plant
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Results reported in text page 6 - below MDL
	Metric 9:	Quality Assurance	Low	QA not discussed; no obvious concerns
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty not discussed, no obvious concerns

Overall Quality Determination Medium

Study Citation:	Kubwabo, C., Rasmussen, P. E., Fan, X., Kosarac, I., Wu, F., Zidek, A., Kuchta, S. L. (2013). Analysis of selected phthalates in Canadian indoor dust collected using a household vacuum and a standardized sampling techniques. Indoor Air 23(6):506-514.
HERO ID:	1588869

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology is described in detail in the materials and methods section.
	Metric 2:	Analytical Methodology	High	Method described in detail, the LODs are reported in the SI.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Data collected in Canada.
	Metric 5:	Currency	Low	Timing of sampling is not reported
	Metric 6:	Spatial and Temporal Variability	High	A total of 126 samples were collected.
	Metric 7:	Exposure Scenario	High	Exposure to phthalates in Canadian indoor houses.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The SI table S1 reports data as mean, median and range.
	Metric 9:	Quality Assurance	High	Samples were collected and analyzed by Health Canada, the study reports a series of QA and QC.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability is reported in terms of range, limitations are not repoted.

Overall Quality Determination High

Study Citation:	Watkins, D. J., Eliot, M., Sathyanarayana, S., Calafat, A. M., Yolton, K., Lanphear, B. P., Braun, J. M. (2014). Variability and Predictors of Urinary Concentrations of Phthalate Metabolites during Early Childhood. Environmental Science & Technology 48(15):8881-8890.
HERO ID:	2347098

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Spot urine samples collected either at home or in clinic (some in both); diaper inserts used for ages 1 to 3 years.
	Metric 2:	Analytical Methodology	Low	Described in SI. SPE-HPLC-MS/MS. Analyses performed by CDC laboratory following strict CLIA QC guidelines. Followed 2011-2012 NHANES protocols for phthalate metabolites. LOD reported only as range (0.1 to 1 ng/mL), however.
	Metric 3:	Biomarker Selection	Medium	Concentration of MCOP in urine, but not MiNP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ohio, Cincinnati
	Metric 5:	Currency	Medium	2004 through 2011
	Metric 6:	Spatial and Temporal Variability	Low	Spot urine samples: compared at home versus clinic collection; compared samples taken 2 weeks apart to those taken 1 year apart for same individual. Total 296 children ages 1 through 5 years.
	Metric 7:	Exposure Scenario	Medium	Questionnaires covered diet, food packaging, consumption of fast food, and personal product use.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Reported in Supplemental Information. Concentrations (ug/L) reported: median, 25th, and 75th percentiles (Table S3); box-and-whisker plots also show arithmetic mean, min, and max (Figure S1).
	Metric 9:	Quality Assurance	High	CDC followed quality control as per the Clinical Laboratory Improvement Act QC guidelines and German External Quality Assessment Scheme.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Evaluated metabolite concentrations relative to demographic characteristics, food packaging and personal care products, age, and other factors.

Overall Quality Determination — Medium

Study Citation:	Tran, B. C., Teil, M. J., Blanchard, M., Alliot, F., Chevreuil, M. (2014). BPA and phthalate fate in a sewage network and an elementary river of France. Influence of hydroclimatic conditions. Chemosphere 119C:43-51.
HERO ID:	2519056

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Well described sampling methodology.
	Metric 2:	Analytical Methodology	Low	Limited data on recovery samples and detection limits not reported by chemical.
	Metric 3:	Biomarker Selection	N/A	Tested for parent chemical in wastewater and river water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France.
	Metric 5:	Currency	Medium	Sampling in 2010-2011.
	Metric 6:	Spatial and Temporal Variability	Medium	4 sites sampled 12 times. No replicates.
	Metric 7:	Exposure Scenario	Medium	Limited data on population of interest and microenvironment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics, raw data not provided.
	Metric 9:	Quality Assurance	Medium	Laboratory control samples were analyzed, limited information on field controls and recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited discussion of limitations, data gaps and uncertainties.

Overall Quality Determination Medium

Study Citation:	Pollack, A. Z., Buck Louis, G. M., Chen, Z., Sun, L., Trabert, B., Guo, Y., Kannan, K. (2014). Bisphenol A, benzophenone-type ultraviolet filters, and phthalates in relation to uterine leiomyoma. Environmental Research 137C:101-107.
HERO ID:	2718036

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most key criteria not reported. However, reference to another paper was cited for complete details on study methods.
	Metric 2:	Analytical Methodology	Medium	Most key criteria met. LODs were reported in Table 2. Recovery data were missing.
	Metric 3:	Biomarker Selection	High	Sampling for metabolites specific for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Urine samples collected from participants in Salt Lake City, Utah and San Francisco, California.
	Metric 5:	Currency	Medium	Sampling conducted during 2007-2009.
	Metric 6:	Spatial and Temporal Variability	Low	Single spot urine samples collected from n=431 participants in Utah and n=63 participants in California (non-statistical sampling method). There was no report of replicate sampling.
	Metric 7:	Exposure Scenario	High	Participant characteristics were summarized. Potential sources were described as widespread exposure to personal care products.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were missing.
	Metric 9:	Quality Assurance	High	Quality assurance procedures reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was characterized within statistical summary data. Potential study limitations were only briefly reported.

Overall Quality Determination Medium

Study Citation:	Vagi, S. J., Azziz-Baumgartner, E., Sjödin, A., Calafat, A. M., Dumesic, D., Gonzalez, L., Kato, K., Silva, M. J., Ye, X., Azziz, R. (2014). Exploring the potential association between brominated diphenyl ethers, polychlorinated biphenyls, organochlorine pesticides, perfluorinated compounds, phthalates, and bisphenol a in polycystic ovary syndrome: a case-control study. BMC Endocrine Disorders 14(1):86.
HERO ID:	2718073

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods were reported.
	Metric 2:	Analytical Methodology	Medium	Recovery samples not reported.
	Metric 3:	Biomarker Selection	High	Mono(carboxyoctyl) phthalate (mCOP) measured.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study performed in California.
	Metric 5:	Currency	Medium	Samples were collected in 2007 and 2008.
	Metric 6:	Spatial and Temporal Variability	Low	52 patients and 50 controls were recruited to the study. No replicates were collected and only single spot urine samples were provided.
	Metric 7:	Exposure Scenario	Medium	Exposure scenario not well characterized. However, note that the aim of this study was to determine if there was an association between patients with polycystic ovarian syndrome and environmental contaminants in their body. As a result, some of this metric's criteria are less applicable.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Low	Limited QA/QC techniques were reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Gaps and limitations were reported but little characterization of variance.

Overall Quality Determination Medium

Study Citation:	Zhang, Y., Wang, P., Wang, L., Sun, G., Zhao, J., Zhang, H., Du, N. (2015). The influence of facility agriculture production on phthalate esters distribution in black soils of northeast China. Science of the Total Environment 506-507:118-125.
HERO ID:	2804035

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most sampling methods reported, except some details were missing (e.g., sampling equipment, storage conditions).
	Metric 2:	Analytical Methodology	High	Key analytical methods (e.g., extraction methods, GC-MS analysis) were reported. MDLs provided in text under Section 2.6.
	Metric 3:	Biomarker Selection	N/A	The study tested for parent chemicals in soil.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from nine cities in China.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	There were a total of 27 samples collected with no replicates.
	Metric 7:	Exposure Scenario	High	Exposure scenario was characterized, including possible sources of exposure (i.e., via contaminated agricultural soil).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics were provided but not raw data.
	Metric 9:	Quality Assurance	High	QA/QC techniques were described and included procedural blank, spike blank, sample duplicates, and recoveries. Recovery ranges were acceptable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key gaps and limitations were not discussed.

Overall Quality Determination Medium

Study Citation:	Yang, G. C. C., Wang, C. L., Chiu, Y. (2015). Occurrence and distribution of phthalate esters and pharmaceuticals in Taiwan river sediments. Journal of Soils and Sediments 15(1):198-210.
HERO ID:	2816375

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods were briefly summarized with reference to Taiwan's NIEA S102.61B standard method.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported (e.g., sample extraction using NIEA M167.01C standard method, spiked and blank smaples, recovery, LC-ESI-MS/MS analytical methods, instruments).
	Metric 3:	Biomarker Selection	N/A	Study tested parent chemicals in river sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study performed in Dianbao River, Taiwan.
	Metric 5:	Currency	Medium	Samples collected in 2011 to 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	35 samples were collected with no replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure scenario is not well characterized, other than some information on pollutant sources (i.e., factories along its flow and their products).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Most summary statistics are missing except for average concentrations and detection frequencies.
	Metric 9:	Quality Assurance	High	QA/QC reported with acceptable recovery.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance characterized with standard deviation, but limitations, data gaps, and uncertainties were not described.

Overall Quality Determination Medium

Study Citation:	Bae, J., Kim, S., Kannan, K., Buck Louis, G. M. (2015). Couples' urinary bisphenol A and phthalate metabolite concentrations and the secondary sex ratio. Environmental Research 137:450-457.
HERO ID:	2816865

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Population was described, urine sampling not described.
	Metric 2:	Analytical Methodology	Medium	LOD range provided. published methods (Guo et al., 2011; Zhang et al., 2011)
	Metric 3:	Biomarker Selection	High	Mono-isononyl phthalate (MiNP) was measured in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Michigan and Texas, USA.
	Metric 5:	Currency	Medium	Samples were collected in 2005 and 2009.
	Metric 6:	Spatial and Temporal Variability	Medium	n = 213 mothers and 212 fathers, no replicates
	Metric 7:	Exposure Scenario	High	The study was a biomonitoring study.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The study reported the geometric mean and 95%CI
	Metric 9:	Quality Assurance	Medium	The quality assurance and control procedures included in published methods (Guo et al., 2011; Zhang et al., 2011)
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The variability was briefly discussed, uncertainty was not discussed.

Overall Quality Determination Medium

Study Citation:	Tran, B. C., Teil, M. J., Blanchard, M., Alliot, F., Chevreuil, M. (2015). Fate of phthalates and BPA in agricultural and non-agricultural soils of the Paris area (France). Environmental Science and Pollution Research 22(14):11118-11126.
HERO ID:	2914670

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sample locations and WWTP characteristics were described. Sludge was sampled from a storage area and kept at -18°C. Appendix contains additional information on sampling timing. Soil and sludge were freeze-dried for 3 days, homogenized, and sieved.
	Metric 2:	Analytical Methodology	High	Authors described extraction procedures (extracted with 15mL of mixture of hexane 50 vol/acetone 50 vol in a Bransonic 2510 ultra-sonic bath (VWR) for 20 min), analytical methods (GC/MS), recoveries (Appendix 5), and LOD/LOQ (Appendix 5).
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in sewage sludge.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study performed in Essonne, France.
	Metric 5:	Currency	Medium	Samples were collected in 2010-2011 and then 2012.
	Metric 6:	Spatial and Temporal Variability	Low	The number of sludge samples was not defined. Four sampling events were conducted in 2010-2011 after a single sludge application. Samples were collected at four different depths during each event and presumably one sample was taken at each depth. A second sampling campaign occurred in 2012 for only surface soil where five samples were collected. There was no mention of replicates for any of them.
	Metric 7:	Exposure Scenario	High	The concentration in sewage sludge from WWTP receiving wastewater from domestic and hospital were determined. This sludge was then applied to agricultural soil and chemical concentrations were compared with those of urban, rural, and forestry soils.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Figures and tables provide mean levels; raw data were not provided.
	Metric 9:	Quality Assurance	High	Recoveries ranged from 55-106% and were corrected by procedural blanks, as reported in Appendix 5.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There was limited to no characterization of variance and some characterization of uncertainty in Appendix 5.

Overall Quality Determination Medium

Study Citation:	Huen, K., Calafat, A. M., Bradman, A., Yousefi, P., Eskenazi, B., Holland, N. (2016). Maternal phthalate exposure during pregnancy is associated with DNA methylation of LINE-1 and Alu repetitive elements in Mexican-American children. Environmental Research 148:55-62.
HERO ID:	3230402

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Two urine samples were collected from mothers at the time ofinterview, aliquoted, barcoded and stored at -80 °C.
	Metric 2:	Analytical Methodology	High	Measurements were performed using solid phase extraction coupled with isotope dilution high-performance liquid chromatography-electro spray ionization-tandem massspectrometry. The LODs are reported in table 2.
	Metric 3:	Biomarker Selection	High	MCPP Non-specific metabolite of several phthalates, MCOP metabolite of DiNP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Salinas, California.
	Metric 5:	Currency	Medium	1999-2000.
	Metric 6:	Spatial and Temporal Variability	High	350 mothers at 13 weeks of pregnancy and 339 at 26 weeks of pregnancy.
	Metric 7:	Exposure Scenario	High	Maternal phthalate exposure in a Mexican American community in Salinas California.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual sample concentrations. Table 2 reports data as median (IQR) min and max.
	Metric 9:	Quality Assurance	High	Quality control procedures included the use of laboratory and field blanks, calibration standards, and controls with high and low concentrations.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Key limitations are reported.

Overall Quality Determination High

Study Citation:	Chen, C. F., Chen, C. W., Ju, Y. R., Dong, C. D. (2016). Determination and assessment of phthalate esters content in sediments from Kaohsiung Harbor, Taiwan. Marine Pollution Bulletin 124(2):767-774.
HERO ID:	3540854

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Details of the sampling procedures, locations, and sample storage have been reported elsewhere (Dong et al., 2015a). Brief description: Surface sediment (0–15 cm) samples were collected at 20 sampling points. Missing mention of sampling efforts to avoid phthalate contamination from materials and person collecting sample. Description of sampling location and sites provided, and shown in Figure 1.
	Metric 2:	Analytical Methodology	High	Use gas chromatography mass spectrometry was used for the analysis of the samples. Five-point calibration curve (2 to 10 ng), procedural blank, check standard, sample duplicates, and certified reference materials were carried out for all samples. Detection limits reported.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Kaohsiung Harbor, Taiwan.
	Metric 5:	Currency	Medium	Samples collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	80 samples; no replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not provided.
	Metric 9:	Quality Assurance	High	Key QA reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Key gaps and limitations not well characterized.

Overall Quality Determination Medium

Study Citation:	Li, R., Liang, J., Duan, H., Gong, Z. (2017). Spatial distribution and seasonal variation of phthalate esters in the Jiulong River estuary, Southeast China. Marine Pollution Bulletin 122(1-2):38-46.
HERO ID:	3859571

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples were collected from 15 sites along the salinity gradient in the river estuary during Aug, April, and January (Fig 1). Water samples were collected from the top layer (0-20cm) in 10L stainless steel barrel and filtered to separate SPM from water and stored at 4C. SPM was free-dried. The top 0-10cm of sediment was collected with grab sampler, stored in glass jar at 4C, freeze-dried at -20C for 72 hours, ground, and sieved. Plastic equipment was avoided to minimize contamination.
	Metric 2:	Analytical Methodology	Medium	Methods used included SPE and GC-MS. Recoveries were reported, but only ranges were provided (pg 40) for LOQs.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in various environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from the Jiulong River estuary, Fujian, Southeast China.
	Metric 5:	Currency	High	Samples were collected in April and August (2014) and January (2015).
	Metric 6:	Spatial and Temporal Variability	Medium	15 sites were sampled in normal (April), wet (August), and dry (January) seasons. Each site was sampled once person season without replicates.
	Metric 7:	Exposure Scenario	High	Study measured phthalate concentrations in river water, suspended particulate matter, and sediment of an estuary affected by river runoff, sewage discharge, agriculture, tourist industry and shipping. The spatial distribution and seasonal variations were also evaluated. This scenario is relevant to local communities who use the estuary.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Tables 1-3 provide range, mean, median, n, and DF for each media in wet, medium, and dry season. No raw data were available.
	Metric 9:	Quality Assurance	High	The range of recoveries was provided on p. 40 (section 2.4) were acceptable. Authors also reported analyzing sample duplicate, procedural blank, and spiked blank.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variance was characterized with range but only minimal discussion of limitations and uncertainties.
Overall Quality Determination			**High**	

Study Citation:	Quintana-Belmares, R. O., Krais, A. M., Esfahani, B. K., Rosas-Pérez, I., Mucs, D., López-Marure, R., Bergman, Å., Alfaro-Moreno, E. (2018). Phthalate esters on urban airborne particles: Levels in PM10 and PM2.5 from Mexico City and theoretical assessment of lung exposure. Environmental Research 161:439-445.
HERO ID:	4167514

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Detailed sampling methodology description, scientifically sound.
	Metric 2:	Analytical Methodology	Medium	Analytical methodology is briefly discussed, recovery samples or calibrations are not mentioned. LOD is discussed but 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	Mexico City.
	Metric 5:	Currency	Medium	Samples from 2013.
	Metric 6:	Spatial and Temporal Variability	High	Paper reports weekly sampling for 7 months, but number of samples is not reported explicitly. They "recovered 30 filters".
	Metric 7:	Exposure Scenario	High	Data closely represents a relevant exposure scenario for the population of Mexico City described in the manuscript.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations are not reported, only summary statistics.
	Metric 9:	Quality Assurance	Low	Field and laboratory blanks were not analyzed, recoveries were not reported. and QA/QC was not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties and limitations are nor discussed, potentially having a substantial impact on the exposure assessment.

Overall Quality Determination Medium

Study Citation:	Olofsson, U., Brorström-Lundén, E., Kylin, H., Haglund, P. (2013). Comprehensive mass flow analysis of Swedish sludge contaminants. Chemosphere 90(1):28-35.
HERO ID:	4182871

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology is discussed in the supplement. The discussion contains most information (site characters, sampling procedure, storage).
	Metric 2:	Analytical Methodology	Medium	Analytical procedure was performed by other labs. LOD was mentioned to be calculated but not reported in the document.
	Metric 3:	Biomarker Selection	N/A	The study tested in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in Sweden.
	Metric 5:	Currency	Low	The study took place in Autumn of 2004.
	Metric 6:	Spatial and Temporal Variability	Medium	Sludge samples were collected at seven STPs.
	Metric 7:	Exposure Scenario	Medium	Sludge was reported as the exposure medium.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The supplement contained the individual data points but still lacked a few important information including standard deviation.
	Metric 9:	Quality Assurance	High	Quality assurance and quality checks was discussed in the supplement. No issues were identified.
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:	Rahbar, M. H., Swingle, H. M., Christian, M. A., Hessabi, M., Lee, M., Pitcher, M. R., Campbell, S., Mitchell, A., Krone, R., Loveland, K. A., Patterson, D. G. (2017). Environmental Exposure to Dioxins, Dibenzofurans, Bisphenol A, and Phthalates in Children with and without Autism Spectrum Disorder Living near the Gulf of Mexico.
HERO ID:	4728376

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Participants and sampling were described briefly
	Metric 2:	Analytical Methodology	Medium	LOD range provided, analysis performed by LabCorp Laboratory using standard methods approved by CALA and NELAP.
	Metric 3:	Biomarker Selection	High	Mono-iso-nonyl phthalate (MiNP) was measured in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in the U.S.
	Metric 5:	Currency	High	Samples were collected between 2015-2016
	Metric 6:	Spatial and Temporal Variability	Low	A total of n = 40 samples were collected, no replicates, urine sampling details not provided
	Metric 7:	Exposure Scenario	Low	This was a biomonitoring study
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean, SD, range were provided
	Metric 9:	Quality Assurance	Low	QA not discussed, no obvious concerns
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty not discussed, no obvious concerns

Overall Quality Determination Medium

Study Citation:	Polinski, K. J., Dabelea, D., Hamman, R. F., Adgate, J. L., Calafat, A. M., Ye, X., Starling, A. P. (2018). Distribution and predictors of urinary concentrations of phthalate metabolites and phenols among pregnant women in the Healthy Start Study. Environmental Research 162:308-317.
HERO ID:	4728411

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most key criteria met. Duration of sample storage data lacking.
	Metric 2:	Analytical Methodology	Medium	Most key criteria met, chemical-specific LOD's reported within supplemental material, lack of recovery sample data.
	Metric 3:	Biomarker Selection	High	Supplemental Table 1 contains specific metabolite concentrations. Mono carboxyisooctyl phthalate (MCOP) was measured for DINP
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples provided by participants in the state of Colorado.
	Metric 5:	Currency	High	Samples collected 2009-2014.
	Metric 6:	Spatial and Temporal Variability	Medium	Total of n=446 participants in convenience (non-statistical sampling approach) sample, providing single spot urines at 24-32 weeks gestation. Additional sub-sample of women (n=24) had three spot urine samples collected at two-week intervals.
	Metric 7:	Exposure Scenario	Medium	Participant characteristics summarized, lack of information on pre-exposure or control samples.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Most key criteria met; lack of raw data.
	Metric 9:	Quality Assurance	Low	Quality assurance procedures not described, however laboratory methods referenced.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability characterized within summary statistics, potential study limitations discussed.

Overall Quality Determination — Medium

Study Citation:	Huffman, A. M., Wu, H., Rosati, A., Rahil, T., Sites, C. K., Whitcomb, B. W., Richard Pilsner, J. (2018). Associations of urinary phthalate metabolites and lipid peroxidation with sperm mitochondrial DNA copy number and deletions. Environmental Research 163:15-Oct.
HERO ID:	4728509

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Participants and sampling described briefly.
	Metric 2:	Analytical Methodology	Low	LOD range provided, CDC analyzed samples.
	Metric 3:	Biomarker Selection	High	Monocarbxyisooctyl phthalate (MCOP) was measured in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	U.S.
	Metric 5:	Currency	High	2014 and 2017
	Metric 6:	Spatial and Temporal Variability	Low	n = 99, no replicates, spot urine samples.
	Metric 7:	Exposure Scenario	High	Biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	GM, 95%CI, % below LOD, percentiles: 25%, 50%, 75%, 95%
	Metric 9:	Quality Assurance	Medium	Standards, spikes, blanks, and LOD approach described. Recovery not included.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability and uncertainty not discussed, no obvious concerns.

Overall Quality Determination Medium

Study Citation:	Malits, J., Attina, T. M., Karthikraj, R., Kannan, K., Naidu, M., Furth, S., Warady, B. A., Vento, S., Trachtman, H., Trasande, L. (2018). Renal function and exposure to bisphenol A and phthalates in children with chronic kidney disease. Environmental Research 167:575-582.
HERO ID:	4829246

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample storage duration is unclear.
	Metric 2:	Analytical Methodology	Low	The main study does not include information on analytical methods, but states that detailed methods can be found in the supplementary materials for the article.
	Metric 3:	Biomarker Selection	High	Mono-(carboxyisooctyl) phthalate (MCOP) was measured in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was performed in the USA.
	Metric 5:	Currency	Medium	The majority of samples were collected from 2005 to 2008, and some were collected between 2009 and 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 538 study participants. Samples were fresh void samples, not 24-hr samples.
	Metric 7:	Exposure Scenario	Medium	The data likely represent the exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Results we're adjusted for urinary creatine. Mean values with 95% confidence intervals were reported. Raw data were not included in the main study (it is unclear whether these data are contained in the supplementary materials).
	Metric 9:	Quality Assurance	Low	The study reports that no QC/QC measures were in place during sampling.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study included a brief discussion of the limitations of its cross-sectional design.
Overall Quality Determination			**Medium**	

Study Citation:	Balalian, A. A., Whyatt, R. M., Liu, X., Insel, B. J., Rauh, V. A., Herbstman, J., Factor-Litvak, P. (2019). Prenatal and childhood exposure to phthalates and motor skills at age 11 years. Environmental Research 171:416-427.
HERO ID:	5039985

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Most key criteria not described. Sampling equipment, sample storage conditions, duration of sample storage, lacking.
	Metric 2:	Analytical Methodology	Medium	Some key criteria briefly described, samples analyzed by CDC with methodology referenced, chemical-specific LOD's reported.
	Metric 3:	Biomarker Selection	High	Sampling for Mono-(carboxyisooctyl) phthalate.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples provided by participants in Harlem and New York, New York hospitals.
	Metric 5:	Currency	Medium	Prenatal spot urine samples collected 1998-2006; age three urines collected 2002-2008; age 5 urines collected 2004-2009; age 7 urines collected 2005-2009.
	Metric 6:	Spatial and Temporal Variability	Medium	Single prenatal 3rd trimester spot urine specimens obtained from n=300 participants 1998-2006; repeated urines collected across ages 3, 5 and 7 for children of mother participants 2002-2009.
	Metric 7:	Exposure Scenario	Medium	Participant characteristics summarized, lack of information on pre-exposure or control samples.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Most key criteria met; lack of raw data.
	Metric 9:	Quality Assurance	Medium	Quality assurance procedures not described however analytic methods referenced and samples noted as analyzed at CDC labs.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability characterized within summary statistics, potential study limitations discussed.
Overall Quality Determination			**Medium**	

Study Citation:	Nassan, F. L., Williams, P. L., Gaskins, A. J., Braun, J. M., Ford, J. B., Calafat, A. M., Hauser, R. (2019). Correlation and temporal variability of urinary biomarkers of chemicals among couples: Implications for reproductive epidemiological studies. Environment International 123:181-188.
HERO ID:	5041439

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Well described
	Metric 2:	Analytical Methodology	High	LOD reported. Standard methods.
	Metric 3:	Biomarker Selection	High	Strong relationship with parent.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Boston
	Metric 5:	Currency	Medium	2004 to 2017
	Metric 6:	Spatial and Temporal Variability	Medium	Hundreds of samples and hundreds of participants. Replicate samples (men and women on same day). Unpooled spot urine samples. Multiple samples per person, so treat as if pooled.
	Metric 7:	Exposure Scenario	Low	Matches exposure scenario for couples seeking fertility treatments, so may not be representative of US population.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Summary statistics only. Downgraded to Low because I cannot tell if the summary statistics are per person (best) or per sample.
	Metric 9:	Quality Assurance	Low	QA/QC not discussed. SG adjustment.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Uncertainties and limitations discussed.

Overall Quality Determination Medium

Study Citation:	Reeves, K. W., Santana, M. D., Manson, J. E., Hankinson, S. E., Zoeller, R. T., Bigelow, C., Hou, L., Wactawski-Wende, J., Liu, S., Tinker, L., Calafat, A. M. (2019). Predictors of urinary phthalate biomarker concentrations in postmenopausal women. Environmental Research 169:122-130.
HERO ID:	5043403

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	Medium	Recovery samples not reported
	Metric 3:	Biomarker Selection	High	Mono-(carboxyisooctyl) phthalate was measured.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	United States
	Metric 5:	Currency	Low	Samples collected between 1993 and 1998
	Metric 6:	Spatial and Temporal Variability	High	>10 samples; replicates
	Metric 7:	Exposure Scenario	High	Exposure sources characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported
	Metric 9:	Quality Assurance	Medium	Key QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some limitations reported

Overall Quality Determination Medium

Study Citation:	Shaffer, R. M., Ferguson, K. K., Sheppard, L., James-Todd, T., Butts, S., Chandrasekaran, S., Swan, S. H., Barrett, E. S., Nguyen, R., Bush, N., Mcelrath, T. F., Sathyanarayana, S. (2019). Maternal urinary phthalate metabolites in relation to gestational diabetes and glucose intolerance during pregnancy. Environment International 123:588-596.
HERO ID:	5043458

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most key criteria met, sampling methodology briefly described; lack of sample storage duration prior to analysis.
	Metric 2:	Analytical Methodology	Medium	Analytical methodology briefly described, limits of detection reported as range, however analytic methods referenced.
	Metric 3:	Biomarker Selection	High	Mono-carboxy-isooctyl phthalate (MCOP) was measured.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples provided by participants in California, Minnesota, New York, and Washington State.
	Metric 5:	Currency	Medium	Samples collected 2010-2012.
	Metric 6:	Spatial and Temporal Variability	Medium	Participants in their first trimester recruited from California, Minnesota, New York, and Washington State during 2010-2012; single spot urines during first (70-100 samples per chemical) and third trimester period (n=679 samples); non-statistical sampling methodology.
	Metric 7:	Exposure Scenario	Medium	Participant characteristics described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Most key criteria met; lack of raw data.
	Metric 9:	Quality Assurance	Medium	Quality assurance procedures briefly described, lack of pre-exposure/baseline samples, however analytic methodology referenced.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability described within statistical summary measures, potential study limitations described and comparisons with previous literature presented.

Overall Quality Determination Medium

Study Citation:	Shin, H. M., Bennett, D. H., Barkoski, J., Ye, X., Calafat, A. M., Tancredi, D., Hertz-Picciotto, I. (2019). Variability of urinary concentrations of phthalate metabolites during pregnancy in first morning voids and pooled samples. Environment International 122:222-230.
HERO ID:	5043463

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology does not represent best protocols. Participants were instructed to collect urine "in a clean plastic container," transfer into a study-provided bottle, then stored in their home refrigerator "or other cool place" for an unspecified amount of time. Additionally, many participants did not include all four requested samples (three first morning voids and one 24-hour) and the selection of samples to analyze from the provided number is unclear.
	Metric 2:	Analytical Methodology	High	Samples were analyzed at a CDC laboratory following methodology that is well-established and reliable. Analyte LOD is provided.
	Metric 3:	Biomarker Selection	High	Mono-(carboxyisooctyl) phthalate (MCOP) was measured.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	California
	Metric 5:	Currency	Medium	2007-2014
	Metric 6:	Spatial and Temporal Variability	Medium	178 mothers (188 pregnancies) were instructed to provided four urine samples each: first morning void urine samples once per week for three weeks, and one 24-hour urine sample on the fourth week. However, many participants did not provide all requested samples; the selection of samples to analyze from the provided number favored first-morning voids and is otherwise unclear.
	Metric 7:	Exposure Scenario	Medium	Biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics for analyte concentration include 5th, 25th, 50th, 75th, and 95th percentile, as well as maximum and geometric mean. Individual concentration values are not reported.
	Metric 9:	Quality Assurance	High	Samples were analyzed at a CDC laboratory following protocols that are well-established to be precise and reproducible, including in-study assurances.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability between sample types (pooled vs. individual) and across trimesters is thoroughly discussed and analyzed.
Overall Quality Determination			**High**	

Study Citation:	Zhang, Z. M., Zhang, H. H., Zou, Y. W., Yang, G. P. (2018). Distribution and ecotoxicological state of phthalate esters in the sea-surface microlayer, seawater and sediment of the Bohai Sea and the Yellow Sea. Environmental Pollution 240:235-247.
HERO ID:	5433212

Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The water and sediment sampling methodology is well described.
	Metric 2:	Analytical Methodology	High	The analytical methods were described, including LOD and recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Bohai Sea and Yellow Sea. Specific sampling locations given.
	Metric 5:	Currency	Medium	The samples were collected in 2014.
	Metric 6:	Spatial and Temporal Variability	High	n=110 water samples, n=38 sediment samples.
	Metric 7:	Exposure Scenario	Medium	The data likely represent a relevant exposure scenario related to phthalate contamination of seawater and sediment in the Bohai and Yellow Seas. Population data or descriptions were not reported.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only raw data was reported.
	Metric 9:	Quality Assurance	High	QA/QC methods were described in detail.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized. Uncertainties were briefly discussed.

Overall Quality Determination High

Study Citation:	Zhang, Z. M., Zhang, H. H., Zhang, J., Wang, Q. W., Yang, G. P. (2018). Occurrence, distribution, and ecological risks of phthalate esters in the seawater and sediment of Changjiang River Estuary and its adjacent area. Science of the Total Environment 619-620:93-102.
HERO ID:	5433253

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology is detailed and complete with information on components such as site characteristics, collection regimen, and equipment.
	Metric 2:	Analytical Methodology	Medium	Extraction and analytical methods were reported, including references to previously published protocols for additional details. Recoveries and MDLs were also reported, but the latter only provided a range for all phthalates combined.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in water and sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was conducted in China.
	Metric 5:	Currency	High	Samples were collected in 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 133 water samples (79 surface water and 54 seawater) and 17 sediment samples were collected without replicates.
	Metric 7:	Exposure Scenario	Medium	Data are likely to represent a relevant exposure scenario with the study area being part of a large economic center. However, details on the population of interest were missing.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations are provided in Tables S3 and S5. Most summary statistics are missing.
	Metric 9:	Quality Assurance	Medium	Authors analyzed control samples and referenced another study for more details. Recoveries were reported as a range, but the lower bound is <70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	A discussion of key uncertainties and limitations was absent. The first paragraph of Results provides some limited characterization of variance, but raw data are available.

Overall Quality Determination Medium

Study Citation:	Chen, C. F., Chen, C. W., Chen, T. M., Ju, Y. R., Chang, Y. K., Dong, C. D. (2017). Phthalate ester distributions and its potential-biodegradation microbes in the sediments of Kaohsiung Ocean Dredged Material Disposal Site, Taiwan. International Biodeterioration & Biodegradation 124:233-242.
HERO ID:	5494792

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	High	Key analytical methods reported.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taiwan
	Metric 5:	Currency	Medium	Samples collected in 2014.
	Metric 6:	Spatial and Temporal Variability	High	>10 samples collected; replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported.
	Metric 9:	Quality Assurance	Medium	QA conducted but reported in a different study.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.

Overall Quality Determination Medium

Study Citation:	Hammel, S. C., Levasseur, J. L., Hoffman, K., Phillips, A. L., Lorenzo, A. M., Calafat, A. M., Webster, T. F., Stapleton, H. M. (2019). Children's exposure to phthalates and non-phthalate plasticizers in the home: The TESIE study. Environment International 132:105061.
HERO ID:	5532853

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology is described for all sample media
	Metric 2:	Analytical Methodology	High	Analytical methodology is described and MDL reported per metabolite in table 2
	Metric 3:	Biomarker Selection	Medium	MONP metabolite was measured. DiNP in hand wipes and dust was also measured.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA NC
	Metric 5:	Currency	High	2014-2016
	Metric 6:	Spatial and Temporal Variability	Medium	No sample replicates, 203 children from 190 families
	Metric 7:	Exposure Scenario	High	Biomonitoring children exposure to phthalates
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data. Table 2 Descriptive statistics for phthalates and non-phthalate plasticizers with their urinary metabolites
	Metric 9:	Quality Assurance	High	Recovery, field blanks, NIST samples for accuracy
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No standard difference reported. Section 3.5 limitations

Overall Quality Determination High

Study Citation:	Zhang, S. H., Guo, A. J., Fan, T. T., Zhang, R., Niu, Y. J. (2019). Phthalates in residential and agricultural soils from an electronic waste-polluted region in South China: distribution, compositional profile and sources. Environmental Science and Pollution Research 26(12):12227-12236.
HERO ID:	5541389

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Key sampling methods reported
	Metric 2:	Analytical Methodology	Medium	Key analytical methods reported
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Residential and agricultural soils from Guiyu, Shantou, China. Maps were provided.
	Metric 5:	Currency	Medium	Samples collected in 2012
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	Medium	Exposure scenario not well characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported
	Metric 9:	Quality Assurance	High	Key QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Gaps and limitations not well characterized

Overall Quality Determination Medium

Study Citation:	Rodríguez-Ramos, R., Socas-Rodríguez, B., Santana-Mayor, Á., Rodríguez-Delgado, M. Á. (2019). Nanomaterials as alternative dispersants for the multiresidue analysis of phthalates in soil samples using matrix solid phase dispersion prior to ultra-high performance liquid chromatography tandem mass spectrometry. Chemosphere 236:124377.
HERO ID:	5617923

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Soil and sand samples were collected following the guidelines established by the Joint Research Centre of the European commission, which is a publicly available and scientifically sound SOP.
	Metric 2:	Analytical Methodology	High	Development of improved analytical methodology was the focus of this study. All important details are included and the methods are scientifically sound. LOQ were reported.
	Metric 3:	Biomarker Selection	N/A	This study was testing for the parent chemical of interest in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	This study used soil and sand samples collected in Tenerife (Canary Islands, Spain).
	Metric 5:	Currency	Low	Timing of sample collection was not reported, but a publication date is available.
	Metric 6:	Spatial and Temporal Variability	Medium	Five soil samples and four sand samples were analyzed. One sample of each type was not a "real" sample collected during the study. Use of replicates was not reported.
	Metric 7:	Exposure Scenario	High	Soil samples were collected from agricultural crop areas related to cereals and potatoes, and sand samples were from beaches. Both sample sets were well characterized and represent relevant exposure sources.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are reported; results obtained as an average of two analyses for each sample. Summary statistics are not reported but not warranted for the size of the data set and contents of the data (i.e., most data points are not detected or below LOQ).
	Metric 9:	Quality Assurance	High	Development of improved analytical methodology was the focus of this study. An exhaustive validation of the whole methodology was carried out, obtaining good linearity as well as recovery values between 70 and 120% with RSDs below 20% for all analytes in the selected matrices.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Quantitative characterization of variability is not reported, but there is some qualitative discussion around variability and uncertainty.
Overall Quality Determination			**High**	

Study Citation:	Huang, C. N., Yee, H., Cho, H. B., Lee, C. W. (2019). Children's exposure to phthalates in dust and soil in Southern Taiwan: A study following the phthalate incident in 2011. Science of the Total Environment 696:133685.
HERO ID:	5618703

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The dust and soil sampling methodologies were well described.
	Metric 2:	Analytical Methodology	High	The analytical methods were described in detail, including LODs and recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Taiwan.
	Metric 5:	Currency	Medium	Samples were collected between 2012 and 2014.
	Metric 6:	Spatial and Temporal Variability	High	n>10 indoor and n>10 outdoor samples.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to phthalates in dust and soil in Taiwan.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics were reported.
	Metric 9:	Quality Assurance	Medium	QA/QC techniques were briefly described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability was characterized (SD, range). Uncertainties were discussed.

Overall Quality Determination High

Study Citation:	Buckley, J. P., Palmieri, R. T., Matuszewski, J. M., Herring, A. H., Baird, D. D., Hartmann, K. E., Hoppin, J. A. (2012). Consumer product exposures associated with urinary phthalate levels in pregnant women. Journal of Exposure Science & Environmental Epidemiology 22(5):468-475.
HERO ID:	5772514

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	Medium	Recovery samples not reported
	Metric 3:	Biomarker Selection	High	Mono-isononyl phthalate is an acceptable biomarker for DINP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Samples collected in 2002 and 2003
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported
	Metric 9:	Quality Assurance	High	Key QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported
Overall Quality Determination			**Medium**	

Study Citation:	Zhang, Z. M., Yang, G. P., Zhang, H. H., Shi, X. Z., Zou, Y. W., Zhang, J. (2019). Phthalic acid esters in the sea-surface microlayer, seawater and sediments of the East China Sea: Spatiotemporal variation and ecological risk assessment. Environmental Pollution 259:113802.
HERO ID:	5933853

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Clear and detailed methods
	Metric 2:	Analytical Methodology	High	Included detection limits and recoveries
	Metric 3:	Biomarker Selection	N/A	The study measured environmental data
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	East China Sea
	Metric 5:	Currency	Medium	Began in 2014
	Metric 6:	Spatial and Temporal Variability	Medium	56 and 98 seawater samples (including surface water samples and the samples at different sampling depths) collected in autumn and spring, respectively. Additionally, 12 SML and 19 sediment samples were obtained in spring. no replicates
	Metric 7:	Exposure Scenario	High	Data represent a relevant exposure scenario, included ecological risk assessment
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	The study reported raw data in supplementary information
	Metric 9:	Quality Assurance	High	Detailed QA/QC section, included recoveries, analyzed control samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited characterization of uncertainties, study limitations and data gaps

Overall Quality Determination High

Study Citation:	Ferguson, K. K., Rosen, E. M., Barrett, E. S., Nguyen, R. H. N., Bush, N., Mcelrath, T. F., Swan, S. H., Sathyanarayana, S. (2019). Joint impact of phthalate exposure and stressful life events in pregnancy on preterm birth. Environment International 133(Pt B):105254.
HERO ID:	6813951

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The sampling methodology was briefly described, citing previously published work.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were well-described but did not include LODs or recoveries.
	Metric 3:	Biomarker Selection	High	The urine metabolite Mono-(carboxyisooctyl) phthalateis closely associated with exposure to the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Medium	The sampling campaign occurred between 2010 and 2012.
	Metric 6:	Spatial and Temporal Variability	High	The study included n=783 study participants that provided urine samples at three routine visits.
	Metric 7:	Exposure Scenario	High	The data closely represent scenarios of phthalate exposure in pregnant women in the U.S.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics were reported (median, IQR).
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not described by the authors.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability was characterized (IQR). The authors discussed uncertainties and study limitations.

Overall Quality Determination High

Study Citation:	Kim, J. H., Kim, D., Moon, S. M., Yang, E. J. (2020). Associations of lifestyle factors with phthalate metabolites, bisphenol A, parabens, and triclosan concentrations in breast milk of Korean mothers. Chemosphere 249:126149.
HERO ID:	6815879

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods (e.g., equipment, collection procedure, storage conditions) were reported.
	Metric 2:	Analytical Methodology	High	Key analytical methods (e.g., extraction, instrumentation, LOQs, recoveries) were reported.
	Metric 3:	Biomarker Selection	High	MiNP is specific to DiNP.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Korea.
	Metric 5:	Currency	High	Samples were collected in 2018.
	Metric 6:	Spatial and Temporal Variability	Medium	221 samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring study that presumed exposure already occurred. Authors broadly discussed possible sources of exposure and aimed to evaluate associations between endocrine disruptions detected in breast milk and consumption of certain foods or use of certain products.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	QA/QC techniques included tests of linearity, accuracy, precision, LOQs, and recoveries. Recoveries were acceptable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variance characterized with standard deviation. Some gaps and limitations were reported, but focused mostly on estimates of daily intake.
Overall Quality Determination			**High**	

Study Citation:	Kim, S., Lee, Y. S., Moon, H. B. (2020). Occurrence, distribution, and sources of phthalates and non-phthalate plasticizers in sediment from semi-enclosed bays of Korea. Marine Pollution Bulletin 151:110824.
HERO ID:	6815967

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods were only briefly described and references to other published studies were provided for more details.
	Metric 2:	Analytical Methodology	High	All key analytical methods (e.g., extraction method, instrumentation) were reported, but individual LOQs were not provided for each phthalate.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Musan Bay, Korea.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	Sixty samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	Industrial and domestic discharges to the bay and its ecological risks were described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were described in detail. Recoveries were <70% for several of the phthalates, and no corrections were explained.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Gaps and limitations were only minimally discussed.

Overall Quality Determination — Medium

Study Citation:	Lee, Y. S., Lim, J. E., Lee, S., Moon, H. B. (2020). Phthalates and non-phthalate plasticizers in sediment from Korean coastal waters: Occurrence, spatial distribution, and ecological risks. Marine Pollution Bulletin 154:111119.
HERO ID:	6815985

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling regimen was not reported, and description of other methods (e.g., equipment) was sparse.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported, including reference to previously published method. LOQs presented in Table S3.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from Korean coastal waters.
	Metric 5:	Currency	High	Samples were collected in 2016.
	Metric 6:	Spatial and Temporal Variability	Medium	Sediment was collected from 50 locations without replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure source was not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	Medium	QA/QC techniques were reported. The mean recovery for each chemical is >70%, but when considering the standard deviations, almost all recoveries fall below 70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limitations and gaps were not characterized.
Overall Quality Determination			**Medium**	

Study Citation:	Nagorka, R., Koschorreck, J. (2020). Trends for plasticizers in German freshwater environments - Evidence for the substitution of DEHP with emerging phthalate and non-phthalate alternatives. Environmental Pollution 262:114237.
HERO ID:	6816080

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Provides overview of sampling procedure with additional details in supplemental info (Section 1, Tables S1 and S2); follows the German Environmental Specimen Bank (ESB) procedures.
	Metric 2:	Analytical Methodology	High	Used LC-MS and provide LOD in supplemental info (Table S6).
	Metric 3:	Biomarker Selection	N/A	Water sampling
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	High	2017
	Metric 6:	Spatial and Temporal Variability	High	13 sampling sites with monthly samples at each site pooled into one annual sample; n = 11 for plasticizer concentration average.
	Metric 7:	Exposure Scenario	High	Monitoring plasticizers in waters (previous studies have found DEHP and other phthalates).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Average, median, range, sample size (n=11), and detection frequency; do not provide individual sample concentrations.
	Metric 9:	Quality Assurance	High	Recoveries >75% (see Table 7 supplementary info); used blanks and controls.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Measured relative standard deviation for repeatability; discuss some limitations.

Overall Quality Determination High

Study Citation:	Zhang, Z. M., Zhang, J., Zhang, H. H., Shi, X. Z., Zou, Y. W., Yang, G. P. (2020). Pollution characteristics, spatial variation, and potential risks of phthalate esters in the water-sediment system of the Yangtze River estuary and its adjacent East China Sea. Environmental Pollution 265(PT A):114913.
HERO ID:	6957439

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The study provided details about sampling sites, equipment, and procedure (additional info in supplementary section)
	Metric 2:	Analytical Methodology	Medium	The study used GC-MS and report method detection limit/detection frequency
	Metric 3:	Biomarker Selection	N/A	The study measured environmental samples
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in the Yangtze River estuary and East China Sea
	Metric 5:	Currency	High	Samples were collected in 2015 and 2017
	Metric 6:	Spatial and Temporal Variability	High	A total of 166 seawater samples and 56 sediment samples
	Metric 7:	Exposure Scenario	Medium	The study evaluated phthalates in water
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The study report average concentrations (Table S3 in supplementary info) but no summary stats or individual sample data
	Metric 9:	Quality Assurance	Medium	The study had procedural standards and blanks used; most recoveries >75%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No measures of variance or uncertainty but interesting discussion about ecological risks

Overall Quality Determination Medium

Study Citation:	Kotowska, U., Kapelewska, J., Sawczuk, R. (2020). Occurrence, removal, and environmental risk of phthalates in wastewaters, landfill leachates, and groundwater in Poland. Environmental Pollution 267:115643.
HERO ID:	6958938

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples were from WWTPs and landfills located in 11 cities (Fig 1). Groundwater was collected from piezometers. Wastewater was from sampler at inlet to plant and pipe draining the treated water. Landfill leachate and groundwater were obtained from drainage wells, open drainage pools, and piezometers. Samples were gathered through glass samplers, filtered, and stored in freezer at -18C.
	Metric 2:	Analytical Methodology	High	All pertinent information was reported (e.g., SPME for extraction, GC-MS for analysis, recoveries, LODs/LOQs in Tables 3 and 4).
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in effluent wastewater, landfill leachate, and groundwater.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Poland.
	Metric 5:	Currency	Medium	Samples were collected during May 2010 - May 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	72 wastewater (36 influent and 36 effluent), 22 leachate, and 16 groundwater samples were collected from 11 Polish cities. Samples were collected once per month or once every two months for 2 years. No replicates were reported.
	Metric 7:	Exposure Scenario	High	Contaminants measured in influent and effluent wastewater from 11 different-sized Polish, municipal WWTPs, as well as landfill leachates and groundwater from three MSW landfills are relevant when discharged into surface waters to aquatic organisms.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 5 and 6 provide range, std, mean, median, and DF. No raw data were provided.
	Metric 9:	Quality Assurance	High	QA/QC was fully described. Recoveries were acceptable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Limitations and uncertainties were not discussed.
Overall Quality Determination			**High**	

Study Citation:	Lee, Y. S., Lee, S., Lim, J. E., Moon, H. B. (2019). Occurrence and emission of phthalates and non-phthalate plasticizers in sludge from wastewater treatment plants in Korea. Science of the Total Environment 692:354-360.
HERO ID:	6959335

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most sampling information provided, such as site information, storage conditions and methods. However, missing the equipment used to collected the sludge.
	Metric 2:	Analytical Methodology	High	Analytical methods, instrument, calibration reported. LOQ reported in table S4.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental sample.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	South Korea
	Metric 5:	Currency	Medium	Samples collected in 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	40 samples. No replicates.
	Metric 7:	Exposure Scenario	High	Measuring phthalates in sludge from WWTP.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not provided. Summary statistics (mean, range) provided in table 1.
	Metric 9:	Quality Assurance	High	Procedural blanks and recovered detailed. All recoveries, except DMP above 70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There is comparison of different types of WTTP. Gaps and limitations not reported.

Overall Quality Determination High

Study Citation:	Dong, C. D., Wang, M. H., Chen, C. F., Shih, Y. J., Chang, K. L., Lee, S. H., Lin, Y. L., Wu, C. H., Chen, C. W. (2020). Detecting phthalate esters in sludge particulates from wastewater treatment plants. Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering 55(10):1233-1240.
HERO ID:	7976582

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology of dehydrated sludge samples and operating conditions of seven WWTPs were described thoroughly. The study included the sample collection equipment, procedures, and storage conditions.
	Metric 2:	Analytical Methodology	High	The analytical methodology was described in detail, including the extraction method, analytical instrumentation, calibration, and analytical method. Detection limits relative percent differences, and recoveries were reported in Table 3.
	Metric 3:	Biomarker Selection	N/A	Parent chemical was measured in sludge samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study samples were collected at WWTPs in southern Taiwan.
	Metric 5:	Currency	Low	The study did not provide a sample collection date, the publication date was 2020.
	Metric 6:	Spatial and Temporal Variability	Low	1 kg of sludge was collected at each of the 7 WWTPs. No replicate samples were reported. It appears that samples were collected at one time, which does not account for spatial and temporal variability within the WWTP.
	Metric 7:	Exposure Scenario	Medium	The study provides concentrations in the wastewater sludge which is indicative of contamination in the environment that people could be exposed to prior to accumulation at the WWTP. However, more discussion could have been provided about sources of exposure. There was no use of exposure controls.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	The individual data points for the sample collected at each WWTP was reported in Table 4. There are not summary statistics reported.
	Metric 9:	Quality Assurance	High	Quality assurance and quality control were discussed including instrument calibration, detection limits, blanks, sample duplicates, and matrix spike standards.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variation of concentrations across the different WWTPs were discussed on p. 1236 and the concentrations in this study were compared across other studies. Limitations and uncertainties were not reported.
Overall Quality Determination			**Medium**	

Study Citation:	Wang, M. H., Chen, C. F., Albarico, F. P. J.,B, Chen, C. W., Dong, C. D. (2022). Occurrence and distribution of phthalate esters and microplastics in wastewater treatment plants in Taiwan and their toxicological risks. Chemosphere 307(Pt 2):135857.
HERO ID:	11784627

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	The study described the sources that the sludge samples were taken from but did not report sample equipment, sampling procedures, or sample storage conditions.
	Metric 2:	Analytical Methodology	High	Analytical methodology was thoroughly described, including the instrument calibration, analytical instrumentation, and extraction method, recovery samples, relative percent difference, and detection limits. MDLs are reported in Tables 1 and S4.
	Metric 3:	Biomarker Selection	N/A	Parent chemical was measured in sludge samples from wastewater treatment plants.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study area was western Taiwan.
	Metric 5:	Currency	Low	The study did not provide a sample collection date, the study was published in 2022.
	Metric 6:	Spatial and Temporal Variability	Low	The study collected between 3-8 samples for each type of treatment plant, locations are reported in Figure 1. No replicate samples were mentioned. Timeline of sample collection was also not reported.
	Metric 7:	Exposure Scenario	High	The authors discuss the potential for human exposure the chemical in soil after application of the sludge samples from WWTPs.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	The concentration of the sludge sample from each plant (n=17) and the MDL were reported in Table 1.
	Metric 9:	Quality Assurance	High	The study thoroughly describes QC measures including the use of a calibration curve, procedural blanks, check standard, sample duplicates, and certified reference materials. The ranges of recoveries and relative percent difference of sample duplicates are reported in text.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability in concentrations within each WWTP type were shown in box plots in Figure 4. They also performed a principal component analysis to explain the variability in concentrations based on the sludge basic properties in section 3.4. Limitations and uncertainties were not discussed.
Overall Quality Determination			**Medium**	

Study Citation:	Schulz, S., Wagner, S., Gerbig, S., Waechter, H., Sielaff, D., Bohn, D., Spengler, B. (2015). DESI MS based screening method for phthalates in consumer goods. Analyst 140(10):3484-3491.
HERO ID:	2914652

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Medium	Samples were provided by German state laboratories. No information was provided on the sample selection process.
	Metric 2:	Analytical Methodology	High	Evaluation of the performance of desorption electrospray ionization (DESI) mass spectrometry (MS) method. All pertinent info is provided, and results are compared to validated methods (GC FID, GC MS, HPLC DAD).
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	Data represent consumer exposure. Products included false teeth, various toys and catering glove. No information was provided on where they were purchased or country of origin.
	Metric 5:	Sample Size and Variability	High	11 real world samples were tested for product concentrations in triplicate.
	Metric 6:	Temporality	High	Sample purchase date was not provided. Paper published in 2015.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	No raw data provided. Summary stats include weight fraction % and variation.
	Metric 8:	Quality Assurance	Medium	QA/QC measured applied and issues explained Calibration curves were obtained from matrix-matched reference materials with coefficients of determination >0.985.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Intra- and inter-day reproducibility was measured. Measurement error was calculated. Differences in results with DESI MS method and confirmatory methods was explained.

Overall Quality Determination High

Study Citation:	Nilsson, N. H., Malmgren-Hansen, B., Bernth, N., Pedersen, E., Pommer, K. (2006). Survey and health assessment of chemicals substances in sex toys.
HERO ID:	6302197

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Sampling methodology is clearly described including the background for collecting each type of sample.
	Metric 2:	Analytical Methodology	High	The analytical methodology and the limit of detection is reported in the document.
	Metric 3:	Biomarker Selection	N/A	The parent chemical is measured in the consumer product.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	The study tests the content and migration of the chemical in adult toys.
	Metric 5:	Sample Size and Variability	High	The study measures concentrations in 15 samples.
	Metric 6:	Temporality	Low	Samples collected before 2006
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	High	The study reports raw data for each adult toy and also weight fractions.
	Metric 8:	Quality Assurance	High	Quality assurance and quality control is reported and used across the study.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	Limitations are reported in terms of the available product information in terms of use and origin. Variability is not clearly reported.

Overall Quality Determination High

Study Citation:	Danish EPA, (2020). Survey of unwanted additives in PVC products imported over the internet.
HERO ID:	11374030

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Products were selected according to various priority criteria including those that are commonly made from PVC (hard and soft) and are available to purchase by Danish consumers from frequently used foreign websites. Products also were required to contain chlorine.
	Metric 2:	Analytical Methodology	Medium	Danish Technological Institute's accredited Method OA-500 was used for phthalates, as detailed provided in Appendix 4. The method is GC-MS and is based on DS/ISO 16181. The detection limit is provided. Expanded analytic uncertainty (k=2): 35% RSD. Recovery values were not provided.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	Data represent consumer exposure scenario for multiple age groups. Products analyzed include children toys, pet toys, personal belongings (bags), hobby materials (tape, cutting board), mats, fitness equipment, footware, and rainwear. While products were purchased in the EU, they were all purchased on-line and all produced in China or other foreign countries. Pictures of products are provided.
	Metric 5:	Sample Size and Variability	High	Concentrations/weight fraction measurement for 41 soft PVC consumer product samples. Duplicate determination of the sample has been performed.
	Metric 6:	Temporality	High	Specific purchase data was not provided, but project was from May until December 2019.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Individual results reported for each sample/product, but raw data was not provided, and results were not summarized across product categories.
	Metric 8:	Quality Assurance	Low	Full evaluation of QA/QC was not provided.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	Analytic uncertainty discussed. Full evaluation of variability and uncertainty was not provided.

Overall Quality Determination Medium

Study Citation:	Lin, W. T., Chen, C. Y., Lee, C. C., Chen, C. C., Lo, S. C. (2021). Air phthalate emitted from flooring building material by the micro-chamber method: Two-stage emission evaluation and comparison. Toxics 9(9):216-216.
HERO ID:	9384670

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	High	Six different flooring materials were tested, representing green building material and non-green building material labels in Taiwan. All pertinent details (e.g. temperature and humidity) of the micro-chamber method according to ISO 16000-25 were provided.
	Metric 2:	Analytical Methodology	Medium	GC/MS analysis method was used according to ISO 16000-33. The detection limit was 100 ppb and calibration curve was established. LC/MSMS analysis method was also used, and the detection limit was 2 ppb.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Testing was done in two stages representing normal temperatures and high temperatures. Blank experiment was done before the floor material tests.
	Metric 5:	Sample Size and Variability	Low	Six different flooring materials were tested. Replicate tests were not performed.
	Metric 6:	Temporality	High	The publication date is 2021.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Low	One result per stage of the experiment is reported in Table 5. There are no summary statistics.
	Metric 8:	Quality Assurance	Low	QA measures were described such as establishment of calibration curve and blank experiment. The recoveries were not reported.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	The study captures variability in different types of green and non-green labeled flooring materials. However, uncertainties or limitations were not adequately discussed.

Overall Quality Determination Medium

Study Citation:	U.S. EPA, U.,.S.G.S. and National Water Quality Monitoring Council (2022). Di-isononyl phthalate(DINP) (CAS RN: 26761-40-0 and 68515-49-1): WQP Output (NWIS, STEWARDS {\&} STORET), Site data {\&} sample results (physical/chemical metadata).
HERO ID:	10709409

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.
	Metric 2:	Analytical Methodology	High	Description of the methods reported in column BQ and detection limit in column BY. A detection limit was not provided for all samples.
Domain 2: Representative				
	Metric 3:	Geographic Area	High	Column X reports the location identifier code. All samples are from the U.S. The information of each code can be found at https://waterdata.usgs.gov/nwis/si
	Metric 4:	Temporal	High	Data was collected from 1988 to 2022. The date is reported in column G.
	Metric 5:	Exposure Scenario	High	Media are reported in column E; location and time are also reported. 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). Mono-isononyl phthalate (MiNP, MNP) (CAS RN: 106610-61-1): NHANES Biomonitoring Data (Urine).
HERO ID:	10709445

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	High	Data reported from 1999 to 2018.
	Metric 5:	Exposure Scenario	Medium	Exposure to DINP 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:	Centers for Disease Control and Prevention : CDC (2022). Mono-(carboxyisooctyl) phthalate (MCOP, MCiOP) (CAS RN: 898544-09-7): NHANES Biomonitoring Data (Urine).
HERO ID:	10709446

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	High	Data reported from 2005 to 2018.
	Metric 5:	Exposure Scenario	Medium	Exposure to DINP 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:	Centers for Disease Control and Prevention : CDC (2022). Mono-oxoisononyl phthalate (MONP, 7 oxo-MMeOp, MOiNP, 7-oxo-MiNP, oxo-MiNP) (CAS RN: 297182-83-3): NHANES Biomonitoring Data (Urine).
HERO ID:	10709540

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	High	Data reported from 2015 to 2018.
	Metric 5:	Exposure Scenario	Medium	Exposure to DINP 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:	ECJRC, (2003). European Union risk assessment report, vol 36: 1,2-Benzenedicarboxylic acid, Di-C9-11-Branched alkyl esters, C10-Rich and Di-"isodecyl"phthalate (DIDP).
HERO ID:	1588746

Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment uses technical approaches generally accepted by the scientific community. Assumptions and modeling inputs and equations generally presented.
Domain 2: Representative	Metric 2:	Exposure Scenario	Medium	Exposure activity assessed likely represents the scenarios of interest, with study limitations in exposure estimations not directly discussed, however assumptions in calculations generally presented.
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	Study characterization of variability within the population/media concentration data lacking for most presented exposures; key assumptions in calculations presented.

Overall Quality Determination Medium

Study Citation:	CHAP, (2014). Chronic Hazard Advisory Panel on phthalates and phthalate alternatives (with appendices).
HERO ID:	2439960

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Report by the Chronic Hazard Advisory Panel on Phthalates and Phthalate Alternative. Systematic review process reported in page 11.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	Worldwide HBM data from 1988 to 2007 reported.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	High	References available.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	High	Variability and uncertainty reported in section 4.1.

Overall Quality Determination High

Study Citation:	Li, R., Liang, J., Gong, Z., Zhang, N., Duan, H. (2017). Occurrence, spatial distribution, historical trend and ecological risk of phthalate esters in the Jiulong River, Southeast China. Science of the Total Environment 580(Elsevier):388-397.
HERO ID:	3483279

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	Scientifically sound methodology.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	Data closely represent exposure scenarios of interest.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	High	References are available for all reported data.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	Medium	Characterized variability, limited description of uncertainties.

Overall Quality Determination High

Study Citation:	EC/HC, (2017). Draft screening assessment: Phthalate substance grouping.
HERO ID:	5353181

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	Medium	Most of the techniques and assumptions cited references, with models providing equations and inputs.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to phthalates in water bodies from Canada, consumer products, and biomonitoring daily intakes.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	Medium	References are available for most reported data, inputs, and defaults; 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	Variability (arithmetic mean, percentiles) and uncertainty were characterized in detail throughout the report.

Overall Quality Determination High

Study Citation:	Danish EPA, (2009). Survey and health assessment of the exposure of 2 year-olds to chemical substances in consumer products.
HERO ID:	6302975

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Methodology	High	The study reports the methodology for selecting the consumer products, laboratory methods for chemical analysis, migration analysis, and calculation of exposure.
Domain 2: Representative				
	Metric 2:	Exposure Scenario	High	This study is a health assessment to evaluate the exposure of 2-year-olds to selective chemicals in consumer products including toys and clothing.
Domain 3: Accessibility/Clarity				
	Metric 3:	Documentation of References	High	The references are available for all the reported data.
Domain 4: Variability and Uncertainty				
	Metric 4:	Variability and Uncertainty	High	The study characterizes the variability of chemicals and exposure in a range of consumer products. The limitations of the study are reported in the conclusion section page 260.

Overall Quality Determination High

Study Citation:	Danish EPA, (2012). Survey No. 117: Exposure of pregnant consumers to suspected endocrine disruptors.
HERO ID:	10622425

Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Methodology	High	The assessment reports the methodology to assess concentrations in selected consumer products and the methods to evaluate the exposure.
Domain 2: Representative	Metric 2:	Exposure Scenario	High	This health assessment evaluates the exposure of pregnant women to a selected chemicals by the use of consumer products.
Domain 3: Accessibility/Clarity	Metric 3:	Documentation of References	High	References are available for all reported data, inputs, and defaults.
Domain 4: Variability and Uncertainty	Metric 4:	Variability and Uncertainty	Medium	Variability of concentrations is reported for selected consumer products, but the results do not report statistical variability. Some limitations are reported in the conclusion section.

Overall Quality Determination High

Study Citation:	Quintana-Belmares, R. O., Krais, A. M., Esfahani, B. K., Rosas-Pérez, I., Mucs, D., López-Marure, R., Bergman, Å., Alfaro-Moreno, E. (2018). Phthalate esters on urban airborne particles: Levels in PM10 and PM2.5 from Mexico City and theoretical assessment of lung exposure. Environmental Research 161:439-445.
HERO ID:	4167514

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	Monthly calculations and lung exposure assessment equations reported. Modeling approach seems basically sound; all results can be viewed in the supplemental spreadsheet.
	Metric 2:	Model Evaluation	Medium	Lung exposure assessment equation comes from peer review. Monthly exposure to phthalates via particulate matter does not appear to be a scenario that has much previous study behind it.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	This is a recent study, though based on data collected in Mexico more than 5 years ago. However, it is uncertain whether the findings can be generalized, as the exposure is calculated month-to-month for the specific 7-month period of the samplings, and there is a high degree of temporal variability over that period.
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	The study and supplemental spreadsheet file contains all the models and calculations.
	Metric 5:	Model Inputs and Defaults	High	Values used to calculate respiratory flow rates and hourly PM data are cited from previous peer-reviewed sources.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	There is discussion of variability in the monitoring data from which the exposures are calculated, including different months, gender and ages. There is no discussion of limitations.

Overall Quality Determination High

Study Citation:	Kim, J. H., Kim, D., Moon, S. M., Yang, E. J. (2020). Associations of lifestyle factors with phthalate metabolites, bisphenol A, parabens, and triclosan concentrations in breast milk of Korean mothers. Chemosphere 249:126149.
HERO ID:	6815879

Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Mathematical Equations	High	Widely accepted daily intake equation, with reference citations from previous studies (Fromme et al. 2010, Kim et al. 2015)
	Metric 2:	Model Evaluation	Medium	Model has had limited evaluation with monitoring data.
Domain 2: Representative				
	Metric 3:	Exposure Scenario	Medium	Study was conducted in 2018, sampling phthalate metabolites in breast milk from mothers in South Korea
Domain 3: Accessibility/Clarity				
	Metric 4:	Model and Model Documentation Availability	High	Sufficient documentation in data sources and companion references.
	Metric 5:	Model Inputs and Defaults	Medium	Most model inputs are identified, referenced and described. Breast milk intake was measured but not reported.
Domain 4: Variability and Uncertainty				
	Metric 6:	Variability and Uncertainty	Medium	Concentration input data include mean and standard deviation (Table 2). Some uncertainties and data limitations are discussed.

Overall Quality Determination Medium

Table 61: Glossary of Select Terms for Data Evaluation

Term	Definition
CI	Confidence Interval
CLIA	Clinical Laboratory Improvement Amendments
DBP	Dibutyl phthalate
DEHP	Di-ethylhexyl phthalate
DESI MS	Desorption Electrospray Ionization mass spectrometry
DF	Detection Frequency
DIBP	Di-isobutyl phthalate
DINP	Diisononyl Phthalate
DMP	Dimethyl phthalate
DPE	Dialkyl phthalate ester
DS/ISO	Danish Standards / International Organization for Standardization
ESB	Environmental Specimen Bank
EU	European Union
GC FID	Gas Chromatography with Flame-Ionization Detection
GC MS, GC/MS, GC-MS	Gas Chromatography - Mass Spectrometry
HBM	Human Biomonitoring
HPLC	High-Performance Liquid Chromatography
HPLC DAD	High-performance liquid chromatography with diode-array detection
HPLC-MS/MS	High-Performance Liquid Chromatography Tandem Mass Spectometer
IQR	Interquartile Range
LC/LC- MS/MS	Tandem Liquid Chromatography-Mass Spectrometry
LC-ESI-MS/MS	Liquid Chromatography-Electrospray Ionization- Tandem Mass Spectometer
LC-MS	Liquid Chromatography-Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantification
MCIOP - MCOP	Mono-(carboxyisooctyl) phthalate
MCPP	Mono-(3-carboxypropyl) phthalate
MDL	Method Detection Limit
MHINP	Mono(hydroxyisononyl) phthalate
MiNP	Mono-isononyl phthalate
MN	Minnesota
MO	Missouri
MSW	Municipal Solid Waste
NA	Not Applicable
NELAP	National Environmental Laboratory Accreditation
NHANES	National Health and Nutrition Examination Survey
NIEA	National Institute for Environmental Research

Continued on next page . . .

Table 61 . . . continued from previous page

Term	Definition
OH-MINP	Mono(hydroxyisononyl) phthalate
OQD	Overall Quality Determination
Oxo Minp	Mono-oxoisononyl phthalate
PCB	Polychlorinated biphenyls
PVC	Polyvinyl chloride
PM	Particulate matter/particles
QA/QC	Quality Assurance/Quality Control
QWASI	Quantitative Water, Air, Sediment Interaction
RSD	Relative Standard Deviation
SD	Standard Deviation
SI	Supplemental Information
SPE	Solid Phase Extraction
SPM	Suspended Particulate Matter
STPs	Sewage Treatment Plant
TDIs	Total Daily Intakes
TSCA	Toxic Substances Control Act
US or USA	United States of America
WWT	Waste Water Treatment