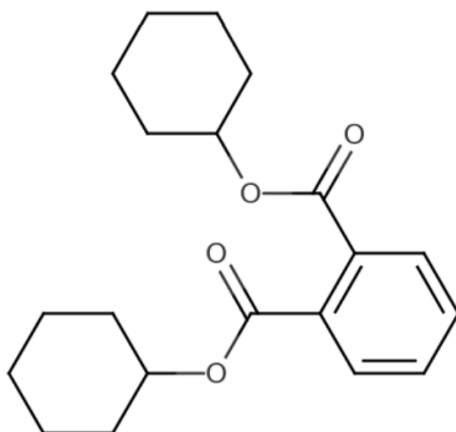

**Data Quality Evaluation Information for
General Population, Consumer, and Environmental Exposure for
Dicyclohexyl Phthalate (DCHP)
(1,2- Benzenedicarboxylic acid, 1,2-dicyclohexyl ester)**

Systematic Review Support Document for the Risk Evaluation

CASRN: 84-61-7



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This supplemental file contains information regarding the data quality evaluation results for data sources that met the PECO screening criteria for the *Consumer and Indoor Dust Exposure Assessment for Dicyclohexyl Phthalate (DCHP)* and the *Environmental Media and General Population and Environmental Exposure for Dicyclohexyl Phthalate (DCHP)*, 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 *Systematic Review Protocol for Dicyclohexyl Phthalate (DCHP)*.

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

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Experimental		
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Database		
Completed Assessment		
Modeling		
673288	Koo, J. W., Parham, F., Kohn, M. C., Masten, S. A., Brock, J. W., Needham, L. L., Portier, C. J. (2002). The association between biomarker-based exposure estimates for phthalates and demographic factors in a human reference population. <i>Environmental Health Perspectives</i> 110(4):405-410.	137

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680285	Fromme, H., Gruber, L., Schlummer, M., Wolz, G., Bohmer, S., Angerer, J., Mayer, R., Liebl, B., Bolte, G. (2007). Intake of phthalates and di(2-ethylhexyl)adipate: Results of the Integrated Exposure Assessment Survey based on duplicate diet samples and biomonitoring data. Environment International 33(8):1012-1020.	139
2501495	Sakhi, A. K., Lillegaard, I. T., Voorspoels, S., Carlsen, M. H., Løken, E. B., Brantsæter, A. L., Haugen, M., Meltzer, H. M., Thomsen, C. (2014). Concentrations of phthalates and bisphenol A in Norwegian foods and beverages and estimated dietary exposure in adults. Environment International 73:259-269.	140
Glossary of Select Terms for Data Evaluation Tables		141

Study Citation:		Vethaak, A. D., Lahr, J., Schrap, S. M., Belfroid, A. C., Rijs, G. B. J., Gerritsen, A., De Boer, J., Bulder, A. S., Grinwis, G. C. M., Kuiper, R. V., Legler, J., Murk, T. A. J., Peijnenburg, W., Verhaar, H. J. M., De Voogt, P. (2005). An integrated assessment of estrogenic contamination and biological effects in the aquatic environment of The Netherlands. Chemosphere 59(4):511-524.		
HERO ID:		70054		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology	Medium	map and sampling details included
	Metric 2:	Analytical Methodology	Low	"An extensive description of all the methods and materials used in our study is provided by Vethaak et al. (2002, in press). Vethaak, A.D., Schrap, M., de Voogt, P. (Eds.), in press."Estrogens and xeno-estrogens in the aquatic environment:an integrated approach for field monitoring and effectassessment. SETAC Technical Publications Series. SETAC Press, Pensacola.
	Metric 3:	Biomarker Selection	N/A	the study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness	Metric 4:	Geographic Area	High	Netherlands
	Metric 5:	Currency	Low	1999
	Metric 6:	Spatial and Temporal Variability	Critically Deficient	sample size not reported, might be in the Vethaak 2002 paper
	Metric 7:	Exposure Scenario	Medium	municipal WW, effluent, industrial WW, rainwater, surface water, suspended water, sediment, bream muscle, flounder muscle
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	range and median provided
	Metric 9:	Quality Assurance	Medium	quality not discussed, but no obvious concerns
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	variability and uncertainty not discussed, but no obvious concerns
Overall Quality Determination			Uninformative	

Study Citation:		Rudel, R. A., Brody, J. G., Spengler, J. D., Vallarino, J., Geno, P. W., Sun, G., Yau, A. (2001). Identification of selected hormonally active agents and animal mammary carcinogens in commercial and residential air and dust samples. Journal of the Air and Waste Management Association (1990-1992) 51(4):499-513.		
HERO ID:		198234		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	No major deficiencies identified.
	Metric 2:	Analytical Methodology	High	No major methodological deficiencies identified.
	Metric 3:	Biomarker Selection	N/A	No biomarker data identified.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Massachusetts
	Metric 5:	Currency	Low	Timing of sample collection for monitoring data is not reported, discussed, or referenced however publication year, 2001, is used as surrogate for sampling year.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates and <10 samples
	Metric 7:	Exposure Scenario	High	No major deficiencies identified.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data provided
	Metric 9:	Quality Assurance	High	No major deficiencies identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No gaps nor limitations reported
Overall Quality Determination			High	

Study Citation:		Zeng, F., Lin, Y., Cui, K., Wen, J., Ma, Y., Chen, H., Zhu, F., Ma, Z., Zeng, Z. (2010). Atmospheric deposition of phthalate esters in a subtropical city. Atmospheric Environment 44(6):834-840.		
HERO ID:		388076		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling equipment and methods are described in excellent detail and are scientifically sound.
	Metric 2:	Analytical Methodology	Medium	Analytical instrumentation and methods are described in excellent detail and are scientifically sound. However, instrumental detection limit for the chemical of interest is not reported, but rather a range of limits for all analytes.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical of interest in an environmental medium.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	2007-2008
	Metric 6:	Spatial and Temporal Variability	Medium	Three sites were sampled for air twice weekly for a year. Unclear if there are replicates.
	Metric 7:	Exposure Scenario	High	Air samples were taken from locations that were relatively isolated from traffic and other ground-level disturbances. Each study site was characterized as urban or suburban within a subtropical city.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are not reported; summary statistics include the minimum, maximum, median, and mean concentrations.
	Metric 9:	Quality Assurance	High	QA/QC methods included use of procedural blanks and surrogate standards. Recoveries for analytes and for surrogates were within acceptable range, and concentration determinations were adjusted to correct for recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Relative standard deviation for all analytes are reported and temporal variability is evaluated at the bulk level. Uncertainty in bulk deposition measurements related to sampling methods is acknowledged. Variation in season analyzed.
Overall Quality Determination			High	

Study Citation:		Peters, R. J. B., Beeltje, H., van Delft, R. J. (2008). Xeno-estrogenic compounds in precipitation. Journal of Environmental Monitoring 10(6):760-769.		
HERO ID:		510316		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology is sufficiently detailed.
	Metric 2:	Analytical Methodology	High	LOD is present. Analytical methodology is sufficiently detailed.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The Netherlands.
	Metric 5:	Currency	Low	Sampling from February-March 2003.
	Metric 6:	Spatial and Temporal Variability	Low	50 samples were taken across 50 sampling sites.
	Metric 7:	Exposure Scenario	Medium	Study site zoning was not described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data was not provided but summary statistics are detailed.
	Metric 9:	Quality Assurance	High	No quality control issues were identified or any identified issues were minor and adequately addressed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Occurrence of some pollutants were low but this is discussed in the limitations.
Overall Quality Determination			Medium	

Study Citation:		Hoppin, J. A., Brock, J. W., Davis, B. J., Baird, D. D. (2002). Reproducibility of urinary phthalate metabolites in first morning urine samples. Environmental Health Perspectives 110(5):515-518.		
HERO ID:		673280		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Medium. Sampling methodology reported sampling procedures, sampling equipment and sample storage conditions for first morning urine samples. Insufficient information regarding duration of sample storage prior to analysis.
	Metric 2:	Analytical Methodology	Medium	Medium. Analytic methodology described in terms of extraction, analytic instrumentation, instrument calibration, limits of detection and matrix adjustment (creatinine) method. Insufficient information regarding recoveries.
	Metric 3:	Biomarker Selection	High	High. Metabolite of parent.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High. Samples provided by study participants residing in Washington, D.C.
	Metric 5:	Currency	Low	Low. Sampling conducted 1996-1997.
	Metric 6:	Spatial and Temporal Variability	Medium	Medium. Two consecutive first-morning urines collected from each of 46 African American participants. Participants randomly selected as representative sample of low to high income strata of study population. Authors acknowledged lack of data regarding temporal variability.
	Metric 7:	Exposure Scenario	Medium	Medium. Exposure sources for study participants not discussed. Population demographics described in terms of race, age and range of income (low to high income strata).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium. Summary statistics for urinary metabolite concentration results presented in terms of description of data (location, population, year of sampling), concentration range, number of samples, frequency of detection, measure of variation (standard deviation), and measure of central tendency (mean, median). Outliers were not removed from data set to obtain measures of variability. Insufficient information regarding raw data.
	Metric 9:	Quality Assurance	Medium	Medium. Quality assurance parameters described in terms of method blanks, batch-specific quality assurance samples from pooled first morning void samples of women of similar ages, and creatinine levels. Samples described as not meeting lab quality assurance criteria excluded (mEP measures on 11 subjects and mINP in one sample).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Medium. Between- and within-subject variability indicated through intra-class correlation coefficients. Between-subject variability noted as greater than within-subject variability. Summary variability statistics reported. Authors discussed limitations of lack of data regarding temporal variability.
Overall Quality Determination			Medium	

Study Citation:		Silva, M. J., Reidy, J. A., Herbert, A. R., Preau, J. L., Jr, Needham, L. L., Calafat, A. M. (2004). Detection of phthalate metabolites in human amniotic fluid. Bulletin of Environmental Contamination and Toxicology 72(6):1226-1231.		
HERO ID:		673529		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology	Low	Low. Sampling methodology only briefly discussed for amniotic fluid samples reported as taken during routine amniocentesis and utilizing only residual specimens for analysis. Insufficient information regarding sampling equipment, sample storage conditions and duration.
	Metric 2:	Analytical Methodology	Medium	Medium. Analytic methodology described in terms of extraction, analytical instrumentation, calibration, chemical-specific limit of detection (LOD). Insufficient information regarding recoveries.
	Metric 3:	Biomarker Selection	Low	Low. Measured metabolites not specific for parent chemical of interest.
Domain 2: Representativeness	Metric 4:	Geographic Area	Critically Deficient	Unacceptable. Geographic location of participants providing samples not reported, discussed, or referenced.
	Metric 5:	Currency	Low	Low. Dates of sample collection not reported. Publication date 2004.
	Metric 6:	Spatial and Temporal Variability	Low	Low. A total of 54 anonymous donors provided amniotic fluid samples for the current study. Insufficient information regarding location and dates of sample collection.
	Metric 7:	Exposure Scenario	Low	Low. Participant demographic information unavailable to researchers and not reported. Potential sources of exposure discussed
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	Medium. Statistical summary measures of number of samples, minimum and maximum concentrations, median and percentiles (10th, 25th, 75th, 90th and 95th). Insufficient information regarding description of data in terms of location, dates of sampling and raw data.
	Metric 9:	Quality Assurance	Medium	Medium. Quality control details of quality control materials prepared from spiked human urine, reagent blanks and standards reported. Insufficient information regarding recoveries and authors noted potential for DEHP contamination of samples during collection and storage followed by production of mEHP metabolites by lipase enzyme activity in the amniotic fluid or by hydrolysis during sample work-up.
Domain 4: Variability and Uncertainty	Metric 10:	Variability and Uncertainty	Low	Low. Statistical summary measures of variability reported. Uncertainty with regards to potential DEHP contamination of collection and storage materials. Discussion of limitations limited to acknowledgement of potential for DEHP contamination.
Overall Quality Determination			Uninformative	

Study Citation:		Lin, Z. P., Ikonomou, M. G., Jing, H., Mackintosh, C., Gobas, F. A. (2003). Determination of phthalate ester congeners and mixtures by LC/ESI-MS in sediments and biota of an urbanized marine inlet. Environmental Science & Technology 37(10):2100-2108.		
HERO ID:		680053		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Surficial sediments; handling described; fish seine netted and frozen, muscle dissected and homogenized; sample extraction described.
	Metric 2:	Analytical Methodology	High	Reversed-phase liquid chromatography/electrospray ionization mass spectrometry (LC/ESI-MS), described in detail, formed molecular adduct ions with sodium; compared with GC/MS.
	Metric 3:	Biomarker Selection	High	Parent chemical concentrations in striped seaperch muscle.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Vancouver Canada; False Creek.
	Metric 5:	Currency	Low	Before 2003.
	Metric 6:	Spatial and Temporal Variability	Low	Four independent sediment samples from each of 4 different locations; 3 striped bass from each of 3 sampling stations.
	Metric 7:	Exposure Scenario	High	Fish muscle concentrations - relevant to human and ecological exposure assessments.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Bar graphs of mean and 1 standard deviation by chemical and by sampling location.
	Metric 9:	Quality Assurance	High	Doubly distilled solvents; lab standards, 5-point calibration, criteria for quantitation; 2 procedural blanks per 4 real samples and 1 PE spiked sample; % recovery and precision reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Extensive analysis of variation and uncertainty in analytic methods; moderate consideration of environmental variation and uncertainty.
Overall Quality Determination			High	

Study Citation:		Tsumura, Y., Ishimitsu, S., Saito, I., Sakai, H., Kobayashi, Y., Tonogai, Y. (2001). Eleven phthalate esters and di(2-ethylhexyl) adipate in one-week duplicate diet samples obtained from hospitals and their estimated daily intake. Food Additives and Contaminants 18(5):449-460.		
HERO ID:		680169		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Food samples were obtained in store or frozen from hospitals. All important details, such as storage conditions and homogenization equipment, were reported with sufficient detail and were scientifically sound.
	Metric 2:	Analytical Methodology	High	Phthalates in homogenized food samples were determined using GC/MS, and all important details of instrumentation and methodology were reported, including detection limits.
	Metric 3:	Biomarker Selection	N/A	This study was testing for the parent chemical of interest in environmental media (food).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	This study analyzed samples of foodstuffs available in Osaka, Japan, and duplicate diet samples from hospitals in Osaka, Aichi, and Niigata, Japan.
	Metric 5:	Currency	Low	Duplicate diet samples were collected in October or December 1999; date of collection of foodstuffs samples was not specified, but can be inferred to have similar timing. The study was published in 2001.
	Metric 6:	Spatial and Temporal Variability	Medium	Four types of foodstuff samples and one-week duplicate diet samples were analyzed in this study. Use of replicates was not reported.
	Metric 7:	Exposure Scenario	High	The foodstuffs and duplicate diets were obtained the same way a consumer would obtain them and represent highly relevant scenarios of exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are not reported; each datum is the average of three trials.
	Metric 9:	Quality Assurance	High	QA/QC methods included performing each analysis in triplicate, use of blanks, and determination of recoveries. All recoveries were within acceptable ranges.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Quantitative characterization of variability is absent. Qualitative characterization of variability by food source is discussed. The only limitation/source of uncertainty discussed is the inherent difference between hospital meals and food in the general population as a representation of phthalate sources.
Overall Quality Determination			High	

Study Citation:		Fromme, H., Gruber, L., Schlummer, M., Wolz, G., Bohmer, S., Angerer, J., Mayer, R., Liebl, B., Bolte, G. (2007). Intake of phthalates and di(2-ethylhexyl)adipate: Results of the Integrated Exposure Assessment Survey based on duplicate diet samples and biomonitoring data. Environment International 33(8):1012-1020.		
HERO ID:		680285		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Study recruited 50 persons among employees of INES and relatives near Munich (possibly biased sample). Required consumption of "normal" diet. Participants trained to collect a duplicate diet daily (7 days) for chemical analyses.
	Metric 2:	Analytical Methodology	Medium	PLE and GC/MS, LC/MS/MS, and LC-MS in SRM mode. Confidence might be higher or lower depending on analytic methods paper submitted for publication by Gruber et al. in 2007.
	Metric 3:	Biomarker Selection	N/A	HERO 198184 reports urinalysis (biomarkers of exposure) for same population.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany.
	Metric 5:	Currency	Medium	2005
	Metric 6:	Spatial and Temporal Variability	High	50 German adults (27 female 23 male) from city, suburban, and rural areas in or near Munich; participants collected daily duplicate diets over 7 consecutive days for a total of 50 x 7 = 350 diet samples.
	Metric 7:	Exposure Scenario	High	Phthalates in diet and amount consumed.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Concentration or amount in daily diet not reported, and DCH intake not calculated because only 24/350 diet samples were above LOD.
	Metric 9:	Quality Assurance	Medium	Replicate samples of homogenized food for one day, triplicate aliquots, LODs reported. QA not discussed in current report.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Relative contribution of measurements to uncertainty and variation in calculated DCH intakes not discussed.
Overall Quality Determination			Medium	

Study Citation:		Zeng, F., Cui, K., Xie, Z., Wu, L., Liu, M., Sun, G., Lin, Y., Luo, D., Zeng, Z. (2008). Phthalate esters (PAEs): Emerging organic contaminants in agricultural soils in peri-urban areas around Guangzhou, China. Environmental Pollution 156(2):425-434.		
HERO ID:		680472		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results.
	Metric 2:	Analytical Methodology	Low	Analytical instrumentation and methods are described in sufficient detail, but limits of detection are only provided as a range for all analytes, not just the chemical of interest.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical of interest in an environmental medium.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	2006
	Metric 6:	Spatial and Temporal Variability	Medium	Single soil samples were taken from 40 sites across 5 districts (n = 4 or greater for each district). No replicates were collected.
	Metric 7:	Exposure Scenario	High	Soil locations from which samples were collected are very well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are not reported; summary statistics include the detection frequency, minimum, maximum, mean, and median concentration for each district.
	Metric 9:	Quality Assurance	High	QA/QC measures included the use of blanks, spike recoveries, surrogate standards, and sample duplicates. Corrections were made based on detectable levels found in procedural blanks, and recoveries were within acceptable ranges.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Relative standard deviation was reported as a range for all analytes, spatial variation between districts is discussed in depth, and there is some discussion of uncertainty.
Overall Quality Determination			Medium	

Study Citation:		Zeng, F., Cui, K., Xie, Z., Wu, L., Luo, D., Chen, L., Lin, Y., Liu, M., Sun, G. (2009). Distribution of phthalate esters in urban soils of subtropical city, Guangzhou, China. Journal of Hazardous Materials 164(2-3):1171-1178.		
HERO ID:		680473		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	All key sampling methods reported
	Metric 2:	Analytical Methodology	High	All 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	Guangzhou, China
	Metric 5:	Currency	Medium	Samples collected in 2005
	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 provided
	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			High	

Study Citation:		Liu, H., Liang, H., Liang, Y., Zhang, D., Wang, C., Cai, H., Shvartsev, S. (2010). Distribution of phthalate esters in alluvial sediment: A case study at JiangHan Plain, Central China. Chemosphere 78(4):382-388.		
HERO ID:		697396		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported
	Metric 2:	Analytical Methodology	Low	Detection limits only reported as a range for all chemicals combined.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in soil and sediment
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	HuBei, China
	Metric 5:	Currency	Medium	Samples collected in 2007 and 2008
	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 provided
	Metric 9:	Quality Assurance	Low	Key QA reported, but recoveries appeared low even after correction. See last paragraph of Section 2.6.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported
Overall Quality Determination			Medium	

Study Citation:		Kasper-Sonnenberg, M., Koch, H. M., Wittsiepe, J., Wilhelm, M. (2012). Levels of phthalate metabolites in urine among mother-child-pairs - Results from the Duisburg birth cohort study, Germany. International Journal of Hygiene and Environmental Health 215(3):373-382.		
HERO ID:		787906		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most key criteria met. Duration of sample storage prior to analysis lacking.
	Metric 2:	Analytical Methodology	Medium	Most key criteria met, analytical methodology referenced, LOQs reported as range.
	Metric 3:	Biomarker Selection	High	Sampling for metabolites specific for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples provided by participants in Duisburg, Germany.
	Metric 5:	Currency	Medium	Sampling conducted 2007-2009.
	Metric 6:	Spatial and Temporal Variability	Medium	Single urine samples provided by n=105 children and n=104 mothers, first-morning urine sampling, non-statistical sampling methods.
	Metric 7:	Exposure Scenario	Medium	Participant characteristics summarized, occupational status unknown, lack of exposure controls.
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 details not reported, however analytic methodology referenced.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Characterization of variability depicted within exposure summary statistics. Some limitations discussed.
Overall Quality Determination			Medium	

Study Citation:		Guo, Y., Wu, Q., Kannan, K. (2011). Phthalate metabolites in urine from China, and implications for human exposures. Environment International 37(5):893-898.		
HERO ID:		787930		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Spot urine samples; stored frozen; sample size reported by location, age, sex; "subpopulations" listed.
	Metric 2:	Analytical Methodology	High	Described in detail for each urinary metabolite. Deconjugation then SPE. ESI-MS/MS. LOQ reported; C13-radiolabeled standards used.
	Metric 3:	Biomarker Selection	Medium	MCHP in urine; not normalized to creatine by individual.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China; cities of Shanghai, Qiqihaer, and Guangzhou.
	Metric 5:	Currency	Medium	2010, May through July.
	Metric 6:	Spatial and Temporal Variability	Medium	Urine spot samples. More than 10 males and 10 females sampled per city; more than 30 individuals aged 20-40 and aged > 40 of each sex included.
	Metric 7:	Exposure Scenario	Medium	Exposure scenario not defined; all sources and routes.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Reported % detected, range, geometric and arithmetic means, and quartiles by sex, city, and age group. Graphically presented 10th and 90th percentiles and individual data points above and below those percentiles.
	Metric 9:	Quality Assurance	High	For each batch of 30 samples, 2 method blanks, spiked blank, 1 pair matrix spiked samples, and duplicates; reported recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Discussion compared metabolites across cities by sex and age group, also across published reports; variance bars by city (Figure 3). High positive skew to data. No discussion of limited sample size.
Overall Quality Determination			Medium	

Study Citation:		Fromme, H., Gruber, L., Seckin, E., Raab, U., Zimmermann, S., Kiranoglu, M., Schlummer, M., Schwegler, U., Smolic, S., Völkel, W. (2011). Phthalates and their metabolites in breast milk - Results from the Bavarian Monitoring of Breast Milk (BAMBI). Environment International 37(4):715-722.		
HERO ID:		787934		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling equipment and methods are described in sufficient detail, although certain aspects (e.g. duration of storage) are missing that are unlikely to have a substantial impact on results.
	Metric 2:	Analytical Methodology	Low	Analytical instrumentation and methods are described in sufficient detail, but LOD for parent diester is missing.
	Metric 3:	Biomarker Selection	N/A	The study is measuring the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany
	Metric 5:	Currency	Medium	Timing was reported as during the study period of the Bavarian Monitoring of Breast Milk (BAMBI) survey without specific years provided; external sources indicate that BAMBI took place 2007-2008.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples of breast milk were collected from 78 mothers (one per mother) at 4 to 8 weeks after delivery. No replicates were collected.
	Metric 7:	Exposure Scenario	High	The exposure scenario of phthalates in breastmilk is highly relevant to nursing infants
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data points are not reported; summary statistics include the minimum, maximum, median, mean, 90th percentile, and 95th percentile of concentrations.
	Metric 9:	Quality Assurance	High	QA/QC measures reported include the use of blanks, references, duplicate or triplicate analyses, and recovery calculations. Only minor issues were identified and subsequently addressed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No measure of variance is provided, but there is qualitative discussion of limitations/uncertainty.
Overall Quality Determination			Medium	

Study Citation:		Guo, Y., Alomirah, H., Cho, H. S., Minh, T. B., Mohd, M. A., Nakata, H., Kannan, K. (2011). Occurrence of phthalate metabolites in human urine from several Asian countries. Environmental Science & Technology 45(7):3138-3144.		
HERO ID:		787935		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sample storage conditions.
	Metric 2:	Analytical Methodology	High	All key analytical methods reported. LOQ reported on lines 96-98 of SI.
	Metric 3:	Biomarker Selection	High	mCHP was the metabolite for DCHP/DCH.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Seven Asian countries were reported - China, India, Japan, Korea, Kuwait, Malaysia, and Vietnam.
	Metric 5:	Currency	Medium	Samples collected in 2010 for all countries except Korea, which were collected during 2006-2007.
	Metric 6:	Spatial and Temporal Variability	Medium	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 measures reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Gaps and limitations characterized. Variance presented with ranges in Table S3.
Overall Quality Determination			High	

Study Citation:		Marcus, M., Christensen, K. Y., Manatunga, A., Rudra, C. B., Brock, J. W., Small, C. M. (2010). Variability of phthalate monoester levels in daily first-morning urine from adult women: A pilot study. Reviews on Environmental Health 25(4):359-368.		
HERO ID:		787937		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The study authors reported sampling methods, participant demographics and sample storage.
	Metric 2:	Analytical Methodology	Medium	The study authors reported analytical methods, instrument and LOD. Recovery samples were not reported.
	Metric 3:	Biomarker Selection	Medium	The biomarkers used were acceptable.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in the United States (New York and Boston).
	Metric 5:	Currency	Low	The participants were recruited between 1990 and 1993.
	Metric 6:	Spatial and Temporal Variability	Low	10 women were studied with no replicate samples.
	Metric 7:	Exposure Scenario	Medium	The data were collected from a monitoring survey and were not linked to a specific source of exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported in the study, but the study authors did report descriptive statistics.
	Metric 9:	Quality Assurance	Low	The study reported some QA/QC including standards and blanks. Some QA was not reported including recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study analyzed variance among and between women, but did not report gaps, limitations, or uncertainties.
Overall Quality Determination			Medium	

Study Citation:		Silva, M. J., Reidy, J. A., Samandar, E., Herbert, A. R., Needham, L. L., Calafat, A. M. (2005). Detection of phthalate metabolites in human saliva. Archives of Toxicology 79(11):647-652.		
HERO ID:		787994		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Some sampling methods not reported
	Metric 2:	Analytical Methodology	Medium	Recovery samples not reported
	Metric 3:	Biomarker Selection	Medium	Acceptable biomarkers
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Low	Sample data collected before 2005
	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	Low	Limited QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported
Overall Quality Determination			Medium	

Study Citation:		Keil, R., Salemm, K., Forrest, B., Neibauer, J., Logsdon, M. (2011). Differential presence of anthropogenic compounds dissolved in the marine waters of Puget Sound, WA and Barkley Sound, BC. Marine Pollution Bulletin 62(11):2404-2411.		
HERO ID:		788135		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Section 2.1; Barkley Sound - water samples collected using bottle; Puget Sound - collected in LDPE cubitainers by volunteers and collected in intertidal zone a beaches; samples filtered; storage conditions not discussed; sampling methodology is brief and incomplete
	Metric 2:	Analytical Methodology	Low	solid phase extraction; GC-MS; detection limits not provided
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Barkley Sound, Vancouver Island, Canada and Puget Sound
	Metric 5:	Currency	Medium	Mar-10
	Metric 6:	Spatial and Temporal Variability	Medium	22 stations in Barkley Sound and 66 locations in Puget Sound, Washington; sampling only between March 23-27. Unclear if there are replicates.
	Metric 7:	Exposure Scenario	High	Puget Sound is highly urbanized watershed; Conversely, BarkleySound has less human influence in the watershed and a lower population density; measured chemicals commonly found in homes in marine waters
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Fig 2 depicts DF and Fig 3 depicts box and whisker plot concentrations. Individual points not reported.
	Metric 9:	Quality Assurance	Medium	No section for QA- but quantities corrected for recoveries relative to recovery standard; analysis blanks were subtracted from all data reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discusses variation between compounds and by location; also discussed variation by human impact. No limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Otake, T., Yoshinaga, J., Yanagisawa, Y. (2004). Exposure to phthalate esters from indoor environment. Journal of Exposure Science & Environmental Epidemiology 14(7):524-528.		
HERO ID:		789515		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is only briefly described. The study cites another published work for a more complete description.
	Metric 2:	Analytical Methodology	Medium	Analytical methodology is only briefly discussed. Sampling precision and recovery was assessed.
	Metric 3:	Biomarker Selection	N/A	Concentrations were measured in indoor air.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in Tokyo, Japan
	Metric 5:	Currency	Low	Sampling was performed in 2000.
	Metric 6:	Spatial and Temporal Variability	Medium	Sampling was performed for 3 consecutive days from a total of 27 homes. The height of sampling from the floor was not specified. It is unclear how many samples per home were collected. Samples for 6 houses were collected in the spring, and samples for the remaining houses were collected in the fall.
	Metric 7:	Exposure Scenario	Medium	The stated study objective was to measure concentrations in contemporary Japanese houses. Only 27 houses or apartments were included, all in one city (Tokyo). All sampled homes belongs to staff affiliated with the researchers' university department. Chemical usage in the homes and characteristics of the homes were not really described.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics are reported, but missing information includes individual data points and the number of samples per home. Box plots were included, but symbols shown in the plots were not defined.
	Metric 9:	Quality Assurance	Medium	The study tested analytical precision and recovery.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Standard deviations were reported. Uncertainties, limitations, and data gaps were not really discussed.
Overall Quality Determination			Medium	

Study Citation:		Suzuki, T., Yaguchi, K., Suzuki, S., Suga, T. (2001). Monitoring of phthalic acid monoesters in river water by solid-phase extraction and GC-MS determination. Environmental Science & Technology 35(18):3757-3763.		
HERO ID:		789731		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	river water samples collected every month from May to February at six sites (Fig 1); collected in 2L glass containers; samples filtered within 8 h
	Metric 2:	Analytical Methodology	High	SPE; GC/MS; MDLs provided in Table 4; recovery samples
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Tama River in Tokyo, Japan
	Metric 5:	Currency	Low	March 1999 to February 2000
	Metric 6:	Spatial and Temporal Variability	High	six sites, collected every month from March to February; 12 times or 12 samples per site equaling 72 samples total
	Metric 7:	Exposure Scenario	High	concentration in water from Tama River which flows through Tokyo metropolitan area and empties into Tokyo Bay; densely populated area; effluent from sewage plants runs into river
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 provides detection times and range per site
	Metric 9:	Quality Assurance	Medium	recoveries measured but not reported for diesters; control samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	discusses major problem of controlling blank values (p.3760); discussed variation by study site
Overall Quality Determination			High	

Study Citation:		Sexton, K., Ryan, A. D., Adgate, J. L., Barr, D. B., Needham, L. L. (2011). Biomarker measurements of concurrent exposure to multiple environmental chemicals and chemical classes in children. Journal of Toxicology and Environmental Health, Part A: Current Issues 74(14):927-942.		
HERO ID:		1249965		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Whole blood samples and urine samples were refrigerated and shipped weekly (packed in freezer packs) to the NationalCenter for Environmental Health, Centers for Disease Control and Prevention, in Atlanta. Some information missing such as equipment used to collect blood and urine samples.
	Metric 2:	Analytical Methodology	Medium	Analytical method and equipment described (liquid chromatography–atmospheric pressure chemical ionization inconjunction with tandem MS), LOD not directly reported, but % of samples <LOD reported in table 1. Calibration missing.
	Metric 3:	Biomarker Selection	High	Metabolite derived from parent chemical (Mono-cyclohexyl phthalate (MCHP)).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Minneapolis, USA
	Metric 5:	Currency	Low	2000-2001
	Metric 6:	Spatial and Temporal Variability	Medium	152 children. There were children with more than one measurement but it is unclear which ones. Timing of urine samples collected not reported.
	Metric 7:	Exposure Scenario	High	Children from disadvantaged, low-income neighborhoods are likelyto be both more exposed to chemical hazards and more susceptible to related adverse health effects.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data. TABLE 1 has Summary of Cotinine (ng/ml), Chromium (μg/ml), Mercury (μg/ml), and Phthalate (ng/ml) Concentrations in Urine Samples From SHIELD Children. Arithmetic mean (SD), P95, and max reported.
	Metric 9:	Quality Assurance	Low	No QA/QC reported, but samples were analyzed at the NationalCenter for Environmental Health, Centers for Disease Control and Prevention. No recoveries or blanks reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Key limitations not reported. Variability (geometric mean) reported in summary of statistics (Table 1). Comparison with CDC data.
Overall Quality Determination			Medium	

Study Citation:		Monsanto, (1983). Investigation of phthalate ester concentrations in a Michigan sewage pond.		
HERO ID:		1316180		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Only briefly described. Missing most sampling information
	Metric 2:	Analytical Methodology	Low	Referenced Environmental Sciences Methods ES-78-M7 and ES-78-M6. LOD not reported
	Metric 3:	Biomarker Selection	N/A	Tested for parent chemical in Daphnia and water lagoon
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Michigan, USA
	Metric 5:	Currency	Low	Published in 1983. No sampling date
	Metric 6:	Spatial and Temporal Variability	Low	3 Daphnia samples, 6 water samples (Table 1), no replicates
	Metric 7:	Exposure Scenario	Low	Data lack key pieces of information so unclear how to characterize the exposure scenario
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual concentrations, limited summary statistics
	Metric 9:	Quality Assurance	Low	Analyzed control samples, did not describe QA/QC techniques
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Did not characterize variance nor discuss uncertainties and study limitations
Overall Quality Determination			Low	

Study Citation:		Fierens, T., Van Holderbeke, M., Willems, H., De Henauw, S., Sioen, I. (2013). Transfer of eight phthalates through the milk chain - A case study. Environment International 51:7-Jan. 1332529		
HERO ID:		1332529		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	sampling sites and methods described in detail
	Metric 2:	Analytical Methodology	High	LOQ in table 2, extraction and equipment described in detail
	Metric 3:	Biomarker Selection	N/A	food - milk
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Belgium
	Metric 5:	Currency	Medium	2010-2011
	Metric 6:	Spatial and Temporal Variability	Medium	n = 1 to 10 for 17 different sample types, no replicates
	Metric 7:	Exposure Scenario	High	milk, butter, cheese
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	min, max, and median included
	Metric 9:	Quality Assurance	Medium	QA briefly described, not reported no obvious concerns
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variability included via different sample types, uncertainty not described, no obvious concerns
Overall Quality Determination			Medium	

Study Citation:		Enke, U., Schleussner, E., Pälme, C., Seyfarth, L., Koch, H. M. (2013). Phthalate exposure in pregnant women and newborns - The urinary metabolite excretion pattern differs distinctly. International Journal of Hygiene and Environmental Health 216(6):735-742.		
HERO ID:		1588876		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Most key criteria met. Duration of sample storage prior to analysis lacking.
	Metric 2:	Analytical Methodology	Medium	Most key criteria met and LOQs reported. Recovery data lacking.
	Metric 3:	Biomarker Selection	High	Metabolites specific for parent chemicals.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Germany.
	Metric 5:	Currency	Medium	Samples collected 2008-2010.
	Metric 6:	Spatial and Temporal Variability	Medium	Total samples (n=47) from women (n=7) during pregnancy and those women (n=9) with newborns providing first urine (n=9) and urine on days 2-5 (n=20); some replicate sampling from pregnant women (3-12 replicates), non-statistical sampling approach.
	Metric 7:	Exposure Scenario	High	Participant demographic characteristics reported and relevant exposure scenario. Children and pregnant women susceptible populations.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Most key criteria met. Lack of raw data. Summary statistics provided.
	Metric 9:	Quality Assurance	Medium	Most key criteria met, QA considerations in sampling equipment reported. Lack of recovery data.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Statistical variability reported within summary measures, discussion of potential reasons for results, however robust discussion of study limitations.
Overall Quality Determination			Medium	

Study Citation:		Zeman, F. A., Boudet, C., Tack, K., Floch Barneaud, A., Brochot, C., Péry, A. R., Oleko, A., Vandentorren, S. (2013). Exposure assessment of phthalates in French pregnant women: Results of the ELFE pilot study. International Journal of Hygiene and Environmental Health 216(3):271-279.		
HERO ID:		1588878		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Urine samples of the mothers were collected in high-densitypolyethylene vials of 250 mL in the delivery room. Several aliquotsof 10 mL were drawn and stored in polypropylene vials at−80C until analysis.
	Metric 2:	Analytical Methodology	High	Analytical methodology is described. The limits of quantification (LQ) of each metabolite are presented in Table 2.
	Metric 3:	Biomarker Selection	High	Urine MCHP
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	Medium	2007
	Metric 6:	Spatial and Temporal Variability	Medium	Sample replicates no reported. 279 urine samples collected.
	Metric 7:	Exposure Scenario	High	Exposure of French pregnant women to a large number of phthalates.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data not reported. Table 2. Urinary phthalate metabolites concentrations (ug/L or ug/g creatinine); Median, Mean SD, Minimum, Maximum, 95th percentile (P95).
	Metric 9:	Quality Assurance	High	The quality controls consisted in: (1) analyzing blanks (solvent and experimental blank); (2) analyzing quality standards (QC standard), prepared at different concentrations; (3) systematicallyadding concentration of QC standards in a control chart toverify the repeatability and the reproducibility.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Table 2 describes the variability of the population. No key limitations reported.
Overall Quality Determination			High	

Study Citation:		Liu, Y.,u, Chen, Z., Shen, J. (2013). Occurrence and Removal Characteristics of Phthalate Esters from Typical Water Sources in Northeast China. Journal of Analytical Methods in Chemistry 2013:419349.		
HERO ID:		1598198		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Described sampling site in detail. Sparse information on sample collection, equipment, and procedures.
	Metric 2:	Analytical Methodology	High	Detection limits were provided as a range from 6 to 30 ng/L. Extraction procedure followed EPA method. Extracted with GC and referenced other publications for more details.
	Metric 3:	Biomarker Selection	N/A	Tested for parent chemicals in water sources
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	2008 and 2011
	Metric 6:	Spatial and Temporal Variability	Medium	16 sampling sites. No replicates
	Metric 7:	Exposure Scenario	Medium	presence of phthalate esters in environment, specifically drinking water sources
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Reported mean, range, and detection frequency but not individual sample stats
	Metric 9:	Quality Assurance	Medium	used procedural blanks, describe sterilization procedure. Most mean recoveries >70%, but low end of some compounds were <70%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Provide range and discuss variation BETWEEN different chemical concentrations at different sites but not variation within samples. Some discussion of limitations and data gaps
Overall Quality Determination			Medium	

Study Citation:		Otake, T., Yoshinaga, J., Yanagisawa, Y. (2001). Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD. Environmental Science & Technology 35(15):3099-3102.		
HERO ID:		1598712		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Samples were collected according to publicly available SOPs that are scientifically sound and widely accepted (i.e., from trusted or authoritative source) for the chemical and media of interest.
	Metric 2:	Analytical Methodology	High	Samples were analyzed according to publicly available analytical methods that are scientifically sound and widely accepted (i.e., from trusted or authoritative source) and are appropriate for the chemical and media of interest.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Japan.
	Metric 5:	Currency	Low	Timing of sample collection for monitoring data is not reported, discussed, or referenced. However, publication year of 2001 is used as a proxy for sampling year.
	Metric 6:	Spatial and Temporal Variability	Medium	There were 5-10 samples collected for a single scenario. No replicates were reported.
	Metric 7:	Exposure Scenario	Low	The data somewhat represents relevant indoor air exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics were included.
	Metric 9:	Quality Assurance	Medium	The study applied and documented quality assurance/quality control measures; however, one or more pieces of QA/QC information is not described. Missing information is unlikely to have a substantial impact on results.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations not reported. There was only a minimal characterization of variability and uncertainty.
Overall Quality Determination			Medium	

Study Citation:		Cheng, Z., Nie, X. P., Wang, H. S., Wong, M. H. (2013). Risk assessments of human exposure to bioaccessible phthalate esters through market fish consumption. Environment International 57-58:75-80.		
HERO ID:		1600107		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling procedure was only briefly mentioned and lacked details. It is mentioned there is more information in S1 (not in HERO link for QCer).
	Metric 2:	Analytical Methodology	High	Analytical procedure -GCMS was described, along with LOQ.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Hong Kong
	Metric 5:	Currency	Medium	May-November 2009
	Metric 6:	Spatial and Temporal Variability	High	20 species of commonly consumed fish were sampled, varying with 3-36 replicates depending on the fish type (table 1)
	Metric 7:	Exposure Scenario	High	Exposure matrix was relevant - food/diet/aquatic species
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Data were reported as average and not individual samples. Some summary statistics provided.
	Metric 9:	Quality Assurance	High	QA/QC was performed. The target compounds have high recovery rates >73.1% and recoveries of internal standards in method blanks and in fish samples were >70%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study compared the results to previous studies and other publications. No limitations provided.
Overall Quality Determination			High	

Study Citation:		Sun, J., Huang, J., Zhang, A., Liu, W., Cheng, W. (2013). Occurrence of phthalate esters in sediments in Qiantang River, China and inference with urbanization and river flow regime. Journal of Hazardous Materials 248-249(1):142-149.		
HERO ID:		1639231		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported
	Metric 2:	Analytical Methodology	High	Key analytical methods reported. See SI for detection limits
	Metric 3:	Biomarker Selection	N/A	Parent chemicals were tested in river sediment
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Qiantang River, China
	Metric 5:	Currency	Medium	Samples collected in 2011
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates
	Metric 7:	Exposure Scenario	Medium	Exposure source characterized - unclear how population can be exposed to the river sediment (i.e., how do they use the river).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not provided
	Metric 9:	Quality Assurance	Medium	Key QA reported. Some recoveries were low if considering the reported range and not just the mean.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported. Variance characterized in SI (Table SM-3)
Overall Quality Determination			Medium	

Study Citation:		Yoshida, T., Matsunaga, I., Tomioka, K., Kumagai, S. (2006). Interior air pollution in automotive cabins by volatile organic compounds diffusing from interior materials: I. Survey of 101 types of Japanese domestically produced cars for private use. Indoor and Built Environment 15(5):425-444.		
HERO ID:		1949033		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	A detailed description of the sampling methodology is provided.
	Metric 2:	Analytical Methodology	Low	The description of the analytical methodology provided has a few flaws.
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in Japan.
	Metric 5:	Currency	Low	The study was conducted in the summer season (June–September) of 2001 (n=14), 2002 (n=28), 2003 (n=47) or 2004 (n=12).
	Metric 6:	Spatial and Temporal Variability	High	There were ≥ 10 samples for a single scenario.
	Metric 7:	Exposure Scenario	High	The exposure scenario discussed in the monitored study represents the exposure scenario of interest for the chemical.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	The presentation of results was good.
	Metric 9:	Quality Assurance	Low	The description of QA/QC was poor.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The presentation of variability and uncertainty was good.
Overall Quality Determination			Medium	

Study Citation:		Almqvist, H., Hanaeus, J. (2006). Organic hazardous substances in graywater from Swedish households. Journal of Environmental Engineering 132(8):901-908.		
HERO ID:		2151800		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	site description and sampling described
	Metric 2:	Analytical Methodology	Low	Accredited contract laboratory conducted analyses, no LOD
	Metric 3:	Biomarker Selection	N/A	environmental samples
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sweden
	Metric 5:	Currency	Low	2001
	Metric 6:	Spatial and Temporal Variability	Low	n = 3
	Metric 7:	Exposure Scenario	Low	graywater
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	range and average 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			Low	

Study Citation:		Fromme, H., Lahrz, T., Kraft, M., Fembacher, L., Dietrich, S., Sievering, S., Burghardt, R., Schuster, R., Bolte, G., Völkel, W. (2013). Phthalates in German daycare centers: Occurrence in air and dust and the excretion of their metabolites by children (LUPE 3). Environment International 61:64-72.		
HERO ID:		2215411		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Sampling Methodology	High	Sampling methodology provided and described. Indoor air samples were collected once on a glass fiber filter and additionally on polyurethane foam using a GGP sampler which allows a standardized particle collection on filters and the adsorption of volatile phthalates to downstream PU foam. Dust sampling was conducted by slowly vacuuming the floor for approximately 5 to 10 min using an ALK dust filter holder connected to a vacuum cleaner.
	Metric 2:	Analytical Methodology	Medium	Some analytical methods not reported, such as recovery samples.
	Metric 3:	Biomarker Selection	High	List of metabolites and parent chemical in Table 1.
Domain 2: Representativeness	Metric 4:	Geographic Area	High	Germany.
	Metric 5:	Currency	Medium	Data collected in 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates collected.
	Metric 7:	Exposure Scenario	High	Children in daycare centers, before and after metabolites and indoor air and particulate characterization.
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	Raw data not provided.
	Metric 9:	Quality Assurance	Medium	QA/QC implied, some info available in supplemental.
Domain 4: Variability and Uncertainty	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.
Overall Quality Determination			High	

Study Citation:		Zheng, X., Zhang, B. T., Teng, Y. (2014). Distribution of phthalate acid esters in lakes of Beijing and its relationship with anthropogenic activities. Science of the Total Environment 476-477:107-113.		
HERO ID:		2241688		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling Methodology	High	Well described and scientifically sound methodology
	Metric 2:	Analytical Methodology	High	Well described, includes LODs and recoveries
	Metric 3:	Biomarker Selection	N/A	Water sampling
Domain 2: Representativeness	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	Samples collected in 2012
	Metric 6:	Spatial and Temporal Variability	Medium	4-10 samples per site
	Metric 7:	Exposure Scenario	Medium	Data are likely to represent a relevant exposure scenario, but the manuscript has limited description of the population of interest and microenvironment
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	Individual data points are not provided, only summary statistics
	Metric 9:	Quality Assurance	Medium	Limited details on field control samples
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties, limitations and data gaps are not discussed
Overall Quality Determination		Medium		

Study Citation:		Das, M. T., Ghosh, P., Thakur, I. S. (2014). Intake estimates of phthalate esters for South Delhi population based on exposure media assessment. Environmental Pollution 189:118-125.		
HERO ID:		2298077		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology is thoroughly described and scientifically sound. No key details are omitted.
	Metric 2:	Analytical Methodology	High	Analytical method is thoroughly described and sound. MDL is provided in supplemental material.
	Metric 3:	Biomarker Selection	N/A	Study is testing for parent chemical in dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in China.
	Metric 5:	Currency	Medium	Samples collected in 2011.
	Metric 6:	Spatial and Temporal Variability	Low	No replicates provided and fewer than 10 samples were collected per scenario.
	Metric 7:	Exposure Scenario	Medium	The source of exposure was not well characterized, but this is an exposure scenario of interest.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	High	Raw data is provided.
	Metric 9:	Quality Assurance	High	QA/QC methods are provided and no issues were identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Robust discussion of limitations and uncertainty is provided.
Overall Quality Determination			High	

Study Citation:		Arbuckle, T. E., Davis, K., Marro, L., Fisher, M., Legrand, M., Leblanc, A., Gaudreau, E., Foster, W. G., Choeurng, V., Fraser, W. D. (2014). Phthalate and bisphenol A exposure among pregnant women in Canada—results from the MIREC study. Environment International 68:55-65.		
HERO ID:		2345941		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Scientifically sound sampling methodology.
	Metric 2:	Analytical Methodology	High	Detailed analytical methodology, reported LOD.
	Metric 3:	Biomarker Selection	High	Metabolite is known to be related with external exposure.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Canada
	Metric 5:	Currency	Medium	Sampling began in 2008 and ended in 2011.
	Metric 6:	Spatial and Temporal Variability	Low	n = 1788, no replicates, single spot urine samples.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data is not reported.
	Metric 9:	Quality Assurance	Low	Limited description of QA/QC techniques and recoveries not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Characterized variability, discussed uncertainties and limitations.
Overall Quality Determination			High	

Study Citation:		Meng, X. Z., Wang, Y., Xiang, N., Chen, L., Liu, Z., Wu, B., Dai, X., Zhang, Y. H., Xie, Z., Ebinghaus, R. (2014). Flow of sewage sludge-borne phthalate esters (PAEs) from human release to human intake: implication for risk assessment of sludge applied to soil. Science of the Total Environment 476-477(Elsevier):242-249.		
HERO ID:		2345986		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	WWTP details included, map in SI, and storage conditions reported. Sampling methods reported previously (Yang, et al., 2011).
	Metric 2:	Analytical Methodology	High	Instrument DL and method DL in Table S2. Extraction and instruments also described in detail.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	2010
	Metric 6:	Spatial and Temporal Variability	Medium	25 WWTP samples, no replicates
	Metric 7:	Exposure Scenario	High	Measuring sewage sludge from WWTP.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean, median, min, max reported in Table 1. Raw data not reported.
	Metric 9:	Quality Assurance	High	Recoveries, DLs, blanks discussed. Recoveries above 70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability, limitations, and uncertainty not discussed, but there are no obvious concerns.
Overall Quality Determination			Medium	

Study Citation:		Liu, H., Cui, K., Zeng, F., Chen, L., Cheng, Y., Li, H., Li, S., Zhou, X., Zhu, F., Ouyang, G., Luan, T., Zeng, Z. (2014). Occurrence and distribution of phthalate esters in riverine sediments from the Pearl River Delta region, South China. Marine Pollution Bulletin 83(1):358-365.		
HERO ID:		2349860		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported
	Metric 2:	Analytical Methodology	Medium	Key analytical methods reported. Only provided a range of MDLs for all phthalates analyzed
	Metric 3:	Biomarker Selection	N/A	Measured parent chemical in riverine sediments
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Pearl River Delta region, South China
	Metric 5:	Currency	Low	Paper published in 2014. No sample collection date reported
	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	Medium	Some QA/QC reported, such as blanks and recoveries. However, the lower bound of recoveries were <70% for some compounds albeit not significantly.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported
Overall Quality Determination			Medium	

Study Citation:		Van Holderbeke, M., Geerts, L., Vanermen, G., Servaes, K., Sioen, I., De Henaauw, S., Fierens, T. (2014). Determination of contamination pathways of phthalates in food products sold on the Belgian market. Environmental Research 134:345-352.		
HERO ID:		2501473		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some sampling methods not reported such as sample storage conditions analytical methods described Biomarkers of interest were not addressed in this reference.
	Metric 2:	Analytical Methodology	High	
	Metric 3:	Biomarker Selection	N/A	
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Belgium
	Metric 5:	Currency	Medium	Samples collected in 2010 and 2011
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates
	Metric 7:	Exposure Scenario	High	Exposure source characterized
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported
	Metric 9:	Quality Assurance	Medium	Limited QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported
Overall Quality Determination			Medium	

Study Citation:		Sakhi, A. K., Lillegaard, I. T., Voorspoels, S., Carlsen, M. H., Løken, E. B., Brantsæter, A. L., Haugen, M., Meltzer, H. M., Thomsen, C. (2014). Concentrations of phthalates and bisphenol A in Norwegian foods and beverages and estimated dietary exposure in adults. Environment International 73:259-269.		
HERO ID:		2501495		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Food selection criteria and pertinent sampling methods were described. Note that some of the sampling parameters (e.g., equipment) do not apply to this study because food were purchased as sold from grocery stores.
	Metric 2:	Analytical Methodology	High	LOQs were provided in Table S1. Extraction, preparation, and instrumentation were described, including reference to previously published protocol.
	Metric 3:	Biomarker Selection	N/A	Parent chemicals were measured in food.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Food samples were collected in Norway.
	Metric 5:	Currency	Medium	Samples were collected in 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	37 different food items and beverages were selected, and the top 1-3 brands for each item were pooled into one sample. No replicates were reported.
	Metric 7:	Exposure Scenario	High	Exposure to typical Norwegian food purchases from local grocery store is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics, such as median, min, and max were reported. No raw data were provided.
	Metric 9:	Quality Assurance	High	Method performance described blanks, reference samples, LOQ, recovery, and intralaboratory reproducibility in both main text and SI.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variance characterized with ranges and some limitations were discussed.
Overall Quality Determination			High	

Study Citation:		Takeuchi, S., Kojima, H., Saito, I., Jin, K., Kobayashi, S., Tanaka-Kagawa, T., Jinno, H. (2014). Detection of 34 plasticizers and 25 flame retardants in indoor air from houses in Sapporo, Japan. Science of the Total Environment 491-492:28-33.		
HERO ID:		2519043		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology is mostly adequately described, but some details are missing (e.g., sample storage conditions/duration). The study does cite some other published works for more complete details.
	Metric 2:	Analytical Methodology	Medium	The analytical methods were described, including LOD but not recoveries.
	Metric 3:	Biomarker Selection	N/A	Concentrations were measured in indoor air.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Sapporo, Japan.
	Metric 5:	Currency	Medium	Samples were collected in 2012.
	Metric 6:	Spatial and Temporal Variability	Low	It appears that only one sample per home was collected. Six homes were sampled.
	Metric 7:	Exposure Scenario	Medium	The data may represent relevant exposure scenarios related to indoor air in Sapporo Japan but only 6 homes were sampled. One home was sampled during a different season from the other homes.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual sample concentrations were reported, without summary statistics.
	Metric 9:	Quality Assurance	Medium	QA/QC techniques were briefly discussed, including the use of field blanks.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variability was not characterized. Very limited discussion of limitations, uncertainties, and data gaps.
Overall Quality Determination			Medium	

Study Citation:		Niu, L., Xu, Y., Xu, C., Yun, L., Liu, W. (2014). Status of phthalate esters contamination in agricultural soils across China and associated health risks.		
HERO ID:		Environmental Pollution 195:16-23. 2519080		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods, equipment, storage reported.
	Metric 2:	Analytical Methodology	Medium	Extraction methods, analytical methods, equipment, calibration, recovery samples reported. LOD reported as a range.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	Samples collected in 2013
	Metric 6:	Spatial and Temporal Variability	Medium	123 samples. No replicates collected.
	Metric 7:	Exposure Scenario	High	Exposure sources characterized (application of agricultural plastic films and activities for soil fertility).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean, median, min, max provided. Raw data not reported.
	Metric 9:	Quality Assurance	High	Key QA reported. Recoveries over 70% and blank samples included.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No gaps and limitations reported. Spatial variation analyzed and SD reported.
Overall Quality Determination			High	

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:		Fisher, M., Arbuckle, T. E., Mallick, R., Leblanc, A., Hauser, R., Feeley, M., Koniecki, D., Ramsay, T., Provencher, G., Bérubé, R., Walker, M. (2015). Bisphenol A and phthalate metabolite urinary concentrations: Daily and across pregnancy variability. Journal of Exposure Science & Environmental Epidemiology 25(3):231-239.		
HERO ID:		2718085		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Medium. Most key criteria met. Duration of sample storage prior to analysis lacking.
	Metric 2:	Analytical Methodology	Medium	Medium. Most key criteria met. Lack of recovery data
	Metric 3:	Biomarker Selection	High	High. Sampling for metabolites specific for parent chemicals.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High. Canada.
	Metric 5:	Currency	Medium	Medium. Sampling 2009-2010.
	Metric 6:	Spatial and Temporal Variability	High	High. Temporal variability high: 24-hour spot urine specimens collected from subjects in Ottawa during early pregnancy on weekdays (n=64 samples) and weekends (n=66 samples), followed by single spot urine specimens for each participant during 2nd (n=70 samples) and 3rd (n=71 samples) trimesters as well as postpartum (n=63 samples).
	Metric 7:	Exposure Scenario	Medium	Medium. Participant characteristics summarized for relevant exposure scenario. Occupation not reported.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium. Most key criteria met. Lack of raw data.
	Metric 9:	Quality Assurance	Medium	Medium. Most key criteria met. Lack of recovery data.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Medium. Most key criteria met, variability summarized within statistical summary measures, lack of robust discussion of potential study limitations.
Overall Quality Determination			Medium	

Study Citation:		Wiberg, B., Lind, P. M., Lind, L. (2014). Serum levels of monobenzylphthalate (MBzP) is related to carotid atherosclerosis in the elderly. Environmental Research 133:348-352.		
HERO ID:		2718093		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some key criteria met, but lack of sample storage conditions and duration of sample storage.
	Metric 2:	Analytical Methodology	Medium	Medium. Lack of recovery and extraction details but analytical methodology referenced as a CDC method. LOD was reported in Results.
	Metric 3:	Biomarker Selection	High	Sampling for metabolites specific for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from participants in Uppsala, Sweden.
	Metric 5:	Currency	Low	Sampling dates were not reported. Publication date is 2014.
	Metric 6:	Spatial and Temporal Variability	Low	A single fasting blood sample was collected from each of n=1016 participants with no replicates.
	Metric 7:	Exposure Scenario	High	This is a biomonitoring paper that aims to study association between exposure to BBP and atherosclerosis. Some of the parameters in this metric do not apply.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not provided.
	Metric 9:	Quality Assurance	Low	Quality assurance procedures not reported, but can be inferred from its use of a CDC method.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Tables only reported the relationships between MBzP and plaques rather than blood levels of MBzP; see Results text for more data points. There is a limited discussion of potential study limitations and low frequency of detection.
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:		Dodson, R. E., Camann, D. E., Morello-Frosch, R., Brody, J. G., Rudel, R. A. (2015). Semivolatile organic compounds in homes: strategies for efficient and systematic exposure measurement based on empirical and theoretical factors. Environmental Science & Technology 49(1):113-122.		
HERO ID:		2816371		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling equipment and methods are reported in detail and scientifically sound.
	Metric 2:	Analytical Methodology	High	Analytical instrumentation and methods are reported in detail and scientifically sound. Method reporting limit calculation is based off of analytical detection limit, which is reported in the supplementary information.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was performed in California.
	Metric 5:	Currency	Medium	Samples were collected in 2006.
	Metric 6:	Spatial and Temporal Variability	Medium	49 dust and indoor and outdoor air samples were collected from 50 homes in California without replicates.
	Metric 7:	Exposure Scenario	Medium	Dust samples were collected from common exposure sites (rugs, upholstery, wood floors, windowsills, ceiling fans, and furniture) in the primary living area of residential homes. Additional information about study communities is available in other publications, although there is little mention of potential product/chemical use in the sampled homes.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics reported include percent of samples above method reporting limit, median, 95th percentile, and maximum concentration of compound of interest in dust. Individual sample concentrations are not reported.
	Metric 9:	Quality Assurance	High	QA/QC measures included use of blanks, split-sample duplicates, and measures of spike recovery, which ranged from 78-108%
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The characterization of variability is absent. However, authors discuss the limitations presented by various approaches to measurement of household exposures to semivolatile organic compounds
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 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	metabolite in urine
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Michigan and Texas
	Metric 5:	Currency	Medium	2005 and 2009
	Metric 6:	Spatial and Temporal Variability	Medium	n = 213 mothers and n = 212 fathers, no replicates
	Metric 7:	Exposure Scenario	High	biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	geometric mean and 95%CI
	Metric 9:	Quality Assurance	Medium	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	variability briefly discussed, uncertainty not discussed.
Overall Quality Determination			Medium	

Study Citation:		Shapiro, G. D., Dodds, L., Arbuckle, T. E., Ashley-Martin, J., Fraser, W., Fisher, M., Taback, S., Keely, E., Bouchard, M. F., Monnier, P., Dallaire, R., Morisset, A. S., Ettinger, A. S. (2015). Exposure to phthalates, bisphenol A and metals in pregnancy and the association with impaired glucose tolerance and gestational diabetes mellitus: The MIREC study. Environment International 83:63-71.		
HERO ID:		3005136		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology only briefly described, cited previously published work (Arbuckle et al., 2014).
	Metric 2:	Analytical Methodology	Medium	Detailed analytical methodology, reported LOD. Some information missing such as calibration, may be mentioned in (Arbuckle et al., 2014; Langlois et al., 2014).
	Metric 3:	Biomarker Selection	High	Biomarker is known to be related with external exposure (MCHP).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Canada
	Metric 5:	Currency	Medium	2008-2011
	Metric 6:	Spatial and Temporal Variability	Medium	1274, no replicates (Table 2).
	Metric 7:	Exposure Scenario	High	Exposure to pregnant women.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Only geometric mean reported.
	Metric 9:	Quality Assurance	Low	QA/QC techniques were not discussed but can be implied through the study's techniques.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Characterized variability, discussed uncertainties and limitations.
Overall Quality Determination			Medium	

Study Citation:		Gao, C. J., Liu, L. Y., Ma, W. L., Ren, N. Q., Guo, Y., Zhu, N. Z., Jiang, L., Li, Y. F., Kannan, K. (2016). Phthalate metabolites in urine of Chinese young adults: Concentration, profile, exposure and cumulative risk assessment. Science of the Total Environment 543(Pt A):19-27.		
HERO ID:		3045442		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Medium. Most key criteria met. Duration of sample storage prior to analysis lacking for urine samples. Approaches to avoid contamination in sampling also missing.
	Metric 2:	Analytical Methodology	High	Key criteria met, LOQ's reported as range, recoveries reported. HPLC system electrospray triple quadrupole mass spectrometer (ESI-MS/MS).
	Metric 3:	Biomarker Selection	High	High. Sampling for metabolite specific for parent chemical. See Table S1 (supplemental).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	High. China.
	Metric 5:	Currency	Medium	Medium. Sampling conducted 2010.
	Metric 6:	Spatial and Temporal Variability	Medium	Sampling in 108 participants across urban, rural areas covering most provinces and municipalities, males and females, first morning urine specimens. No replicates.
	Metric 7:	Exposure Scenario	Medium	Medium. Participant characteristics summarized, potential exposure sources discussed, occupational status unknown, lack of baseline/control samples.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Medium. Most key criteria met. Lack of raw data.
	Metric 9:	Quality Assurance	Medium	Medium. Quality assurance key criteria met. Lack of baseline samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability represented by statistical summary measures, limitations discussed, uncertainties identified.
Overall Quality Determination			High	

Study Citation:		HEW, (2016). Current status and historical variations of phthalate ester (PAE) contamination in the sediments from a large Chinese lake (Lake Chaohu). Environmental Science and Pollution Research 23(11):10393-10405.		
HERO ID:		3052884		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported (e.g., site characteristics, location, equipment).
	Metric 2:	Analytical Methodology	Medium	Key analytical methods reported, but LOD were only reported as a range for all but two of the PAEs combined. Paper did note that the supplemental materials provide detailed recoveries and detection limits. However, supplemental materials were not available at the time of QC.
	Metric 3:	Biomarker Selection	N/A	Study measured parent compounds in media (sediment).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Lake Chaohu, China.
	Metric 5:	Currency	Medium	Samples were collected in 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	More than 20 samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	Authors measured phthalate concentrations in a lake that serves as an important source of drinking water, industry, and agriculture for millions of residents.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not provided.
	Metric 9:	Quality Assurance	High	Key QA/QC reported. Recoveries for all but one non-TSCA phthalate were acceptable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Key gaps and limitations were not reported. Standard deviations provided in Table 1 for surface sediment, and ranges provided in Table 5 for core sediment.
Overall Quality Determination			High	

Study Citation:		Sun, J., Pan, L., Zhan, Y., Lu, H., Tsang, D. C., Liu, W., Wang, X., Li, X., Zhu, L. (2015). Contamination of phthalate esters, organochlorine pesticides and polybrominated diphenyl ethers in agricultural soils from the Yangtze River Delta of China. Science of the Total Environment 544:670-676.		
HERO ID:		3070929		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods (e.g., site characteristics, sampling location, equipment) were reported.
	Metric 2:	Analytical Methodology	Medium	Key analytical methods (e.g., instrumentation, extraction) were reported. However, LODs were only reported as a range for all phthalates combined.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in the soil.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Study was performed in the Yangtze River Delta, China.
	Metric 5:	Currency	Medium	Samples were collected in 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 241 topsoil samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	Authors measured the levels of phthalates in farmland soil resulting from rapid urbanization.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	Key QA/QC were reported, such as duplicate analysis, recoveries, and blank corrections.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not reported, and variance only characterized by min and max.
Overall Quality Determination			Medium	

Study Citation:		Asimakopoulos, A. G., Xue, J., De Carvalho, B. P., Iyer, A., Abualnaja, K. O., Yaghmoor, S. S., Kumosani, T. A., Kannan, K. (2016). Urinary biomarkers of exposure to 57 xenobiotics and its association with oxidative stress in a population in Jeddah, Saudi Arabia. Environmental Research 150:573–581.		
HERO ID:		3070934		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Participants and sample collection described, storage described. Missing information such as container used for collection.
	Metric 2:	Analytical Methodology	High	LOD, LOQ, extraction, calibration, recoveries, equipment and detailed methods in SI.
	Metric 3:	Biomarker Selection	High	Metabolites known to be derived from parent compound (MCHP).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Saudi Arabia
	Metric 5:	Currency	Medium	2014
	Metric 6:	Spatial and Temporal Variability	Low	n =130, no replicates. Spot urine samples.
	Metric 7:	Exposure Scenario	Medium	Exposure to general population who visited a hospital. No information given on how subjects were chosen.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Min, max, mean, median for detects only; Kaplan-Meier method including non-detects. Individual points not reported.
	Metric 9:	Quality Assurance	High	High recoveries (over 70%), matrix effects, LODs, calibration, blanks, internal and external standards described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Some discussion of variability, comparison with other studies. Discussion of limitations.
Overall Quality Determination			High	

Study Citation:		Arbuckle, T. E., Fisher, M., Macpherson, S., Lang, C., Provencher, G., Leblanc, A., Hauser, R., Feeley, M., Ayotte, P., Neisa, A., Ramsay, T., Tawagi, G. (2016). Maternal and early life exposure to phthalates: The Plastics and Personal-care Products use in Pregnancy (P4) study. Science of the Total Environment 551-552(Elsevier):344-356.		
HERO ID:		3230415		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported.
	Metric 3:	Biomarker Selection	High	Acceptable biomarker.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Ottawa, Canada.
	Metric 5:	Currency	Medium	Samples collected between 2009 and 2010.
	Metric 6:	Spatial and Temporal Variability	High	>10 samples; replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure source 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	High	Limitations reported.
Overall Quality Determination			High	

Study Citation:		Ouyang, X., Weiss, J. M., de Boer, J., Lamoree, M. H., Leonards, P. E. (2017). Non-target analysis of household dust and laundry dryer lint using comprehensive two-dimensional liquid chromatography coupled with time-of-flight mass spectrometry. Chemosphere 166:431-437.		
HERO ID:		3455857		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Dust sample not fully specified.
	Metric 2:	Analytical Methodology	Low	LOD or LOQ not reported
	Metric 3:	Biomarker Selection	N/A	The study is testing for the parent chemical
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Uppsala, Sweden and Netherlands
	Metric 5:	Currency	Low	The timing of collection is not specified but references available (Ouyang et al., 2015) and (Ouyang et al., 2016).
	Metric 6:	Spatial and Temporal Variability	Medium	Five dust samples and six dryer lint samples
	Metric 7:	Exposure Scenario	High	Exposure to household dust
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data reported
	Metric 9:	Quality Assurance	Medium	Deviation, recovery and quality control issues discussed. No control samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Accuracy of the analytical technique reported but variability and uncertainty not clearly discussed.
Overall Quality Determination			Medium	

Study Citation:		Polidoro, B. A., Comeros-Raynal, M. T., Cahill, T., Clement, C. (2017). Land-based sources of marine pollution: Pesticides, PAHs and phthalates in coastal stream water, and heavy metals in coastal stream sediments in American Samoa. Marine Pollution Bulletin 116(1-2):501-507.		
HERO ID:		3466558		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Authors provided a detailed description of sampling process, including information on water and sediment collection sites, equipment, and more.
	Metric 2:	Analytical Methodology	High	Extraction methods and Gas Chromatography-Mass Spectrometry (GC–MS) were explained. Recoveries and detection limits were reported in main text and supplemental, respectively.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in American Samoa.
	Metric 5:	Currency	High	Samples were collected in 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	Two water samples were collected from 8 different sites, but it is unclear if those two samples were collected at the same time and place as each other. (Note that composite sediment samples were also taken, but sediment wasn't tested for phthalates).
	Metric 7:	Exposure Scenario	High	Study measured the presence of heavy metals and contaminants in coastal streams and surface waters by a landfill originating from multiple sources.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Study provided a graph of maximum concentrations per site but not the exact values. There were no summary statistics.
	Metric 9:	Quality Assurance	Low	There was little reporting of QA/QC except for recoveries, which was reported as 40-94% for all phthalates combined.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	There was no characterization of variance or discussion of limitations, uncertainties, and gaps.
Overall Quality Determination			Medium	

Study Citation:		Huang, H. B., Pan, W. H., Chang, J. W., Chiang, H. C., Guo, Y. L., Jaakkola, J. J., Huang, P. C. (2017). Does exposure to phthalates influence thyroid function and growth hormone homeostasis? The Taiwan Environmental Survey for Toxicants (TEST) 2013. Environmental Research 153(6):63-72.		
HERO ID:		3466596		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampled population, methods, equipment, storage samples all reported.
	Metric 2:	Analytical Methodology	High	Analytical methods, instrument and LOD reported.
	Metric 3:	Biomarker Selection	High	Biomarker is known to have a relationship with external exposure.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in Taiwan.
	Metric 5:	Currency	Medium	Samples were taken from 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	358 in total: 279 adults, 79 minors. No replicates.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant exposure scenarios, including a questionnaire to identify possible exposures.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics reported. Individual points not reported.
	Metric 9:	Quality Assurance	Low	Analyzed control samples, limited description of QA/QC techniques. Recoveries not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Characterized variability through different participants sampled. Discussed uncertainties and limitations.
Overall Quality Determination			High	

Study Citation:		Wu, W., Zhou, F., Wang, Y., Ning, Y., Yang, J. Y., Zhou, Y. K. (2017). Phthalate levels and related factors in children aged 6-12 years. Environmental Pollution 220(Pt B):990-996.		
HERO ID:		3469193		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methods, instrument, storage and study population all reported.
	Metric 2:	Analytical Methodology	High	Analytical methods, instrument and LOD reported.
	Metric 3:	Biomarker Selection	High	Biomarker is known to be related with external exposure.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study site is China.
	Metric 5:	Currency	Medium	Sampling was conducted from January 2014 to July 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	336 total samples from children. No replicates reported.
	Metric 7:	Exposure Scenario	Medium	Data was collected from China in 2014 and the exact source of the exposures are unclear.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics reported. Raw data not reported.
	Metric 9:	Quality Assurance	Medium	QA procedures was reported to be used, however, there is no details of it. Recovery was >90%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Characterized variability, did not discuss uncertainties and limitations.
Overall Quality Determination			Medium	

Study Citation:		Rocha, B. A., Asimakopoulos, A. G., Barbosa, F., Kannan, K. (2017). Urinary concentrations of 25 phthalate metabolites in Brazilian children and their association with oxidative DNA damage. Science of the Total Environment 586:152-162.		
HERO ID:		3531624		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description of sampling methodology.
	Metric 2:	Analytical Methodology	High	Well described analytical methods, reported LOD.
	Metric 3:	Biomarker Selection	High	Biomarkers are known to be related with external exposure.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Brazil
	Metric 5:	Currency	Medium	Samples from 2012-2013.
	Metric 6:	Spatial and Temporal Variability	Low	300 samples, no replicates.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics only.
	Metric 9:	Quality Assurance	High	Detailed QA/QC techniques.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Characterized variability, did not discuss uncertainties and limitations.
Overall Quality Determination			High	

Study Citation:		Lee, K. M., Kho, Y., Kim, P. G., Park, S. H., Lee, J. H. (2017). Urinary levels of phthalate metabolites and associations with demographic characteristics in Korean adults. Environmental Science and Pollution Research 24(17):14669-14681.		
HERO ID:		3859032		
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.
		Metric 3: Biomarker Selection	High	Sampling for metabolites specific for parent chemical of interest.
Domain 2: Representativeness		Metric 4: Geographic Area	High	Samples provided by participants in South Korea.
		Metric 5: Currency	High	Samples collected in 2009.
		Metric 6: Spatial and Temporal Variability	Medium	Sampling strategy based upon random sample of national census data, single spot urine samples collected, distributions across rural and urban, age group, gender and other demographics provided.
		Metric 7: Exposure Scenario	Medium	Participant characteristics summarized, potential for occupational exposure described, 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 minimally described with some key criteria met; lack of recovery data.
Domain 4: Variability and Uncertainty		Metric 10: Variability and Uncertainty	Medium	Variability characterized within summary statistics, potential study limitations, including occupational exposure, discussed.
Overall Quality Determination			Medium	

Study Citation:		Chen, Q., Yang, H., Zhou, N., Sun, L., Bao, H., Tan, L., Chen, H., Ling, X., Zhang, G., Huang, L., Li, L., Ma, M., Yang, H., Wang, X., Zou, P., Peng, K., Liu, T., Shi, X., Feng, D., Zhou, Z., Ao, L., Cui, Z., Cao, J. (2017). Phthalate exposure, even below US EPA reference doses, was associated with semen quality and reproductive hormones: Prospective MARHCS study in general population. Environment International 104(Elsevier):58-68.		
HERO ID:		3859041		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampled participants, equipment and storage described. However, sampling methods are only briefly discussed, and missing detail may have a substantial impact on results.
	Metric 2:	Analytical Methodology	High	Analytical instrumentation and methods are discussed in detail and are scientifically sound. LOD is reported.
	Metric 3:	Biomarker Selection	Medium	The monoester phthalate analyte is a metabolite of multiple parent chemicals, not just the chemical of interest, and there is not a stated method to apportion the estimate to only the chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in China.
	Metric 5:	Currency	Medium	The study was conducted in June 2013 and June 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	One urine spot sample was collected at one timepoint from 796 participants without the use of replicates. 656 participants provided second samples one year later.
	Metric 7:	Exposure Scenario	Medium	The study is measuring phthalates in men with demographics given. However, the source of exposure is unclear.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual data points are not reported; summary statistics include percentage of samples above LOD, mean, minimum, maximum, and percentiles (5, 25, 50, 75, 95) of concentration.
	Metric 9:	Quality Assurance	Medium	QA/QC techniques are not directly discussed except for reporting of recovery for each metabolite (between 81.6% and 105.5%).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The relative standard deviation for each metabolite was reported to be below 10%, indicating low variability. Limitation/sources of uncertainty are also briefly discussed.
Overall Quality Determination			Medium	

Study Citation:		Saeed, T., Al-Jandal, N., Abusam, A., Taqi, H., Al-Khabbaz, A., Zafar, J. (2017). Sources and levels of endocrine disrupting compounds (EDCs) in Kuwait’s coastal areas. Marine Pollution Bulletin 118(1-2):407-412.		
HERO ID:		3859095		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Authors provided a detailed description of sampling sites, methodology (e.g., equipment, storage), and processing methods (mostly relevant to sediments).
	Metric 2:	Analytical Methodology	Low	Detection limits were not reported.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Kuwait.
	Metric 5:	Currency	High	Samples were collected during 2015-2016.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 41 samples (14, 12, 15) were collected without replicates from the inflow and outflow of three water treatment plants. Sediment and seawater were collected once from each of five different locations. No replicates were reported.
	Metric 7:	Exposure Scenario	High	Phthalates in seawater/coastal areas near sewage treatment is relevant
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data provided for phthalates levels at the 3 treatment plants in Tables S2-S4. Tables 3-4 show raw data for seawater and marine samples. Summary statistics were missing though.
	Metric 9:	Quality Assurance	Medium	Authors reported that about 10% of samples were duplicated, and recovery standards were incorporated. Recoveries were reported in Table S1 and acceptable.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No measures of variance were provided, but raw data were available. There was no discussion about limitations.
Overall Quality Determination			Medium	

Study Citation:		Chi, C., Xia, M., Zhou, C., Wang, X., Weng, M., Shen, X. (2017). Determination of 15 phthalate esters in air by gas-phase and particle-phase simultaneous sampling. Journal of Environmental Sciences 55:137-145.		
HERO ID:		3859102		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling method, equipment, and conditions were described.
	Metric 2:	Analytical Methodology	High	GCMS was used to perform the analysis. MDL and IDL were reported for each chemical for 2 phases - gas and particle.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study only reported that 4 different kinds of microenvironments were collected, but no specific locations were reported.
	Metric 5:	Currency	Low	No sampling date or publication date is provided - 2016.
	Metric 6:	Spatial and Temporal Variability	High	The number of air samples collected from busses, subways, taxis and private cars was 105, 40, 30, 60, respectively.
	Metric 7:	Exposure Scenario	High	Exposure matrix was relevant - indoor air from different kinds of traffic microenvironments.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Mean concentrations were reported with range, no individual data were reported.
	Metric 9:	Quality Assurance	High	QA/QC was performed, recovery rate were all above 90%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	The study had a robust discussion of variability and the sampling methods.
Overall Quality Determination			High	

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	N/A	DCH not quantified in water, SPM, and sediment samples	
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:		Le Coadou, L., Le Ménach, K., Labadie, P., Dévier, M. H., Pardon, P., Augagneur, S., Budzinski, H. (2017). Quality survey of natural mineral water and spring water sold in France: Monitoring of hormones, pharmaceuticals, pesticides, perfluoroalkyl substances, phthalates, and alkylphenols at the ultra-trace level. Science of the Total Environment 603-604:651-662.		
HERO ID:		3864659		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling equipment and methods are described in sufficient detail, but certain aspects (e.g. duration of storage) were absent that are unlikely to have a substantial impact on results.
	Metric 2:	Analytical Methodology	High	Analytical instrumentation and methods are described in sufficient detail and are scientifically sound. LOQ is reported for each analyte in Table S1.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical of interest in an environmental medium.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected for bottled water sold in France, but the actual source of the water were located in France, New Caledonia, Reunion Island, Luxembourg, and Italy.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	40 brands of bottled water were sampled without replicates.
	Metric 7:	Exposure Scenario	High	Samples were collected directly after the bottling process and are a good representation of exposure to the consumer.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	N/A	All results for phthalates were below the limit of quantification. Therefore, there were no data to report or summarize statistically.
	Metric 9:	Quality Assurance	High	QA/QC measures included the use of blanks, control samples, internal standards, and external calibration (in order to prevent internal phthalates contamination) in procedures documented by other references.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Because all samples were below LOQ, no characterization of variability could be reported. A robust discussion demonstrated minimal uncertainties from the analytical process.
Overall Quality Determination			High	

Study Citation:		Wang, H., Liang, H., Gao, D. W. (2017). Occurrence and distribution of phthalate esters (PAEs) in wetland sediments. Journal of Forestry Research 28(6):1241-1248.		
HERO ID:		4172527		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling of sediments, materials used, and sample storage described.
	Metric 2:	Analytical Methodology	High	Sample extraction and analysis provided, used GC/MS. Analysis parameters and conditions reported. QA/QC described and adequate. Detection limits in text.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	Samples collected in 2014
	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	High	Variability among sites discussed. Sources of uncertainty were discussed and appropriate.
Overall Quality Determination			High	

Study Citation:		Liao, C., Liu, W., Zhang, J., Shi, W., Wang, X., Cai, J., Zou, Z., Lu, R., Sun, C., Wang, H., Huang, C., Zhao, Z. (2018). Associations of urinary phthalate metabolites with residential characteristics, lifestyles, and dietary habits among young children in Shanghai, China. Science of the Total Environment 616-617:1288-1297.		
HERO ID:		4285933		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Method selecting children presented in Huang et al. (2016) and Wang et al. (2016). First morning urine collected in polyethylene containers; stored -40 C. Questionnaires on residential characteristics, lifestyle (cleaning habits), foods, etc. (see Supplemental Table A.1).
	Metric 2:	Analytical Methodology	High	SPE; isotope dilution-HPLC-heated electrospray ionization source (HESI) with triple quadrupole MS. Sample preparation and measurement conditions thoroughly described. All urine metabolite analyses performed during 3 weeks in September, 2016.
	Metric 3:	Biomarker Selection	Medium	MCHP in first morning urine; detected in <50% of samples; therefore, not analyzed or reported results.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China, Shanghai, six districts
	Metric 5:	Currency	Medium	March 2013 to December 2014
	Metric 6:	Spatial and Temporal Variability	Medium	Children aged 5-10 years, n = 434. Comparison groups of 213 girls and 221 boys; suburban vs urban; low and high frequencies of cleaning/dusting/changing bedclothes; some food types. Minimum group size for comparison >10. However, only one urine sample per child.
	Metric 7:	Exposure Scenario	Medium	Evaluated many in-home possible exposure characteristics via questionnaire or in-home visit. Highest phthalate metabolites in urine during summer; five other associations identified.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Detected in less than 50% of samples; results, therefore, not reported.
	Metric 9:	Quality Assurance	High	Low and high-concentration QC (n=3 each) samples and 3 blanks per batch of 48 (or 96) samples; 7 internal standard concentration calibration levels; Supplemental Table A.4 reports QC details by metabolite.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Children sampled across all 4 seasons; however, only one first morning urine sample per child.
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 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	metabolite in urine	
Domain 2: Representativeness	Metric 4: Geographic Area	High	U.S.	
	Metric 5: Currency	High	2015-2016	
	Metric 6: Spatial and Temporal Variability	Low	n = 40, no replicates, urine sampling details not provided	
	Metric 7: Exposure Scenario	Low	biomonitoring	
Domain 3: Accessibility/Clarity	Metric 8: Reporting of Results	Medium	Mean, SD, range 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:		Albert, O., Huang, J. Y., Aleksa, K., Hales, B. F., Goodyer, C. G., Robaire, B., Chevrier, J., Chan, P. (2018). Exposure to polybrominated diphenyl ethers and phthalates in healthy men living in the greater Montreal area: A study of hormonal balance and semen quality. Environment International 116:165-175.		
HERO ID:		4728683		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methods, demographics, materials and storage were reported in this biomonitoring study.
	Metric 2:	Analytical Methodology	Medium	The analytical methods, instrument, LOD and LOQ were reported for hair and urine. Recovery samples were not reported by study authors.
	Metric 3:	Biomarker Selection	High	The study reported acceptable biomarkers.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in Montreal, Canada.
	Metric 5:	Currency	Medium	Data were collected between 2009 and 2012.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from 153 men but there were no replicate samples collected.
	Metric 7:	Exposure Scenario	Medium	It is unclear where the sources of exposure come from.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics reported in Table 2. Raw data were not reported by the study authors.
	Metric 9:	Quality Assurance	Medium	Some QA was implied but some important QC components were not reported such as recovery samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Some gaps and limitations were reported. Variability captured through different demographics of participants studied.
Overall Quality Determination			Medium	

Study Citation:		Smarr, M. M., Kannan, K., Sun, L., Honda, M., Wang, W., Karthikraj, R., Chen, Z., Weck, J., Buck Louis, G. M. (2018). Preconception seminal plasma concentrations of endocrine disrupting chemicals in relation to semen quality parameters among male partners planning for pregnancy. Environmental Research 167:78-86.		
HERO ID:		4728828		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Detailed sampling methods.
	Metric 2:	Analytical Methodology	Medium	Well described analytical methods, did not report LOD.
	Metric 3:	Biomarker Selection	High	Biomarker is known to be related with external exposure.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	USA
	Metric 5:	Currency	Medium	Sampling began in 2005.
	Metric 6:	Spatial and Temporal Variability	Low	n=501 study participants, with duplicate samples.
	Metric 7:	Exposure Scenario	Medium	Limited information about the source and microenvironment.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics.
	Metric 9:	Quality Assurance	Low	QA/QC techniques only briefly discussed, cited previously published work.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Characterized variability and discussed study limitations.
Overall Quality Determination			Medium	

Study Citation:		Zhang, H., Zhou, Q., Xie, Z., Zhou, Y., Tu, C., Fu, C., Mi, W., Ebinghaus, R., Christie, P., Luo, Y. (2018). Occurrences of organophosphorus esters and phthalates in the microplastics from the coastal beaches in north China. Science of the Total Environment 616-617:1505-1512.		
HERO ID:		4829473		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some methods not reported such as sample storage conditions. More information provided in other references.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported, including extraction methods, analytical instrument, LOD provided in supplementary file.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from China.
	Metric 5:	Currency	High	Samples collected in 2015.
	Metric 6:	Spatial and Temporal Variability	Medium	28 samples collected. No replicates mentioned.
	Metric 7:	Exposure Scenario	High	Samples collected from the sand near the sea.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported. Summary statistics such as mean, median, range reported.
	Metric 9:	Quality Assurance	High	Key QA reported. Procedural blanks and high recoveries reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Gaps and limitations not reported. Variation, such as SD, comparison to other studies, and spatial analysis reported.
Overall Quality Determination			High	

Study Citation:		Chen, Y., Jiang, L., Lu, S., Kang, L., Luo, X., Liu, G., Cui, X., Yu, Y. (2019). Organophosphate ester and phthalate ester metabolites in urine from primiparas in Shenzhen, China: Implications for health risks. Environmental Pollution 247:944-952.		
HERO ID:		5039996		
Domain		Metric	Rating	Comments
Domain 1: Reliability		Metric 1: Sampling Methodology	High	Sampling methodology is adequately described.
		Metric 2: Analytical Methodology	Medium	LOQ is not stated in the main article, but is reportedly provided in the supplemental materials for this article.
		Metric 3: Biomarker Selection	High	The biomarker (metabolite in urine samples) is appropriate.
Domain 2: Representativeness		Metric 4: Geographic Area	High	Participants were recruited in Shenzhen Maternal and Child Health Hospital (China).
		Metric 5: Currency	High	Samples were collected between September 2013 and June 2015.
		Metric 6: Spatial and Temporal Variability	Medium	Samples collected from 84 Primiparas but no replicates. First-morning voids were collected as opposed to 24-hr sampling.
		Metric 7: Exposure Scenario	High	The data represent the population of interest.
Domain 3: Accessibility/Clarity		Metric 8: Reporting of Results	Medium	Summary statistics were detailed and complete but individual data points and measures of variance were not reported.
		Metric 9: Quality Assurance	High	Recoveries were measured, and blanks were analyzed. Glassware was cleaned and heated to minimize background contamination. Results were normalized by specific gravity.
Domain 4: Variability and Uncertainty		Metric 10: Variability and Uncertainty	Low	No measure of variance is reported. The study briefly discussed its primary limitation (small sample size).
Overall Quality Determination			High	

Study Citation:		Zhu, Q., Jia, J., Zhang, K., Zhang, H., Liao, C., Jiang, G. (2019). Phthalate esters in indoor dust from several regions, China and their implications for human exposure. Science of the Total Environment 652:1187-1194.		
HERO ID:		5041236		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology is thoroughly described and scientifically sound. No key details are omitted.
	Metric 2:	Analytical Methodology	High	Analytical method is thoroughly described and sound. LOD and LOQ is provided in the text.
	Metric 3:	Biomarker Selection	N/A	Study is testing for parent chemical in dust.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in China.
	Metric 5:	Currency	High	Samples collected from 2017-2018.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates provided.
	Metric 7:	Exposure Scenario	High	The source of exposure was well characterized and this is an exposure scenario of interest.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data is not provided, but summary statistics are given.
	Metric 9:	Quality Assurance	High	QA/QC methods are provided and no issues were identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited gaps and limitations are reported. Characterization of variability is limited but the range is provided.
Overall Quality Determination			High	

Study Citation:	Kang, H., Kim, S., Lee, G., Lee, I., Lee, J. P., Lee, J., Park, H., Moon, H. B., Park, J., Kim, S., Choi, G., Choi, K. (2019). Urinary metabolites of dibutyl phthalate and benzophenone-3 are potential chemical risk factors of chronic kidney function markers among healthy women. Environment International 124:354-360.			
HERO ID:	5043489			
Domain	Metric		Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported
	Metric 2:	Analytical Methodology	Medium	Recovery samples not reported
	Metric 3:	Biomarker Selection	High	Acceptable biomarker
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Korea
	Metric 5:	Currency	High	Samples collected in 2015 to 2016
	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	Medium	Limited QA reported
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported
Overall Quality Determination			High	

Study Citation:		Assens, M., Frederiksen, H., Petersen, J. H., Larsen, T., Skakkebæk, N. E., Juul, A., Andersson, A. M., Main, K. M. (2019). Variations in repeated serum concentrations of UV filters, phthalates, phenols and parabens during pregnancy. Environment International 123:318-324.		
HERO ID:		5043499		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology is only briefly discussed, therefore, most sampling information is missing and likely to have a substantial impact on results.
	Metric 2:	Analytical Methodology	High	Analytical instrumentation and methods are described in sufficient detail and are referenced to other published studies. LOD is reported for each analyte.
	Metric 3:	Biomarker Selection	High	The monoester phthalate biomarker is a metabolite of just the chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Copenhagen, Denmark
	Metric 5:	Currency	Low	1999-2001
	Metric 6:	Spatial and Temporal Variability	Medium	Blood serum samples from 128 pregnant women taken at various stages of pregnancy; 119 had samples from 4 timepoints.
	Metric 7:	Exposure Scenario	Medium	Phthalate metabolites were measured from prenatal serum of pregnant women. However, it is uncertain what the exposure sources are.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data are not reported; summary statistics include the detection rate, maximum, and percentiles (10, 25, 50, 75, 90) of concentration of metabolite.
	Metric 9:	Quality Assurance	Medium	QA/QC measures were briefly described and referenced to other published studies, but the results of these measures are not explicitly reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Characterization of variability is reported, and within-person and across-person variation are thoroughly investigated. However, discussion of methodological limitations or sources of uncertainty is absent.
Overall Quality Determination			Medium	

Study Citation:		Cheng, Z., Liu, J. B., Gao, M., Shi, G. Z., Fu, X. J., Cai, P., Lv, Y. F., Guo, Z. B., Shan, C. Q., Yang, Z. B., Xu, X. X., Xian, J. R., Yang, Y. X., Li, K. B., Nie, X. P. (2019). Occurrence and distribution of phthalate esters in freshwater aquaculture fish ponds in Pearl River Delta, China. Environmental Pollution 245:883-888.		
HERO ID:		5043518		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The study reported most necessary sampling methods including sample collection and storage methods.
	Metric 2:	Analytical Methodology	High	Methodology described in detail and includes extraction method, analytical instrumentation, recoveries, and LOD & LOQ.
	Metric 3:	Biomarker Selection	N/A	This metric is not applicable to the data source.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	This study was conducted in the Pearl River Delta, China.
	Metric 5:	Currency	High	The samples were collected between July 2016 and September 2017.
	Metric 6:	Spatial and Temporal Variability	High	At least 5 replicate samples were collected at each of 22 aquaculture fish ponds.
	Metric 7:	Exposure Scenario	Medium	The study is not able to make explicit links between sources of exposure and chemical concentrations.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Mean concentrations were reported.
	Metric 9:	Quality Assurance	High	The study authors reported all key QA.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The study authors reported few gaps, limitations, and uncertainties.
Overall Quality Determination			High	

Study Citation:		Kweon, D., Kim, M. K., Zoh, K. (2018). Distribution of brominated flame retardants and phthalate esters in house dust in Korea. Environmental Engineering Research 23(4):354-363.		
HERO ID:		5043550		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	QC: sampling methodology well described table 1
	Metric 2:	Analytical Methodology	Medium	Some analytical methods not reported, such as recovery samples
	Metric 3:	Biomarker Selection	N/A	QC: indoor dust media
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	QC: Korea
	Metric 5:	Currency	Medium	Data collected in 2011
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates collected
	Metric 7:	Exposure Scenario	High	QC: indoor dust is relevant scenario for phthalates/frs
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data reported
	Metric 9:	Quality Assurance	High	QC: detailed QA/QC provided for calibration and recoveries in supplementary materials
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	No gaps nor limitations reported
Overall Quality Determination			High	

Study Citation:		Lee, Y. M., Lee, J. E., Choe, W., Kim, T., Lee, J. Y., Kho, Y., Choi, K., Zoh, K. D. (2019). Distribution of phthalate esters in air, water, sediments, and fish in the Asan Lake of Korea. Environment International 126:635-643.		
HERO ID:		5043593		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology discussed including study area, sampling procedures and equipment, as well as storage conditions.
	Metric 2:	Analytical Methodology	High	Analytical methodology discussed, including extraction methods, instrumentation, and LOD and LOQ provided in SI.
	Metric 3:	Biomarker Selection	N/A	Measured parent chemical in air, water, sediment and fish.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from Asan Lake, Korea.
	Metric 5:	Currency	High	Samples collected in 2016 and 2017.
	Metric 6:	Spatial and Temporal Variability	Medium	Air samples collected from site A1 (n=4), water samples from sites WS1–WS12 (n=47), sediment from sites WS1–WS12 (n=47), and fish samples near sites WS11 and W12 (n=30) at different seasons and spatial variation. No indication of replicate samples.
	Metric 7:	Exposure Scenario	High	Air, water, sediment, and fish collected from the largest artificial lake in Korea that is surrounded and likely affected by pollution from an industrial complex.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported. Statistics provided in Tables 1 and 2, including the mean, median, range, and detection frequency.
	Metric 9:	Quality Assurance	High	QA/QC described, including blanks and control samples as well as recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Seasonal and spatial variation discussed. Uncertainty only minimally discussed, no obvious concerns.
Overall Quality Determination			High	

Study Citation:		Sun, H., An, T., Li, G., Qiao, M., Wei, D. (2014). Distribution, possible sources, and health risk assessment of SVOC pollution in small streams in Pearl River Delta, China. Environmental Science and Pollution Research 21(17):10083-10095.		
HERO ID:		5188487		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	clear and detailed sampling methods
	Metric 2:	Analytical Methodology	High	detailed methods, reported recoveries and LODs in supp. information
	Metric 3:	Biomarker Selection	N/A	Not a biomonitoring study
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Medium	Sampling began in 2008, ended in 2009
	Metric 6:	Spatial and Temporal Variability	High	2 samples per site, 6 sites, 2 seasons
	Metric 7:	Exposure Scenario	Medium	Data may represent a relevant exposure scenario. Authors acknowledge that residents wouldn't drink the water directly
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics, no raw data
	Metric 9:	Quality Assurance	High	detailed QA/QC, analyzed control samples, reported recoveries
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:		Lee, S., Ahn, R. M., Kim, J. H., Han, Y. D., Lee, J. H., Son, B. S., Lee, K. (2019). Study design, rationale and procedures for human biomonitoring of hazardous chemicals from foods and cooking in Korea. International Journal of Environmental Research and Public Health 16(14):2583.		
HERO ID:		5386084		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported.
	Metric 3:	Biomarker Selection	High	Acceptable biomarker.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Korea
	Metric 5:	Currency	Low	Study conducted in 2009-2011.
	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	Low	Few limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Dodson, R. E., Bessonneau, V., Udesky, J. O., Nishioka, M., McCauley, M., Rudel, R. A. (2019). Passive indoor air sampling for consumer product chemicals: A field evaluation study. Journal of Exposure Science & Environmental Epidemiology 29(1):95-108.		
HERO ID:		5432871		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The air sampling methodology was well described and is scientifically sound
	Metric 2:	Analytical Methodology	High	The analytical methods were described, including LOD and recoveries.
	Metric 3:	Biomarker Selection	N/A	The authors analyzed air samples.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Data was collected in Boston, USA.
	Metric 5:	Currency	High	The samples were collected in Oct. 2013-July 2015.
	Metric 6:	Spatial and Temporal Variability	Low	n=37 samples, without replicates.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related to consumer product chemicals in indoor air in Boston.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics were reported. Individual sample concentrations were not reported.
	Metric 9:	Quality Assurance	High	QA/QC techniques were described in detail, including the use of control samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability was characterized (range, 95th percentile). Uncertainties and study limitations were discussed in detail.
Overall Quality Determination			High	

Study Citation:		Lee, I., Kim, S., Park, S., Mok, S., Jeong, Y., Moon, H., Lee, J., Kim, S., Kim, H., Choi, G., Choi, S., Kim, S.,uY, Lee, A., Park, J., Choi, K. (2019). Association of urinary phthalate metabolites and phenolics with adipokines and insulin resistance related markers among women of reproductive age. Science of the Total Environment 688(Elsevier):1319-1326.		
HERO ID:		5433031		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sample storage conditions described, however duration of sample storage and most key sampling criteria not described.
	Metric 2:	Analytical Methodology	Medium	Most key criteria described, LOQ’s reported as range; analytic methods referenced.
	Metric 3:	Biomarker Selection	High	Sampling for metabolites specific for parent chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples provided by participants in Seoul, Gyeonggi, Imcheon and Jeju, Republic of Korea.
	Metric 5:	Currency	High	Sample collection dates not reported, although can be inferred as recruitment 2015-2016 and publication date 2019.
	Metric 6:	Spatial and Temporal Variability	Medium	Urine samples collected from n=459 participants selected for analytic sample after exclusions for study objectives and missing data from original n=516 women visiting health centers for regular checks and n=70 randomly chosen women participating in the CHECK study. Years of sample collection not reported. Non-statistical sampling methods.
	Metric 7:	Exposure Scenario	Medium	Participant characteristics summarized with respect to outcomes of interest.
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 detailed, most key criteria met; lack of baseline pre-exposure sampling.
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:		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:		Wu, Y., Sun, J., Zheng, C., Zhang, X., Zhang, A., Qi, H. (2019). Phthalate pollution driven by the industrial plastics market: a case study of the plastic market in Yuyao City, China. Environmental Science and Pollution Research 26(11):11224-11233.		
HERO ID:		5433502		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology discussed, including location of sites, sampling equipment, number of samples per media, and storage conditions.
	Metric 2:	Analytical Methodology	High	Key analytical methodology discussed, including extraction method, analytical instrumentation, recovery samples, and detection limits (Table S2) per media.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in soil, vegetables, and sediment.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from sites downwind of the plastic market in Yuyao City, China.
	Metric 5:	Currency	High	Samples collected in 2017.
	Metric 6:	Spatial and Temporal Variability	High	Twenty-one soil samples, 21 vegetable samples, and 16 sedimentsamples were collected downwind of the market.
	Metric 7:	Exposure Scenario	High	Soil, vegetable, and sediment samples collected downwind of a plastic market in China.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Several summary statistics were reported, including geometric mean, median, and range.
	Metric 9:	Quality Assurance	High	Key QA reported, including the use of blanks and recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	There is discussion of variability from the different sampling sites and distance from the market. Gaps and limitations not well characterized
Overall Quality Determination			High	

Study Citation:		Wu, J., Ma, T., Zhou, Z., Yu, N.,a, He, Z., Li, B., Shi, Y., Ma, D. (2019). Occurrence and fate of phthalate esters in wastewater treatment plants in Qingdao, China. Human and Ecological Risk Assessment 25(6):1547-1563.		
HERO ID:		5442818		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling methodology only briefly described, including sampling equipment, storage conditions, and study site characteristics. However, sampling procedure not discussed, especially for influent and effluent.
	Metric 2:	Analytical Methodology	Low	Analytical methodology discussed including extraction methodology, analytical equipment, and recovery samples. Detection limits not provided.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in WWTP influent, effluent, and sludge.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from WWTPs in Qingdao, China.
	Metric 5:	Currency	Medium	Samples collected in April 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	A total of 57 sewage and 9 sludge samples collected from 3 WWTPs. Number of influent, effluent, and samples within the each WWTPs not provided.
	Metric 7:	Exposure Scenario	High	Type of sewage each WWTP treats is described as well as each treatment process.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data not reported. Table 1 provides summary statistics for influent from the three WWTPs. Table 2 provides mean of influent and effluent per WWTP and Table 3 statistics for sludge per WWTP. Number of samples per data set not clearly defined.
	Metric 9:	Quality Assurance	High	Key QA reported including use of blanks and recoveries (ranging from 78.5% to 109%).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Gaps and limitations were not reported. There was only a minimal characterization of variance.
Overall Quality Determination			Medium	

Study Citation:		Chatonnet, P., Boutou, S., Plana, A. (2014). Contamination of wines and spirits by phthalates: Types of contaminants present, contamination sources and means of prevention. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 31(9):1605-1615.		
HERO ID:		5490367		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported.
	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	France
	Metric 5:	Currency	Medium	Study published in 2014.
	Metric 6:	Spatial and Temporal Variability	Medium	>10 samples; no replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure source characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported.
	Metric 9:	Quality Assurance	Low	Limited QA reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Zimmermann, S., Gruber, L., Schlummer, M., Smolic, S., Fromme, H. (2012). Determination of phthalic acid diesters in human milk at low ppb levels. Food Additives & Contaminants: Part A, Chemistry, Analysis, Control, Exposure & Risk Assessment 29(11):1780.		
HERO ID:		5492285		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology briefly discussed. Authors cite previously published peer-review publication for more details.
	Metric 2:	Analytical Methodology	High	Key analytical methods reported, including extraction method, instrumentation, and detection limits.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in human milk.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from southern Germany.
	Metric 5:	Currency	Low	Study published in 2012. No date for research study provided.
	Metric 6:	Spatial and Temporal Variability	Medium	30 milk samples collected from 30 individuals. No replicate samples indicated.
	Metric 7:	Exposure Scenario	Medium	Sources of exposure not characterized, but the data represent a relevant general exposure scenario.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics provided, including number of samples below LOQ, max, median, and 95th percentile. Raw data reported
	Metric 9:	Quality Assurance	High	Key QA reported, including method blanks, standards, and recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability and uncertainty discussed, including discrepancies with other published studies and limitations with sample size.
Overall Quality Determination			Medium	

Study Citation:		Garí, M., Koch, H. M., Pálmke, C., Jankowska, A., Wesołowska, E., Hanke, W., Nowak, D., Bose-O’Reilly, S., Polańska, K. (2019). Determinants of phthalate exposure and risk assessment in children from Poland. Environment International 127:742-753.		
HERO ID:		5540505		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The cohort methodology have been published previously (Polańska et al., 2009, 2011, 2016a).
	Metric 2:	Analytical Methodology	High	LOD reported in table 2. Samples were analyzed in the spot urine samples using high performance liquid chromatography coupled with tandem mass spectrometry (HPLC-MS/MS) method.
	Metric 3:	Biomarker Selection	High	Urine MCHP
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Poland
	Metric 5:	Currency	High	2014-2015
	Metric 6:	Spatial and Temporal Variability	Medium	No sample replicates, n=250 samples.
	Metric 7:	Exposure Scenario	High	Biomonitoring
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No individual data points. Table 2 Concentrations of phthalate metabolites in urine of seven year-old children (inµg/l) in the REPRO_PL cohort (n=250).
	Metric 9:	Quality Assurance	Medium	QC is mentioned but not reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Key limitation described, variability reported in table 2.
Overall Quality Determination			High	

Study Citation:		Li, K., Ma, D., Wu, J., Chai, C., Shi, Y. (2016). Distribution of phthalate esters in agricultural soil with plastic film mulching in Shandong Peninsula, East China. Chemosphere 164:314-321.		
HERO ID:		5540829		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology discussed, including sampling procedure, sample information, and storage conditions.
	Metric 2:	Analytical Methodology	Medium	Analytical methodology discussed, including extraction method, analytical instrumentation, and recovery samples. However, MDL not reported for this chemical. Only a range is provided for PAEs.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in soil.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected from four areas (Qingdao, Weihai, Weifang, and Yantai) in Shandong Peninsula, East China.
	Metric 5:	Currency	Medium	Samples collected in 2012.
	Metric 6:	Spatial and Temporal Variability	High	A total of 108 samples collected from 36 vegetable fields, in 4 areas (Qingdao samples: 30, Yantai samples: 30, Weifang samples: 24, and Weihai samples: 24).
	Metric 7:	Exposure Scenario	High	Samples collected from soils with plastic film mulching in vegetable fields in China.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 2 provides summary statistics for all the agricultural soils, including range, mean, std, and detection frequency. Raw data not reported.
	Metric 9:	Quality Assurance	High	Key QA reported, including use of blanks, standards, and recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability between the four study areas as well as depth of soil discussed and presented in Figs 2 and 3. Gaps and limitations not well characterized.
Overall Quality Determination			High	

Study Citation:		Schechter, A., Lorber, M., Guo, Y., Wu, Q., Yun, S. H., Kannan, K., Hommel, M., Imran, N., Hynan, L. S., Cheng, D., Colacino, J. A., Birnbaum, L. S. (2013). Phthalate concentrations and dietary exposure from food purchased in New York State. Environmental Health Perspectives 121(4):473-494.		
HERO ID:		5540861		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Description of sampling methodology is limited, but most criteria are not applicable given it mostly involved purchasing food samples.
	Metric 2:	Analytical Methodology	High	Extraction and analytical methods described in detail for the various food types.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in food.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Food samples were purchased in New York.
	Metric 5:	Currency	Medium	Samples were collected in 2011.
	Metric 6:	Spatial and Temporal Variability	Medium	72 commonly consumed food samples were purchased without replicates.
	Metric 7:	Exposure Scenario	High	The potential exposure to phthalates via food is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data may be reported in the supplementary materials, but cannot access them.
	Metric 9:	Quality Assurance	Medium	QA conducted (e.g., spiked blank, matrix, duplicate analysis), but reference to methods was provided and not described fully.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited characterization of variance. Some gaps and limitations were reported.
Overall Quality Determination			Medium	

Study Citation:		Wang, X., Lou, X., Zhang, N., Ding, G., Chen, Z., Xu, P., Wu, L., Cai, J., Han, J., Qiu, X. (2015). Phthalate esters in main source water and drinking water of Zhejiang Province (China): Distribution and health risks. Environmental Toxicology and Chemistry 34(10):2205-2212.		
HERO ID:		5540969		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Site description, collection timing, equipment, storage, and more were all reported.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported. LODs/LOQs are in Table S2.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemical in source and drinking water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from Zhejiang, China.
	Metric 5:	Currency	Medium	Samples were collected in 2013.
	Metric 6:	Spatial and Temporal Variability	Medium	Water was collected from 19 different sources without replicates.
	Metric 7:	Exposure Scenario	High	Exposure to phthalates via drinking water is relevant.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported.
	Metric 9:	Quality Assurance	High	Key QA/QC methods were reported, including recoveries which were acceptable. (Note that main text has a typo on reported recoveries. Refer to Table S2 for exact numbers).
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Gaps and limitations were not described.
Overall Quality Determination			High	

Study Citation:		Yuan, S. Y., Liu, C., Liao, C. S., Chang, B. V. (2002). Occurrence and microbial degradation of phthalate esters in Taiwan river sediments. Chemosphere 49(10):1295-1299.		
HERO ID:		5541359		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Methodology was succinct but complete.
	Metric 2:	Analytical Methodology	High	Extraction and analysis was performed according to USEPA SW-846 method 8270.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Taiwan.
	Metric 5:	Currency	Low	Sampling was conducted in 2000.
	Metric 6:	Spatial and Temporal Variability	Medium	14 river water and 6 sediment samples were collected without replicates.
	Metric 7:	Exposure Scenario	High	Samples collected from some of the most heavily contaminated in Taiwan where aquatic environments may be affected.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data were provided.
	Metric 9:	Quality Assurance	Low	Recoveries are acceptable but little reporting of QA/QC otherwise. It can be inferred that proper protocols were followed through the study's use of a standard method.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Key uncertainties, limitations, and data gaps were not discussed.
Overall Quality Determination			Medium	

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:		Fromme, H., Lahrz, T., Piloty, M., Gebhart, H., Oddoy, A., Rüden, H. (2004). Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany). Indoor Air 14(3):188-195.		
HERO ID:		5556411		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Unclear how the sampled buildings were selected
	Metric 2:	Analytical Methodology	High	LODs provided (called "determination limits") Standard analytic methods. Blanks and recoveries measured.
	Metric 3:	Biomarker Selection	N/A	NA since testing for parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Berlin, Germany
	Metric 5:	Currency	Low	2000 to 2001
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates used. n = 59, 74, or 30
	Metric 7:	Exposure Scenario	Medium	No info on chemical use inside building.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics but no raw data
	Metric 9:	Quality Assurance	Medium	Recovery rates and blanks were used. No detailed discussion of QA/QC
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Good discussion of uncertainty and variability in the estimated phthalate intake. No discussion of limitations of the concentration data.
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:		Pereira, J., Selbourne, M. D., Pocas, F. (2019). Determination of phthalates in olive oil from European market. Food Control 98:54-60.		
HERO ID:		5619803		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported.
	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	Samples collected from markets from several European countries (Sweden, Spain, Portugal, Ireland, Italy, Luxemburg, Portugal).
	Metric 5:	Currency	Medium	Samples collected in 2014.
	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	High	Raw data reported in Figure 2.
	Metric 9:	Quality Assurance	Medium	Limited QA reported.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Few gaps and limitations reported.
Overall Quality Determination			High	

Study Citation:		Kunikane, S., Ando, M., Aizawa, T., Kanegaki, Y. (2004). A nationwide survey of endocrine disrupting chemicals in source and drinking waters in Japan. Journal of Water and Environment Technology 2(1):17-22.		
HERO ID:		5628092		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Authors discussed little beyond site characteristics.
	Metric 2:	Analytical Methodology	Medium	Detection limits provided in Table 2. Authors cited the analytical methods that were prepared by the Environment Agency but little details beyond that.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in ground and surface water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Japan.
	Metric 5:	Currency	Low	Samples were collected in 1999.
	Metric 6:	Spatial and Temporal Variability	Medium	45 samples were collected without replicates.
	Metric 7:	Exposure Scenario	Low	Most details are missing (e.g., exposure source, details, population of interest, microenvironment).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data were not reported, and only detection frequency and range were reported.
	Metric 9:	Quality Assurance	Low	Authors did attempt to reduce analytical variations between samples by using the same laboratory. However, all other QA/QC protocols were missing.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance was characterized by range. There was no discussion of uncertainty and study limitations.
Overall Quality Determination			Low	

Study Citation:		Wang, X. T., Ma, L. L., Sun, Y. Z., Xu, X. B. (2006). Phthalate esters in sediments from Guanting Reservoir and the Yongding River, Beijing, People’s Republic of China. Bulletin of Environmental Contamination and Toxicology 76(5):799-806.		
HERO ID:		5629322		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some methods not reported, such as sample storage conditions, equipment, and regimen.
	Metric 2:	Analytical Methodology	Medium	Extraction and analytical methods followed EPA’s SW-846 and 8061A with modifications reported. MDLs were only reported as a range for all phthalates combined.
	Metric 3:	Biomarker Selection	N/A	Study measured parent chemicals in surface water.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected from the Guanting Reservoir and Yongding River in China.
	Metric 5:	Currency	Low	Samples were collected in 2003.
	Metric 6:	Spatial and Temporal Variability	Medium	Samples were collected from 12 sites with no report of replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure source not well characterized.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not provided.
	Metric 9:	Quality Assurance	Low	QA/QC can be implied through its use of EPA protocols.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Variance was characterized with range and SD, but there was no discussion of gaps and limitations.
Overall Quality Determination			Medium	

Study Citation:		Lee, I., Alakeel, R., Kim, S., Al-Sheikh, Y. A., Al-Mandeel, H., Alyousef, A. A., Kho, Y., Choi, K. (2019). Urinary phthalate metabolites among children in Saudi Arabia: Occurrences, risks, and their association with oxidative stress markers. Science of the Total Environment 654:1350-1357.		
HERO ID:		5750962		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Concise but clear sampling methods.
	Metric 2:	Analytical Methodology	High	Detailed analytical methods, reported LOD in Supporting Information.
	Metric 3:	Biomarker Selection	High	Biomarker is known to represent external exposure.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Saudi Arabia
	Metric 5:	Currency	High	Sampling in 2017.
	Metric 6:	Spatial and Temporal Variability	Low	109 samples, no replicates.
	Metric 7:	Exposure Scenario	High	Data closely represent relevant exposure scenarios.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics.
	Metric 9:	Quality Assurance	Low	QA/QC not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Study limitations only briefly discussed.
Overall Quality Determination			High	

Study Citation:		Dodson, R. E., Udesky, J. O., Colton, M. D., Mccauley, M., Camann, D. E., Yau, A. Y., Adamkiewicz, G., Rudel, R. A. (2017). Chemical exposures in recently renovated low-income housing: Influence of building materials and occupant activities. Environment International 109:114-127.		
HERO ID:		5755270		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methods are standard SOPs and are detailed in the paper and the SI.
	Metric 2:	Analytical Methodology	High	MRLs are tabulated. The paper and SI adequately discuss methodology.
	Metric 3:	Biomarker Selection	N/A	Testing for the parent chemical in an environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Boston, MA.
	Metric 5:	Currency	Medium	Samples were collected from 2013-2014.
	Metric 6:	Spatial and Temporal Variability	High	10 pre-occupancy and >= 25 post-occupancy samples were collected. Duplicates were collected.
	Metric 7:	Exposure Scenario	Medium	Information on potential chemical use not discussed beyond describing the measured concentrations.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Summary statistics were reported, but no raw data were reported (unless provided in the SI).
	Metric 9:	Quality Assurance	High	The QAQC discussion was adequate.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	There was sufficient discussion on variability and uncertainty.
Overall Quality Determination			High	

Study Citation:		Huang, Y., Li, J., Garcia, J. M., Lin, H., Wang, Y., Yan, P., Wang, L., Tan, Y., Luo, J., Qiu, Z., Ji-An, C., Shu, W. (2014). Phthalate levels in cord blood are associated with preterm delivery and fetal growth parameters in chinese women. PLoS ONE 9(2):e87430.		
HERO ID:		5755647		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	The sampling methodology was described in detail and is scientifically sound.
	Metric 2:	Analytical Methodology	High	The analytical methods were described, including recoveries and LOD.
	Metric 3:	Biomarker Selection	High	The study tested for parent chemicals in cord blood.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study was conducted in China.
	Metric 5:	Currency	Medium	The samples were collected between 2011 and 2012.
	Metric 6:	Spatial and Temporal Variability	High	n=207 volunteers.
	Metric 7:	Exposure Scenario	High	The data closely represent relevant exposure scenarios related phthalates.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics were reported (mean and percentiles).
	Metric 9:	Quality Assurance	High	QA/QC techniques were described in detail.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Variability was characterized (percentiles). 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	Medium	Acceptable biomarker
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:		Gao, C. J., Wang, F., Shen, H. M., Kannan, K., Guo, Y. (2020). Feminine hygiene products-a neglected source of phthalate exposure in women. Environmental Science & Technology 54(2):930-937.		
HERO ID:		5932884		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported. Sample location and details of material and products reported.
	Metric 2:	Analytical Methodology	Medium	Key analytical methods reported. Extraction and analytical equipment described (centrifuge and GC) but calibration not described. LOQ reported as a range and not individual chemicals. Instrumental analysis described in another study (ref 28).
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples from China
	Metric 5:	Currency	High	Samples collected in 2017 and 2018
	Metric 6:	Spatial and Temporal Variability	Medium	56 Feminine Care Products. 64 Sanitary Napkins. There is mention of duplicates.
	Metric 7:	Exposure Scenario	High	Exposure source characterized- feminine care products.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not reported. Summary statistics (mean, range, median) reported.
	Metric 9:	Quality Assurance	High	Key QA reported. Two method blanks, two matrix-spiked samples,and duplicates were analyzed. High recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limitations characterized. Comparison to other feminine products. SD not reported.
Overall Quality Determination			High	

Study Citation:		Karthikraj, R., Lee, S., Kannan, K. (2019). Urinary concentrations and distribution profiles of 21 phthalate metabolites in pet cats and dogs. Science of the Total Environment 690:70-75.		
HERO ID:		5933622		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Some information, such as sampling storage not described.
	Metric 2:	Analytical Methodology	High	SI includes LOQ, matrix spike recoveries and recoveries for NIST certified standard reference materials (SRM). Extraction methods, calibration, and equipment also included.
	Metric 3:	Biomarker Selection	High	Metabolites in cats and dogs. Biomarker is derived from exposure to the chemical of interest (MCHP).
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	New York
	Metric 5:	Currency	High	2017
	Metric 6:	Spatial and Temporal Variability	Medium	50 cats and 50 dogs, no replicates.
	Metric 7:	Exposure Scenario	Medium	Exposure to pets (dogs and cats).
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 1 has mean, median, SD, min, max, and detection frequency. Individual points not reported.
	Metric 9:	Quality Assurance	High	QA/QC discussed in detail. Procedural blanks analyzed. Recoveries over 70%.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variation in dogs and cats, gender, age, habitat analyzed. Comparison to human exposure also analyzed.
Overall Quality Determination			High	

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	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	includes 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:		Başaran, B., Soylu, G. N., Yılmaz Civan, M. (2020). Concentration of phthalate esters in indoor and outdoor dust in Kocaeli, Turkey: implications for human exposure and risk. Environmental Science and Pollution Research International 27(2):1808-1824.		
HERO ID:		6813710		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling methodology for samples of indoor and outdoor dust were described in terms of sampling equipment, procedures, and sample storage conditions, but were lacking storage duration details.
	Metric 2:	Analytical Methodology	High	Limits of quantification were reported. Analytical methodology was detailed in terms of extraction, analytical instrumentation, calibration, and recoveries. Extraction was described as conducted according to modified U.S. EPA methods.
	Metric 3:	Biomarker Selection	N/A	Sampling was conducted within environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Sampling was conducted in Kocaeli, Turkey.
	Metric 5:	Currency	High	Sampling was conducted in 2016.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicate samples were collected, however a total of n=90 samples were collected for indoor dust and n=90 samples were collected for outdoor dust.
	Metric 7:	Exposure Scenario	High	Indoor and outdoor dust sampling was conducted within an industrialized area of Turkey between February and April of 2016.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	No raw data was provided. Statistical summary measures included median, mean, standard deviation and range. Frequencies of detection were noted.
	Metric 9:	Quality Assurance	Medium	Quality assurance procedures were detailed and included analytical instrument calibration and recoveries, but no pre-exposure sampling was conducted.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	The study characterizes variability but overall study limitations were not detailed.
Overall Quality Determination			Medium	

Study Citation:		van Drooge, B. L., Rivas, I., Querol, X., Sunyer, J., Grimalt, J. O. (2020). Organic air quality markers of indoor and outdoor PM2.5 aerosols in primary schools from Barcelona. International Journal of Environmental Research and Public Health 17(10):3685.		
HERO ID:		6814514		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Duplicate sampling to consider seasonality, sampling period provided.
	Metric 2:	Analytical Methodology	Medium	Missing sampling information including LOD or LOQ not described but used.
	Metric 3:	Biomarker Selection	N/A	Biomarkers were not assessed nor relevant to this study.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Primary Schools from Barcelona
	Metric 5:	Currency	Medium	Year of data collection is unclear; however, it is likely 2012-2013.
	Metric 6:	Spatial and Temporal Variability	High	Over 10 samples, replicates collected to account for seasonality.
	Metric 7:	Exposure Scenario	High	The exposure scenario assessed is relevant to indoor and ambient air pathways analyses for TSCA risk evaluation.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Multiple pieces of information not presented.
	Metric 9:	Quality Assurance	Medium	Though recoveries were discussed, replicates were not evident.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	While standard deviations were discussed, study lacked discussion of uncertainties or biases.
Overall Quality Determination			Medium	

Study Citation:		Lucas, D., Polidoro, B. (2019). Urban recreational fisheries: Implications for public health in metro-Phoenix. Chemosphere 225:451-459.		
HERO ID:		6816022		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Fishing techniques and catch limits as per Arizona Game and Fish Department regulations, 2018. Missing information such as how many caught in each area.
	Metric 2:	Analytical Methodology	Low	Analytic method recoveries ranged from 20% to 40% for phthalates; results uncorrected for recovery; MDLs not reported; MDLs might be found in Supplemental Materials for a different report (Pulford et al. 2017; HERO 3974170).
	Metric 3:	Biomarker Selection	Low	From each fish, 5 gram "tissue" sample collected, presumably muscle but not reported. All species (sunfish, trout, bluegill, catfish, bass) among those caught and eaten by local anglers.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Arizona, metro-Phoenix lakes and ponds
	Metric 5:	Currency	High	2018
	Metric 6:	Spatial and Temporal Variability	Medium	21 fish from 11 urban lakes/ponds. Unclear if there are replicates.
	Metric 7:	Exposure Scenario	High	Recreational anglers consuming self-caught fish; urban aquatic ecosystems.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Frequency of detection by lake = 10/11 for DBP. Concentrations of individual phthalates reported as different colors in stacked bar graphs by lake or by fish species; however, sample sizes, variance within and across lakes and fish species not reported. Individual points not reported as well.
	Metric 9:	Quality Assurance	Low	Very low spiked phthalate recoveries (20% to 40%). Results presented are uncorrected for method recoveries.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	Concentrations shown in stacked bar graphs by fish species and by lake/pond from which one could estimate the individual phthalate concentration (wet weight); however, only one sampling season. No limitations reported.
Overall Quality Determination			Medium	

Study Citation:		Liu, X., Peng, C., Shi, Y., Tan, H., Tang, S., Chen, D. (2019). Beyond Phthalate Diesters: Existence of Phthalate Monoesters in South China House Dust and Implications for Human Exposure. Environmental Science & Technology 53(20):11675-11683.		
HERO ID:		6816038		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Sampling methodology is thoroughly described and scientifically sound. No key details are omitted.
	Metric 2:	Analytical Methodology	High	Analytical method is thoroughly described and sound. LOQ is provided in supplemental material.
	Metric 3:	Biomarker Selection	High	Acceptable biomarker selected for concentration in urine.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples collected in China.
	Metric 5:	Currency	High	Samples collected from 2018-2019.
	Metric 6:	Spatial and Temporal Variability	Medium	No replicates collected.
	Metric 7:	Exposure Scenario	Medium	The source of exposure was not well characterized, but this is an exposure scenario of interest.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data is not provided, but summary statistics are given.
	Metric 9:	Quality Assurance	High	QA/QC methods are provided and no issues were identified.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited gaps and limitations are reported. Characterization of variability is limited but the range is provided.
Overall Quality Determination			High	

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. Used LC-MS and provide LOD in supplemental info (Table S6). Water sampling
	Metric 2:	Analytical Methodology	High	
	Metric 3:	Biomarker Selection	N/A	
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. Recoveries >75% (see Table 7 supplementary info); used blanks and controls.
	Metric 9:	Quality Assurance	High	
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:		Tang, Z., Chai, M., Cheng, J., Wang, Y., Huang, Q. (2019). Occurrence and distribution of phthalates in sanitary napkins from six countries: Implications for women’s health. Environmental Science & Technology 53(23):13919-13928.		
HERO ID:		6816332		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	The study mentions that random supermarkets were chosen and brands were chosen based on a questionnaire but no details on the supermarkets and the questionnaire are reported.
	Metric 2:	Analytical Methodology	Medium	Extraction methods, analytical instruments and methods described. Quantitation was performed using the internal calibration method based on 35 five-point calibration curve for individual phthalates. LOQ reported as a range and not for individual chemicals.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Japan, South Korea, US, UK, Australia, Germany
	Metric 5:	Currency	High	Samples collected in 2016.
	Metric 6:	Spatial and Temporal Variability	High	72 samples. It is not explicitly mentioned but inferred that there is a replicate for each sample (6 samples for 6 countries- two samples each for 72 total).
	Metric 7:	Exposure Scenario	High	Exposure source relevant for sanitary napkin exposure to women.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Median, 10th, 50th, and 90th percentiles reported. Raw data not reported.
	Metric 9:	Quality Assurance	High	QA reported. The recoveries of 15 target phthalates in spiked matrices ranged from 81.9 to 107%. Procedural blanks used.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	High	Several limitations mentioned. Variation in locations and brands analyzed.
Overall Quality Determination			High	

Study Citation:		Zhao, X., Shen, J. M., Zhang, H., Li, X., Chen, Z. L., Wang, X. C. (2020). The occurrence and spatial distribution of phthalate esters (PAEs) in the Lanzhou section of the Yellow River. Environmental Science and Pollution Research 27(16):19724-19735.		
HERO ID:		6817577		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Surface water samples (0-50cm) collected and stored in glass bottles while 50g surface sediment (0-10cm) concurrently collected and stored in steel jars; Fig 1 and Table 2 provide information on location of sampling sites; water stored at 4C and sediment at -20C; water passed through filter; sediment freeze dried and grinded
	Metric 2:	Analytical Methodology	Medium	Liquid-liquid extraction; GC-MS; recoveries; LOD reported as a range from 0.05-0.74 ng/L for water and 0.008-0.26 ng/g for sediment; SI has more information. No instrument calibration.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Yellow River, Lanzhou, Gansu Province, China
	Metric 5:	Currency	High	August 2016-March 2017
	Metric 6:	Spatial and Temporal Variability	Medium	12 stations, each sampled during dry and wet periods. No replicates.
	Metric 7:	Exposure Scenario	High	Surface water and sediment from a river in an industrial base and integrated transportation hub.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 3 provides average, range, and DF for water in rainy season and dry season; Table 4 for sediment. Individual points not reported.
	Metric 9:	Quality Assurance	High	Recoveries ranged from 70-140%. Deionized water and diatomite sediment blank samples (n = 3) were extracted similar to the real samples.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Examined temporal and spatial distribution in the river (fig 2 and 3; Table 5 and 6); compared findings to previous studies and other areas. No limitations reported.
Overall Quality Determination			High	

Study Citation:		Philips, E. M., Jaddoe, V. W. V., Deierlein, A., Asimakopoulos, A. G., Kannan, K., Steegers, E. A. P., Trasande, L. (2020). Exposures to phthalates and bisphenols in pregnancy and postpartum weight gain in a population-based longitudinal birth cohort. Environment International 144:106002.		
HERO ID:		6957398		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sample storage time was not specified.
	Metric 2:	Analytical Methodology	Medium	LOD was reported as a range for all phthalates.
	Metric 3:	Biomarker Selection	High	The biomarkers (metabolites of phthalates) are appropriate.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The study population is from Rotterdam, Netherlands. Urine samples were transported to New York for analysis.
	Metric 5:	Currency	Medium	Samples were collected from 2004 to 2005.
	Metric 6:	Spatial and Temporal Variability	Medium	Urine spot samples were collected.
	Metric 7:	Exposure Scenario	High	There is no clear exposure scenario, but this is a biomonitoring study among pregnant and postpartum women.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Individual raw data were not reported in the main study. However, in a large cohort study like this, providing raw data might not be feasible.
	Metric 9:	Quality Assurance	Low	Quality control measures were not discussed.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	The study includes a discussion of its strengths and limitations. Characterization of variance only for maternal weight gain but not metabolite concentrations measured in urine.
Overall Quality Determination			Medium	

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	provide details about sampling sites, equipment, and procedure (additional info in supplementary section)
	Metric 2:	Analytical Methodology	Medium	used GC-MS and report method detection limit/detection frequency
	Metric 3:	Biomarker Selection	N/A	environmental samples
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Yangtze River estuary and East China Sea
	Metric 5:	Currency	High	2015 and 2017
	Metric 6:	Spatial and Temporal Variability	High	166 seawater samples and 56 sediment samples
	Metric 7:	Exposure Scenario	Medium	studying phthalates in water
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	report average concentrations (Table S3 in supplementary info) but no summary stats or individual sample data
	Metric 9:	Quality Assurance	Medium	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:		Tang, S., He, C., Thai, P., Vijayasathay, S., Mackie, R., Toms, L. L., Thompson, K., Hobson, P., Tscharke, B., O’Brien, J. W., Mueller, J. F. (2020). Concentrations of phthalate metabolites in Australian urine samples and their contribution to the per capita loads in wastewater. Environment International 137:105534.		
HERO ID:		6957476		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Sampling equipment and procedures were reported in the study. Some sampling methods not reported such as sampler calibration.
	Metric 2:	Analytical Methodology	High	Key analytical methods were reported. The LOQ was reported. Recovery samples were reported.
	Metric 3:	Biomarker Selection	Medium	This study included an acceptable biomarker.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	This study was conducted in Southeast Queensland, Australia.
	Metric 5:	Currency	Medium	The samples were collected between 2012 to 2017.
	Metric 6:	Spatial and Temporal Variability	High	>10 samples were collected but there were no replicates.
	Metric 7:	Exposure Scenario	Medium	Specific sources of exposure were not well characterized in this study. This was a biomonitoring study so specific sources were not documented.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data in this study were not reported.
	Metric 9:	Quality Assurance	High	Key QA was reported in this study. Recovery samples were reported, controls were collected, etc.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No gaps or limitations were reported in this study.
Overall Quality Determination			Medium	

Study Citation:		Sol, C. M., Santos, S., Duijts, L., Asimakopoulos, A. G., Martinez-Moral, M. P., Kannan, K., Jaddoe, V. W. V., Trasande, L. (2020). Fetal phthalates and bisphenols and childhood lipid and glucose metabolism: A population-based prospective cohort study. Environment International 144:106063.		
HERO ID:		6957607		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling equipment and methods are only briefly mentioned, and missing details may have a substantial impact on results.
	Metric 2:	Analytical Methodology	Low	Analytical instrumentation and methods are cited to an external source and very little detail is provided. LOD is reported in supplementary information.
	Metric 3:	Biomarker Selection	High	The monoester phthalate biomarker is a metabolite of just the chemical of interest.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	The Netherlands
	Metric 5:	Currency	Low	2004-2005
	Metric 6:	Spatial and Temporal Variability	Medium	Pooled urine spot samples from757 participants at three timepoints
	Metric 7:	Exposure Scenario	High	The exposure scenario of fetuses during gestation is highly relevant
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Low	Raw data are not reported; summary statistics include percentage below LOD, median, and percentiles (25, 75) of concentration.
	Metric 9:	Quality Assurance	Low	Quality assurance/quality control techniques and results were not directly discussed, but can be implied through the study's use of standard laboratory protocols
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No characterization of variation of results was reported, and limitations/sources of uncertainty are only briefly discussed.
Overall Quality Determination			Low	

Study Citation:		Bach, C., Rosin, C., Munoz, J. F., Dauchy, X. (2020). National screening study investigating nine phthalates and one adipate in raw and treated tap water in France. Environmental Science and Pollution Research International 27(29):36476-36486.		
HERO ID:		6957772		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Raw and treated water from surface water and groundwater collected from 101 departments; collected twice n glass vials; immediately wrapped in aluminum foil and capped; stored at 4C before analysis; detailed sampling protocol in Fig S1; no pretreatment for treated water, but raw water was centrifuged.
	Metric 2:	Analytical Methodology	High	Extraction, analytical instrument (SPE-LC-MS/MS), calibration solutions, internal standard calibration, recoveries described. LOQ provided Table 2.
	Metric 3:	Biomarker Selection	N/A	Parent chemical in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	France
	Metric 5:	Currency	High	November 2015-July 2016
	Metric 6:	Spatial and Temporal Variability	High	101 sites (271 raw water samples and 283 treated samples); collected twice in single sampling campaign.
	Metric 7:	Exposure Scenario	High	Concentration in raw and treated drinking water throughout France.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Table 4 provides concentration in raw water (surface water and ground water) and tap water (from surface water, groundwater, and mixture of the two); n, DF, max, average.
	Metric 9:	Quality Assurance	High	QA described in detail. Recoveries provided in Table 3; field blanks described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Compared between tap and raw water; compared results to previous studies. No limitations reported.
Overall Quality Determination			High	

Study Citation:		Song, J., Lu, S., Wu, Y., Zhou, C., Li, X., Li, J. (2020). Migration and distribution characteristics of organic and inorganic fractions in condensable particulate matter emitted from an ultralow emission coal-fired power plant. Chemosphere 243:125346.		
HERO ID:		6959325		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Low	Sampling equipment and methods are briefly described, but most details are missing which may have a substantial impact on results.
	Metric 2:	Analytical Methodology	Low	Analytical instrumentation and methods are briefly described, but most details are missing and no form of detection limit is reported.
	Metric 3:	Biomarker Selection	N/A	This study is testing for the parent chemical of interest in an environmental medium.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	Low	Paper was published in 2019. The sampling date was not reported.
	Metric 6:	Spatial and Temporal Variability	Low	Single samples were collected from four sites, with no mention of replicates.
	Metric 7:	Exposure Scenario	Low	The sampling sites evaluate various stages of a coal-fired power plant, but it is unclear if there are later steps in the system prior to any likely exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Critically Deficient	Data are only reported in the form of total concentration for all phthalate, the identity of the detected phthalates, and the percentage of phthalates that were not DBP. While the concentration for DBP can be determined from this, the calculated value might be highly uncertain without more precise information.
	Metric 9:	Quality Assurance	Medium	QA/QC measures described include determination of linearity and recovery rate, both of which were within acceptable levels, but the methods by which these were determined were not described.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	No characterization of variability is presented and there is no discussion of limitations or sources of uncertainty.
Overall Quality Determination			Uninformative	

Study Citation:		Yue, N., Deng, C., Li, C., Wang, Q., Li, M., Wang, J., Jin, F. (2020). Occurrence and distribution of phthalate esters and their major metabolites in porcine tissues. Journal of Agricultural and Food Chemistry 68(25):6910-6918.		
HERO ID:		6968617		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Sampling Methodology	Critically Deficient	The sampling methodology is not discussed. Only information given is 16 pigs from a livestock farm in Shangzhuang village, Beijing.
	Metric 2:	Analytical Methodology	Medium	LOD and LOQ range provided; instrumentation described; recovery rates in SI
	Metric 3:	Biomarker Selection	High	parent and metabolite in pig tissues
Domain 2: Representativeness	Metric 4:	Geographic Area	High	China
	Metric 5:	Currency	High	2017
	Metric 6:	Spatial and Temporal Variability	High	16 pigs: Three samples were taken from each of these six types of porcine tissue samples (liver, heart, kidney, muscle, spleen, and lungs)
	Metric 7:	Exposure Scenario	Medium	livestock farm
Domain 3: Accessibility/Clarity	Metric 8:	Reporting of Results	Medium	average reported; SD or SE not specified
	Metric 9:	Quality Assurance	Medium	blanks, recovery described in QA/QC section
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Low	variability and uncertainty not discussed; no obvious concerns
Overall Quality Determination		Uninformative		

Study Citation:		Zhang, B. T., Gao, Y. M., Lin, C. Y., Yang, W., Liu, T., Liu, X. T., Wang, Y. (2020). Spatial distribution of phthalate acid esters in sediments of the Laizhou Bay and its relationship with anthropogenic activities and geochemical variables. Science of the Total Environment 722:137912.		
HERO ID:		6968622		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Key sampling methods reported
	Metric 2:	Analytical Methodology	High	Key analytical methods reported. LOD reported in supplemental.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Laizhou Bay, China
	Metric 5:	Currency	High	Samples collected in 2018
	Metric 6:	Spatial and Temporal Variability	High	>10 samples; there is mention of duplicate samples.
	Metric 7:	Exposure Scenario	High	Statistical analyses that characterize exposure scenario
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data not provided. Summary statistics reported.
	Metric 9:	Quality Assurance	High	Key QA reported and in supplemental.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Limited gaps and limitations reported. There is discussion of variation.
Overall Quality Determination			High	

Study Citation:		Henriksen, L. S., Mathiesen, B. K., Assens, M., Krause, M., Skakkebæk, N. E., Juul, A., Andersson, A. M., Hart, R. J., Newnham, J. P., Keelan, J. A., Pennell, C., Main, K. M., Frederiksen, H. (2020). Use of stored serum in the study of time trends and geographical differences in exposure of pregnant women to phthalates. Environmental Research 184:109231.		
HERO ID:		6968891		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	Medium	Limited description of sampling methods.
	Metric 2:	Analytical Methodology	Medium	Limited description of analytical methods, mentioned LOD but didn't report it.
	Metric 3:	Biomarker Selection	High	Metabolites are known to be related to external exposure.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Australia and Denmark
	Metric 5:	Currency	Low	Samples from 1997 to 2001, and 2012-2014.
	Metric 6:	Spatial and Temporal Variability	Low	213 samples, no replicates.
	Metric 7:	Exposure Scenario	Medium	Missing discussion of relation to the source of exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Only summary statistics.
	Metric 9:	Quality Assurance	Medium	Analyzed control samples, did not describe QA/QC techniques.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Did not characterize variability. Discussed uncertainties and study limitations.
Overall Quality Determination			Medium	

Study Citation:		Bohlin-Nizzetto, P., Aas, W., Nikiforov, V. (2019). Monitoring of Environmental Contaminants in Air and Precipitation, 2018.		
HERO ID:		6994279		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology	High	Air samples were collected using high volume air samplers. All important details were reported and the methodology was scientifically sound.
	Metric 2:	Analytical Methodology	Low	Samples were spiked with internal standards, extracted, and quantified using UPLC-MSMS. All important details were reported and the methodology is scientifically sound. However, while LOD and LOQ were referenced throughout the report, the specific values of these limits were not reported.
	Metric 3:	Biomarker Selection	N/A	This study was testing for the chemical of interest in environmental media.
Domain 2: Representativeness				
	Metric 4:	Geographic Area	High	Samples were collected in Norway.
	Metric 5:	Currency	High	Samples were collected in 2017-2018.
	Metric 6:	Spatial and Temporal Variability	Medium	Active air samples were collected over on a weekly basis over the course of a year. The number of samples per year was reported to be compound and site specific, between 12 and 52, but not explicitly reported for each compound. Further, use of replicates was not reported.
	Metric 7:	Exposure Scenario	High	Air samples were well characterized and highly relevant for possible exposure.
Domain 3: Accessibility/Clarity				
	Metric 8:	Reporting of Results	Medium	Raw data were not reported. Summary statistics included detection frequency and mean concentrations.
	Metric 9:	Quality Assurance	Medium	Analyses were carried out by NILU laboratories, which were accredited in accordance with NS-EN ISO/IEC 17025. QC measures included field and lab blank samples, but were not further explained.
Domain 4: Variability and Uncertainty				
	Metric 10:	Variability and Uncertainty	Medium	Variability was characterized qualitatively over time. There was brief discussion of uncertainty inherent in the more newly developed procedures for "organic contaminants of emerging concern," but was not further explained.
Overall Quality Determination			Medium	

Study Citation:		Fierens, T., Vanermen, G., Van Holderbeke, M., De Henaauw, S., Sioen, I. (2012). Effect of cooking at home on the levels of eight phthalates in foods. Food and Chemical Toxicology 50(12):4428-4435.		
HERO ID:		1311695		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Con- ditions	Medium	Sampling methodology appears reasonable, but is not described in full detail.
	Metric 2:	Analytical Methodology	Medium	Analytical procedure refers back to a previous study (Fierens et al., 2012). Analysis seems to have been per- formed using GC-EI-MS. LOQs are reported in Section 2.4.
	Metric 3:	Biomarker Selection	N/A	Biomarkers are not used in this study; phthalate levels are assessed directly.
Domain 2: Representative				
	Metric 4:	Testing Scenario	Medium	The experiment is designed to mimic typical home-cooking procedures and equipment. General environmental conditions are not described.
	Metric 5:	Sample Size and Variability	High	Fifteen foods were sampled. Each sample was taken in duplicate.
	Metric 6:	Temporality	Medium	Data was collected in 2011, between 5 and 15 years ago.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Raw data is reported, but summary statistics are minimal.
	Metric 8:	Quality Assurance	Low	There is no specific discussion of QA/QC procedures, but also no indication of issues.
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Low	There is no specific discussion of variability or uncertainty.
Overall Quality Determination			Medium	

Study Citation:		Dodson, R. E., Nishioka, M., Standley, L. J., Perovich, L. J., Brody, J. G., Rudel, R. A. (2012). Endocrine disruptors and asthma-associated chemicals in consumer products. Environmental Health Perspectives 120(7):935-943.		
HERO ID:		1325358		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Conditions	Low	Sampling methodology explained but not from an authoritative or referenced source. Choose to use composite samples (mixed different sources to make one average product).
	Metric 2:	Analytical Methodology	High	Analytical methods described and appear scientifically sound. LOD and additional information in the supplemental file.
	Metric 3:	Biomarker Selection	N/A	Tested consumer products.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	Data likely to represent relevant exposure from alternative products.
	Metric 5:	Sample Size and Variability	Medium	Number of products used to make "composite" product ranged from 1-8; 27 different product tested; included duplicate samples.
	Metric 6:	Temporality	Medium	Tested products from between 5-10 years ago.
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	Raw data not reported - exact concentrations remain unknown.
	Metric 8:	Quality Assurance	High	QA/QC described (details in supplemental file).
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	High	Discussion included on variability and uncertainty.
Overall Quality Determination			High	

Study Citation:		Tang, Z., Chai, M., Cheng, J., Wang, Y., Huang, Q. (2019). Occurrence and distribution of phthalates in sanitary napkins from six countries: Implications for women’s health. Environmental Science & Technology 53(23):13919-13928.		
HERO ID:		6816332		
Domain		Metric	Rating	Comments
Domain 1: Reliability				
	Metric 1:	Sampling Methodology and Con- ditions	High	The sample collection mimics consumer behavior (on-line and store purchases). The study design called for a selection of ten whole samples and the creation of two composite samples for analysis made from subsets cut from the whole samples. The authors recognized the potential for contamination and sealed the composite samples quickly.
	Metric 2:	Analytical Methodology	Medium	The authors describe the instrument used and the sample preparation briefly in Section S1 of the Supplemen- tary file. I do not see that they describe how they created the analysis sample (0.5g aliquot) from a large com- posite sample of pieces of ten whole sanitary napkins. I presume that the authors chose not to describe this detail, but it leaves out an important step if one wanted to repeat the experiment. The authors present a range of LOQs for phthalates in Section S1; from this, I could deduce that the LOQ for each chemical is presented as the ”<#” in Table 1 of the main report that presents the results.
	Metric 3:	Biomarker Selection	N/A	Biomarkers of interest were not addressed in this reference.
Domain 2: Representative				
	Metric 4:	Testing Scenario	High	The sample collection mimics consumer behavior (on-line and store purchases). The study did not include actual testing but is considered an Experimental type due to the samples being commercial products (i.e., not biological samples).
	Metric 5:	Sample Size and Variability	High	Each composite sample was composed of subsets derived from ten different sanitary napkins. The authors analyzed both composites and summarized by country of origin (n = 12 composites).
	Metric 6:	Temporality	High	The authors collected the samples in 2016, which is within five years of the current year (2021).
Domain 3: Accessibility/Clarity				
	Metric 7:	Reporting of Results	Medium	The authors did not include raw data in the material. They adjusted the concentrations for the amounts found in blanks, but they did not adjust the results for the recoveries. The information in Table 1 includes sample size, median, range, and detection frequency.
	Metric 8:	Quality Assurance	Medium	The authors recognized the potential for contamination and sealed the composite samples quickly. The study included blanks at intervals and tested for recoveries. Although the authors did not correct the concentrations for the recoveries, the rates for recoveries were high; from this, I assessed that the reported values would be suitable for extraction (with this caveat included in the notes).
Domain 4: Variability and Uncertainty				
	Metric 9:	Variability and Uncertainty	Medium	The authors described how different manufacturing methods (sometimes in different countries) could affect the concentrations of the phthalates in the products. The authors briefly mention that these chemicals have been found in other products in other studies, but they did not clarify how the results compare to studies of sanitary napkins except for their own previous work.
Overall Quality Determination			High	

Study Citation:		Koo, J. W., Parham, F., Kohn, M. C., Masten, S. A., Brock, J. W., Needham, L. L., Portier, C. J. (2002). The association between biomarker-based exposure estimates for phthalates and demographic factors in a human reference population. Environmental Health Perspectives 110(4):405-410.		
HERO ID:		673288		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Equations for estimating intakes and intermediate values required are all provided, described, and cited (Kohn et al).
	Metric 2:	Model Evaluation	High	Regression analysis conducted in LIFEREG, SAS 8.0, widely accepted. The model is from peer reviewed study and has undergone evaluation.
Domain 2: Representative	Metric 3:	Exposure Scenario	Medium	Concentration data used in model from 2000 and limited discussion of exposure factors.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	Low	SAS 8.0 is not freely and publicly available. Some references might not be publicly available.
	Metric 5:	Model Inputs and Defaults	High	Fractional excretions are provided with descriptions, all inputs are provided.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	Medium	Low standard error in regression estimates and significant demographic variations in exposure and metabolism of phthalates; some discussion on uncertainty related to sufficient data, range of data sources, issues and assumptions relating to estimates from metabolites.
Overall Quality Determination		Medium		

Study Citation:		Kohn, M. C., Parham, F., Masten, S. A., Portier, C. J., Shelby, M. D. (2000). Human exposure estimates for phthalates. Environmental Health Perspectives 108(10):A440-A442.		
HERO ID:		675254		
Domain	Metric		Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Daily exposure is estimated using a linear 2-compartment model, with equations 1 & 2 provided for total and urinary excretion fractions (and rate constants), and equation 3 for individual intake.
	Metric 2:	Model Evaluation	Medium	Model has at least limited evaluation through comparison with data from other models.
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	Article is from 2000; >15 years and may not represent current exposures.
	Metric 4:	Model and Model Documentation Availability	High	There is some documentation available in the data source; this article is cited in other studies.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Medium	Inputs and defaults are generally identified, referenced and described. Metabolite concentrations may be found in Blount et al 2000.
	Metric 6:	Variability and Uncertainty	Medium	Measures of uncertainty are discussed on pp. A441 and A442. Limitations not discussed.
Overall Quality Determination		Medium		

Study Citation:		Fromme, H., Gruber, L., Schlummer, M., Wolz, G., Bohmer, S., Angerer, J., Mayer, R., Liebl, B., Bolte, G. (2007). Intake of phthalates and di(2-ethylhexyl)adipate: Results of the Integrated Exposure Assessment Survey based on duplicate diet samples and biomonitoring data. Environment International 33(8):1012-1020.		
HERO ID:		680285		
Domain		Metric	Rating	Comments
Domain 1: Reliability	Metric 1:	Mathematical Equations	High	Intake modeling equation is given and appears to be based on previously published and peer-reviewed material.
	Metric 2:	Model Evaluation	Medium	The intake equation used for modeling is cited as being based on two previous papers. There is no specific evaluation of its appropriateness for this group of chemicals.
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	Data was collected at some point between late 2005 and 2007, so it may not reflect current exposure conditions. The population of the study was German, so results may not correspond to US populations.
Domain 3: Accessibility/Clarity	Metric 4:	Model and Model Documentation Availability	High	The model intake equation input variables are given in the paper.
	Metric 5:	Model Inputs and Defaults	High	The input values that were used are provided in the paper, and are cited to previous peer-reviewed works.
Domain 4: Variability and Uncertainty	Metric 6:	Variability and Uncertainty	Medium	There is discussion of variability within the subjects, and there is a discussion of the limitations of the approach used for calculation.
Overall Quality Determination			Medium	

Study Citation:		Sakhi, A. K., Lillegaard, I. T., Voorspoels, S., Carlsen, M. H., Løken, E. B., Brantsæter, A. L., Haugen, M., Meltzer, H. M., Thomsen, C. (2014). Concentrations of phthalates and bisphenol A in Norwegian foods and beverages and estimated dietary exposure in adults. Environment International 73:259-269.		
HERO ID:		2501495		
Domain	Metric	Rating	Comments	
Domain 1: Reliability	Metric 1:	Mathematical Equations	Low	General modeling approach is given and seems to be standard, but no specific equation is provided.
	Metric 2:	Model Evaluation	Low	General modeling approach is given and seems to be standard, but no specific equation is provided.
Domain 2: Representative	Metric 3:	Exposure Scenario	Low	This is a moderately recent study (5-15 years old) but the study population is Norwegian, so there may be dietary differences from the US population.
	Metric 4:	Model and Model Documentation Availability	Low	The model is only broadly described, and must be inferred to be typical of dietary intake modeling.
Domain 3: Accessibility/Clarity	Metric 5:	Model Inputs and Defaults	Low	Some relevant values such as body weight are taken from a previous survey and not reported in this paper.
	Metric 6:	Variability and Uncertainty	Medium	There is some discussion of variation from country to country in similar dietary studies.
Overall Quality Determination		Low		

Table 131: Glossary of Select Terms for Data Evaluation

Term	Definition
ADD	Average daily dose
ADC	Average daily concentration
AERMOD	American Meteorological Society/EPA Regulatory Model
BLS	Bureau of Labor Statistics
CASRN	Chemical Abstracts Service Registry Number
CBI	Confidential business information
CDR	Chemical Data Reporting
CEHD	Chemical Exposure Health Data
CEM	Consumer Exposure Model
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPSC	Consumer Product Safety Commission
CWA	Clean Water Act
DEHP	Diethylhexyl phthalate
DIDP	Diisodecyl phthalate
DINP	Diisononyl phthalate
DIY	Do-it-yourself
DMR	Discharge Monitoring Report
EPA	Environmental Protection Agency (or the Agency)
EPCRA	Emergency Planning and Community Right-to-Know Act
ESD	Emission scenario document
EU	European Union
FDA	Food and Drug Administration
FFDCA	Federal Food, Drug, and Cosmetic Act
GS	Generic scenario
K_{OC}	Soil organic carbon: water partitioning coefficient
K_{OW}	Octanol: water partition coefficient
HEC	Human equivalent concentration
HED	Human equivalent dose
IADD	Intermediate average daily dose
IR	Ingestion rate
LCD	Life cycle diagram
LOD	Limit of detection
LOEC	Lowest-observed-effect concentration
Log K_{OC}	Logarithmic organic carbon: water partition coefficient
Log K_{OW}	Logarithmic octanol: water partition coefficient
MOE	Margin of exposure
NAICS	North American Industry Classification System

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Table 131 ...continued from previous page

Term	Definition
NEI	National Emissions Inventory
NHANES	National Health and Nutrition Examination Survey
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NOAEL	No-observed-adverse-effect level
NOEC	No-observed-effect-concentration
NPDES	National Pollutant Discharge Elimination System
NTP	National Toxicology Program
OCSPP	Office of Chemical Safety and Pollution Prevention
OECD	Organisation for Economic Co-operation and Development
OEL	Occupational exposure limit
OES	Occupational exposure scenario
ONU	Occupational non-user
OPPT	Office of Pollution Prevention and Toxics
OSHA	Occupational Safety and Health Administration
PBZ	Personal breathing zone
PECO	Population, exposure, comparator, and outcome
PEL	Permissible exposure limit (OSHA)
PESS	Potentially exposed or susceptible subpopulations
PND	Postnatal day
PNOR	Particulates not otherwise regulated
POD	Point of departure
POTW	Publicly owned treatment works
PPAR α	Peroxisome proliferator activated receptor alpha
PVC	Polyvinyl chloride
REL	Recommended Exposure Limit
SACC	Science Advisory Committee on Chemicals
SDS	Safety data sheet
SOC	Standard Occupational Classification
SpERC	Specific Emission Release Category
SUSB	Statistics of U.S. Businesses (U.S. Census)
TRI	Toxic Release Inventory
TRV	Toxicity reference value
TSCA	Toxic Substances Control Act
TSD	Technical support document
TWA	Time-weighted average
UF	Uncertainty factor
U.S.	United States
WWTP	Wastewater treatment plant
7Q10	The lowest 7-day average flow that occurs (on average) once every 10 years

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Table 131 ...continued from previous page

Term	Definition
30Q5	The lowest 30-day average flow that occurs (on average) once every 5 years